HIGH ALTITUDE AIR FLOW REGULATION FOR AUTOMOBILES

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ABSTRACT

High altitude performance is a major concern for automobiles. Due to lack of air density and pressure at high altitude the mass flow rate to engine drops considerably with altitude. This in turn will affect the volumetric efficiency of the engine. This is an area of great concern for Indian road conditions. The Indian road condition varies from sea level to around 6000m. Thus the engine performance varies drastically will altitude.

We had considered flow through the inlet manifold for a four cylinder turbocharger diesel engine at low and high rpm. At lower rpm at around 1500 the turbocharger boost pressure will negligible, thus the engine will be in natural aspiration. Now at this normal running condition the mass flow to engine drops considerably with altitude. Now for a speed of around 2500 rpm there is sufficient flow to around 3000m and then drops. The flow pattern for a single cylinder in open condition has analyzed to find the average mass flow for different altitude.

Keywords- Automobile, High Altitude, Turbulence Effect, Engine Performance, Turbocharger

I. INTRODUCTION

Altitude has a big effect on engine performance. The reason as altitude increases, air thins and as air is required for combustion, power produced by the engine decreases .But engine horse power falls off about 3 percent for each 1000 feet above sea level. In India the road conditions ranges from sea level to 6000m. That is power produced by engine falls to 18%. We know that volumetric efficiency is one of major factor that determines the performance of an ICE. One of the major factors that influence on volumetric efficiency is air mass flow rate towards engine. As altitude increases atmospheric pressure decreases so mean effective pressure decreases. Altitude increases air density also decreases. We can note considerable deduction in engine performance. One of the methods of increasing power output is by means of increasing mean effective pressure.

Our aim is to provide sufficient air flow to the engine so as to improve the efficiency of the engine at normal speeds even at high altitudes. In order to obtain that we are modifying intake system of an engine, by providing an additional passage with an electric supercharger at one end and connected to existing intake manifold. The mass flow rate and volumetric efficiency of existing system and proposed system has been studied and compared. Engine performs well at atmospheric condition so our aim is to provide sea level conditions at higher altitude. Supercharger is controlled with help of microcontroller governed by pressure and altitude sensors. When we reach an altitude of 1000m the supercharger is switched on. This system operates with in the turbo lag period

Chao He et al. (2011),conducted a study on emission characteristic of a heavy duty diesel engine at higher altitudes and they inferred that as the altitude increases, the emissions of HC, CO, NOx and smoke of diesel

engine increase, as well as diesel exhaust particles number, especially at the engine speed of 2000 r/min [1]. At some special engine conditions, that is heave-load and low-speed, the reduced emissions of HC and NOx can be observed at high altitudes.

Kevin Norman et al. (2009), suggested clogging the air filter has no significant effect on the fuel economy of the newer vehicles (all fuel injected with closed-loop control and one equipped with MDS) [2]. The engine control systems were able to maintain the desired AFR regardless of intake restrictions, and therefore fuel consumption was not increased. Acceleration performance on all vehicles was improved with a clean air filter.

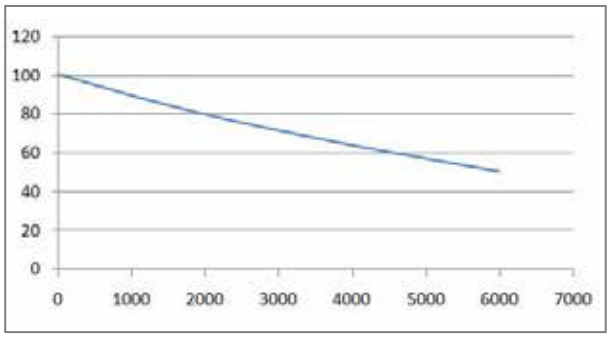
Nik Rosli Abdullah et al.(2013),analyzed the impact of air intake pressure on engine performance and emission characteristics of an SI engine [3]. This study will encourage the vehicle users to ensure their vehicle's air filter is always in clean and good condition. Ensuring clean and good condition of air filter will maintain higher air intake pressure and absorption of polluted particles through air filter. Clogged and dirty air filter reduces the air intake pressure and thus the engine performance and fuel economy.

II. PROBLEM DEFENITION AND BACKGROUND

In India the road conditions ranges from sea level conditions to around 6000m. As altitude increases the atmospheric pressure and air density decreases. This decrease in properties will reduce the performance of the engine at higher altitudes greatly affects volumetric efficiency. Even though there is a system to provide air at higher pressure to engine in order to improve the performance of the engine this is possible only when the engine rpm is above 1750. Up to this much of time engine gets only thin air so there by the engine performance obtained is undesirable. The lag noticed in boosting of air pressure accordance with engine rpm is called turbo lag.

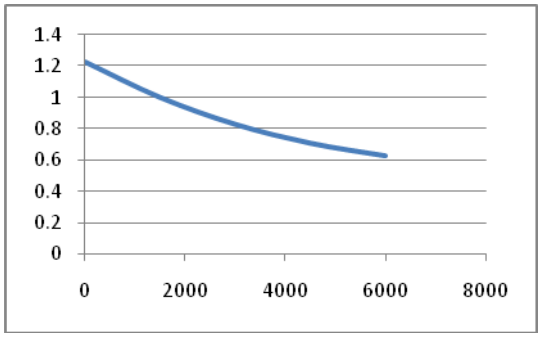
So our prime aim is to avoid turbo lag that is to create a situation at higher altitudes where engine gets required pressurized air at normal speed to obtain this condition. In order to obtain that we are modifying intake system of an engine, by providing an additional passage with an electric supercharger at one end and connected to existing intake manifold. The mass flow rate and volumetric efficiency of existing system and proposed system has been studied and compared. Engine performs well at atmospheric condition so our aim is to provide sea level conditions at higher altitude.

Supercharger is controlled with help of microcontroller governed by pressure and altitude sensors. When we reach an altitude of 1000m the supercharger is switched on. This system operates with in the turbo lag period.



X axis- altitude (m) Y axis-pressure (kPa)

Fig. 1: Pressure variation with altitude



X axis-altitude (m) Y axis-density (kg/m^3)

Fig. 2: Variation of air density with altitude

From the above two Figures, we can see that as we going to higher altitude there is a considerable decrease in atmospheric pressure and air density. The density of air decreases about 7% for every 1000m altitude. The Indian road conditions ranges between 0 to 6000m. We can see that for top road conditions performance decreases about 50%.

At present automobiles employ supercharging and turbocharging systems that rely only on engine speed. They are capable of providing sufficient boost at high rpm. But at normal speeds the boost is so low. Thus for normal speeds the need for pressure boost is needed, the system must be independent of engine speeds but depend on the altitude of operation and manifold pressure. This will allow us to provide the sufficient boost at normal speeds based on altitude only.

III. METHODLOGY ADOPTED

For starting every work we should find out a problem, the topic was selected by us by counting difficulties faced in driving at higher altitudes. When we go to higher altitudes vehicle pulling power is found to be decreasing this will increase driving difficulties. Technically speaking as we go to higher altitudes the volumetric efficiency of the engine is found to be decreasing. So our first step towards this project is to verify the problem. We discussed in team, guide and heavy vehicle drivers. Our next step was to find key factor that cause these problems. Then we notice that as altitude increases the atmospheric pressure and air density is found to be decreasing. Then we studied the effect of decrease in atmospheric pressure and air density in the performance of the engine. To make analysis simpler we chosen different altitudes, 0m, 1500m, 3000m, 4500m, 6000m. Our next step to find out atmospheric pressures and air densities at above mentioned altitudes. Various atmospheric pressure and densities as shown in Table I and Table II.

Pressure at various altitudes obtained by using the relation,

$$P=100\{ [44331.514-Z] / 11880.516 \}^{5.255}$$

Variation of density with altitude using the relation,

$$P = \rho RT$$

Temperatures at different altitudes find out Gay Lusacc's law, then substituting in above equation, we get densities as shown in Table II.

Table I: Variation of Atmospheric Pressure with Altitudes

ALTITUDE, Z (m)	PRESSURE(kPa)
0	101.325
1500	85
3000	72
4500	61
6000	51

Table II: Variation of Density with Altitudes

ALTITUDES (m)	DENSITY (kg/m^3)
0	1.225
1500	1
3000	0.83
4500	0.71
6000	0.635

We calculated volumetric efficiencies of the engine at different conditions for speed of 1500 rpm. We compared the volumetric efficiency of the proposed system with that of existing one at a speed of 1500 rpm. The flow pattern, static pressure and velocity profile has been analyzed using ANSYS 15.

The Figures 3 and 4 shows the turbulence produced at different inserting positions. To identify the optimum position to insert secondary passage, we considered two cases in which the secondary passage given perpendicular to main inlet and in other case the secondary passage given at an inclined angle (45^0).

It is observed that in first position the mass flow rate found to be lesser than that of second case. And observed that the turbulence kinetic energy also found to be lower than that of second case. So the undesirable effect cavitation can be reduced in second case. So second position considered.

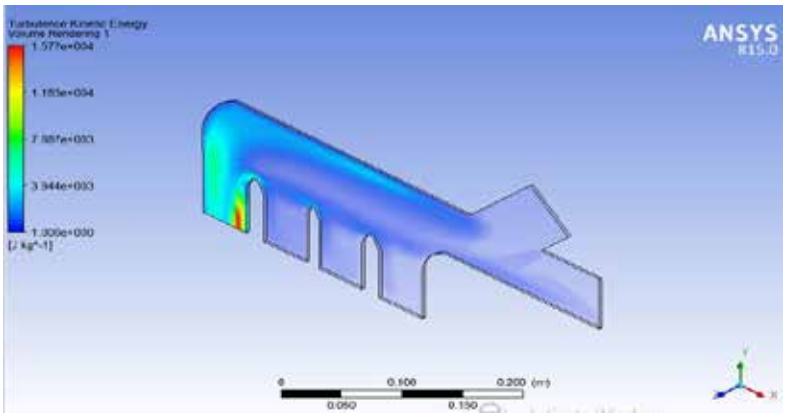


Fig. 3: Turbulence effect for the given position

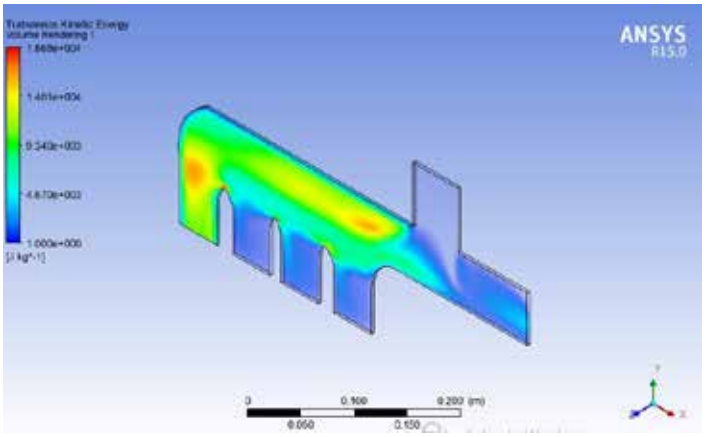


Fig. 4: Turbulence effect for the given position

IV. HIGH ALTITUDE AIR FLOW REGULATOR

In order to create model first of all we need to select an engine to get dimensions for modelling of intake manifold. The most popular Hyundai i20 CRDI 1.4 l diesel engine selected. The engine specification given below,

- 4 cylinder 4 stroke diesel
- Swept volume 1336 cc
- Maximum torque 220 Nm
- Bore 2.95”
- Stroke 3.11”
- Maximum power 89 bhp

In order to provide air at a higher pressure we use a turbocharger which will come in to operation when engine rpm gets beyond 1750 rpm. The turbocharger placed in main passage which will compress the air to required pressure. But this is not sufficient at higher altitudes at normal speeds due to lack of boost pressure at lower rpm.

The Figures 5 shows catia model of existing manifold and Figure 6 shows catia model of proposed system. In order to avoid the problem faced in higher altitudes we introduce a secondary passage which runs parallel to main passage. The secondary passage gives sufficient air flow to the manifold with the help of supercharger fitted at one end.

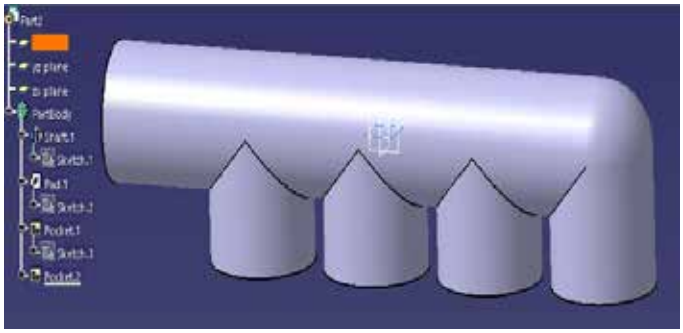


Fig. 5: Existing model

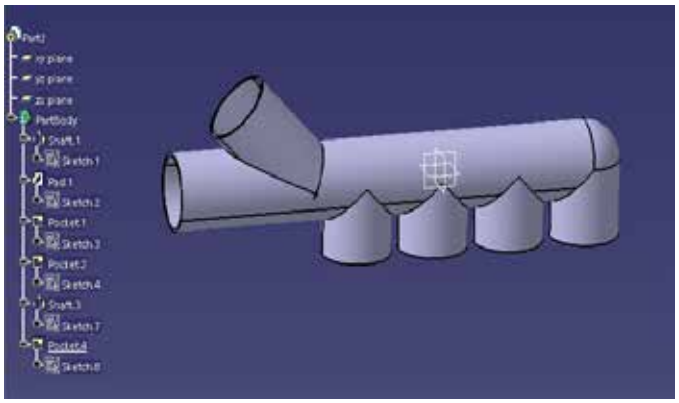


Fig. 6: Proposed model

Table III: Mesh Details

Nodes	2279
Elements	2120
Mesh size	0.05mm
Equation used	K and epsilon
Analysis type	Steady state

Table III shows mesh details of ANSYS analysis. First we had obtained the various inlet and exit values of the manifold. We are considering a steady state analysis of the manifold with a single cylinder in open condition. Thus a suction pressure is provided at the cylinder and different air pressures are provided at inlet. The main two pressure losses are due to friction losses and filter losses. The friction losses occurring in the intake system is assumed to be a constant whose value is around 8.5 kPa. The other main loss is filter losses, it is around 1.5kPa. So the total loss is around 10 kPa, which is a constant. Figure 7 shows air pressure filter losses in intake manifold.

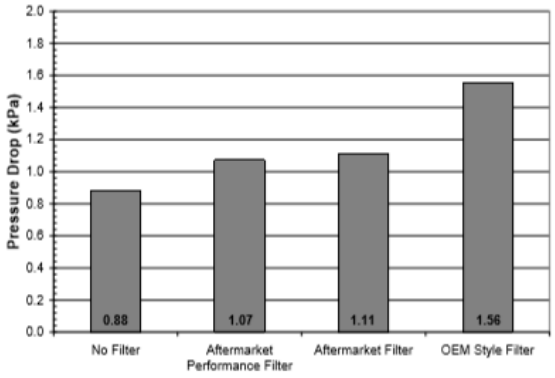


Fig. 7: Air filter losses

Table IV: Boundary Conditions For Existing System

INLET PRESSURE (kPa)	ALTITUDE (m)	OUTLET PRESSURE (kPa)	DENSITY ($kg/m^{3)}$
91	0	-10	1.225
75	1500	-10	1
62	3000	-10	.82
51	4500	-10	.71
41	6000	-10	.635

To improve the performance we runs a secondary passage parallel to main intake ,the secondary passage connected to main to a point before the region of turbulence to avoid cavitations. The secondary passage consist of an electric super charger ,an MAP is placed in main passage. When going to higher altitude then air density decreases at this time the electric super charger placed in secondary passage starts working and compress the air to a higher pressure corresponding to altitude, that is this system always trying to maintain sea level conditions.

When the pressure reaches sea level conditions the electric super charger get switch off. Tables IV and V shows the boundary conditions of existing and proposed systems.

Table V: Boundary Conditions of Proposed System

Primary inlet pressure (kpa)	Secondary inlet pressure (kpa)	Altitude (m)	Outlet pressure (kpa)	Density (kg/m$^{3)}$
91	91	0	-10	1.225
75	109.47	1500	-10	1
62	96.47	3000	-10	0.83
51	85.47	4500	-10	0.71
41	75.47	6000	-10	0.635

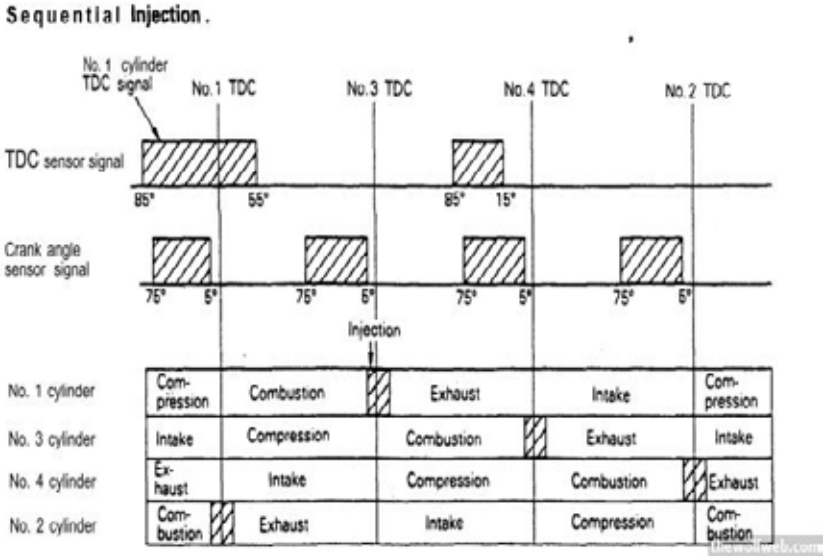


Fig. 8: Valve timing diagram of 4 stroke engine

Even though the flow condition is transient we did our analysis on steady state condition. By noticing the above Figure 8 we can see that in every point on every stroke of engine there is suction taking place in one of four cylinders. So we can infer that the effect produced when one cylinder is opened for a period of time is equal to actual working condition. To get transient values we took rms values of steady state analysis.

Using above given values steady state analysis of the manifold using ANSYS workbench 15.0.The values obtained were compared and plotted. The micro controlled based governing system has been proposed along with analysis. The governing system consist of manifold absolute pressure sensor and an altitude sensor for real time data acquisition. The values obtained are passed through micro controller which governs the running of supercharger.

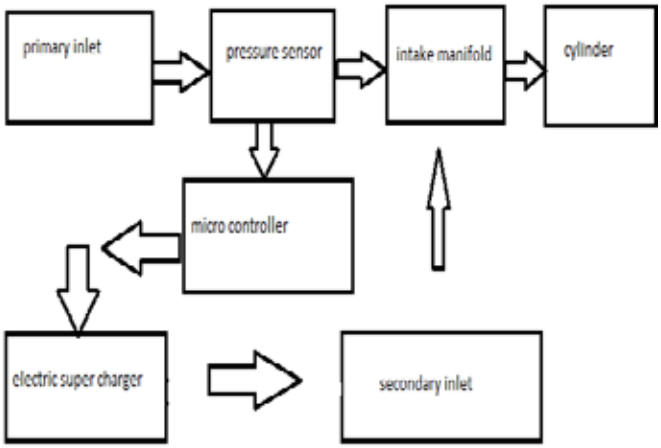


Fig. 9: Diagram of proposed intake

The flow diagram of proposed system is shown in Figure 9, that there is an electrical control module with in which a barometric pressure sensor is placed. This will sense the pressure variation with altitude. The air pressure in main duct can be measured by MAP. We can set a suitable pressure value in control module which is close to sea level conditions. As the vehicle going to higher altitude the difference between MAP and barometric reading increases. When the difference goes beyond the limit the supercharger placed in secondary passage will activated. So mass flow of air can be improved. When MAP reads sea level condition the secondary duct will cut off automatically.

Our prime aim is to improve the volumetric efficiency,

$$h_{vol} = \frac{3456 \times CFM}{CID \times RPM}$$

CID = NOC x 0.7854 x bore^2 x stroke

CID = 4 x 0.7854 x 2.95 x 3.11 x 2.95

=85.08 in^3

The mass flow of air of existing and proposed system studied and compared. After that the improvement in volumetric efficiency checked.

Table VI: Comparison of Mass Flow Rate

Altitude (m)	Mass flow of existing system (kg/s)	Mass flow of proposed system (kg/s)
0	2.40	2.4
1500	1.94	2.2
3000	1.64	1.89
4500	1.39	1.65
6000	1.20	1.44

From the Table VI we can see that the mass flow rate of air is increased as compared to existing system. By in cooperating additional passage to existing passage it will definitely improve the mass flow rate. It is seen that the mass flow rate increase about to 20% to 30%.

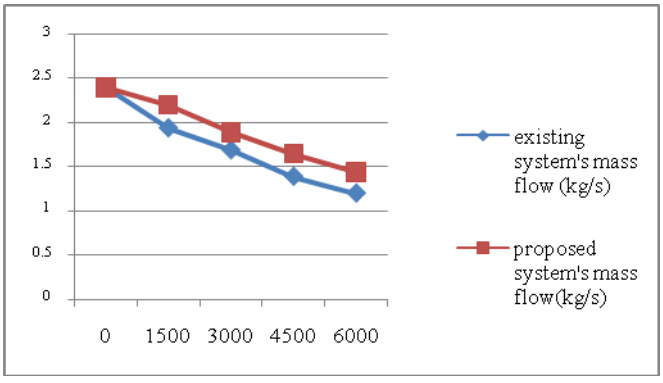
Table VII: Comparison of Volumetric Efficiency

Altitude(m)	η_{vol} existing system (%)	η_{vol} proposed system (%)
0	78.56	78.56
1500	64.8	72.04
3000	53.7	65.85
4500	45.73	57.47
6000	39.02	49.977

From the above Table VII we can see that the volumetric efficiency of proposed system is higher than existing system. When the mass flow rate increases it will definitely increase the volumetric efficiency. With proposed system the volumetric efficiency can be increased to 8 % to 12 %.

V. RESULTS AND DISCUSSION

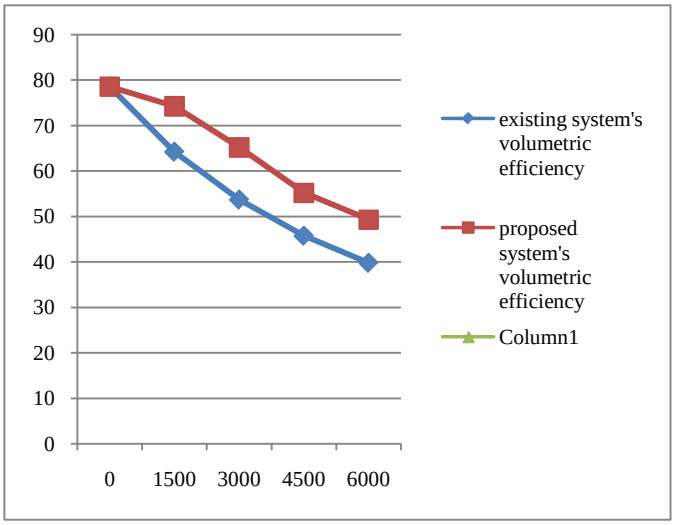
It is seen that by adopting proposed system the volumetric efficiency can be improved to 8-15% from sea level to extreme high road conditions. Which is obtained by improving the mass flow rate to engine. So by referring to analysis report we can infer that our proposed system is a solution to get high volumetric efficiency in higher altitudes. Declined volumetric efficiency of current system is due to less air density in higher altitudes, this problem is rectified by providing a secondary passage with electric super charger. The supercharger is governed by micro controller.



X -altitude(m) Y-mass flow rate(kg/s)

Fig. 10: Mass flow rate comparison

We can see that the mass flow rate of air is increased as compared to existing system. In our proposed system there is an additional secondary passage which will come in to action when the air pressure in main duct falls below.



X-Altitude(m) Y-Volumetric efficiency(%)

Fig. 11: Volumetric efficiency comparison

By in cooperating additional passage to existing passage it will definitely improve the mass flow rate. It is seen that the mass flow rate increase about to 20% to 30%. These variations are shown in Figures 10 and 11.

VI. CONCLUSIONS

It is seen that in existing automobiles when going to higher altitude mass flow rate found to be decreasing so that performance found to be inadequate. In order to improve the mass flow rate a secondary duct run parallel to main duct. This is provided with an electric super charger. This will come in to action when main inlet pressure falls under atmospheric pressure. The secondary duct helps to maintain pressure almost equal to sea level conditions. Improve the efficiency of the engine at normal speeds even at high altitudes. Proposed system the volumetric efficiency is found to be higher than that of existing system. The mass flow rate and volumetric efficiency of existing system and proposed system has been studied and compared. To provide sea level conditions at higher altitude. By doing so performance of the engine can be improved.

The proposed system will improve the volumetric efficiency of the engine by about 10% in all altitudes. This system is cost effective and can be successfully implemented in any given vehicle with minimal modifications. The best suitable position for fixing the secondary passage is in between the inlet manifold and inlet duct. The flow pattern will not get changed inside the manifold in addition of the secondary duct. Thus this flow will not affect the resonator design.

The flow pattern and the pressure developed in the manifold shows a improvement in flow rate at various altitudes. Air flow to engine is the only external factor that affects the engine performance at altitudes. The improvement in airflow will thus enhance the volumetric efficiency and in turn the overall efficiency of the engine.

With the improvement in air flow the combustion will be better and the emission characteristics of the engine. Thus the CO emission and particulate emission will also drops.

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LEGALIZING DATA INTEGRITY PROTECTION IN RENOVATING CODING BASED CLOUD STORAGE

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ABSTRACT

This paper is based on how to protect data in cloud storage against corruptions by efficient data integrity checking and recovery procedures. In proposed system, we design a data integrity protection (DIP) scheme under a mobile Byzantine adversarial modeland enable the client to feasibly verify the integrity of data from malicious corruptions. It is desirable to enable clients to verify the integrity of their data in the cloud. We implement a DIP scheme for the FMSR codes under a multiserver setting. We builtFMSR-DIP codes, which preserve the fault tolerance and repair traffic saving properties of FMSR codes.

Keywords: Data integrity protection, fault tolerance, FMSR code,FMSR-DIP code

1. INTRODUCTION

Cloud storage is a model of data storage where the digital data is stored in logical puddle, the physical storage spread multiple servers, and the physical environment is typically owned and managed by a hosting company. These cloud storage givers are responsible for keeping the data available and accessible, and the physical environment are protected and running. Cloud storage services can be obtained through a co-together cloud computer service, a web service application programming interface (API) or by applications that use the API, such as cloud desktop storage, a cloud storage gateway or Web-based content management systems.Cloud storage is based on highly practical infrastructure and is like wider cloud computing in terms of ingressable interfaces, near-abrupt elasticity and scalability, multi-tenancy, and metered resources.Cloud storage generally denotes a hosted object storage service, but the phrase has widen to include other types of data storage that are now available as a service, like block storage.

Cloud storage is:

1. Made up of many distributed resources, but still acts as one - often referred to as federated storage clouds

2. Highly fault tolerant through redundancy and distribution of data

3. Highly durable through the creation of versioned copies

4. Typically eventually consistent with regard to data replicas.

Outsourcing data storage improves the attack surface area:

a) When data is issued it is stored at many locations improving the risk of unauthorised physical entry to the data. For example, in cloud based architecture, data is reproduce and moved usually so the risk of unauthorised data recovery improves considerably. The manner that data is reproduced depends on the service level a customer select and on the service given. Different cloud vendors provide different service levels. Risk of

unauthorized entry to data can be diminished through the use of encryption, which can be appealed to data as part of the storage service or by on-premises equipment that encrypts data prior to uploading it to the cloud.

b) The number of people with entry to the data who could be compromised improves dramatically. One company might have a small team of administrators, network engineers but a cloud storage company will have more customers and thousands of servers and therefore a much larger team of technical staff with physical and electronic access to almost all of the data at the entire facility or perhaps the total company. Encryption keys that are kept by the service user, as positioned to the service provider limit the entry to data by service provider employees.

c)By splitting storage and networks with many other users/customers it is feasible for other customers to admit your data. Sometimes because of inaccurate actions, faulty equipment, a bug and sometimes because of offender intent. This risk applies to all types of storage and not only for cloud storage. The risk of possessing data read during transmission can be diminished through encryption technology. Encryption in transit preserve data as it is being transmitted to and from the cloud service. Encryption at rest preserve data that is stored at the service provider. Encrypting data in an on-precise cloud service on-ramp system can issue both kinds of encryption protection.

II RELATED WORKS

Proofs of Retrievability: Theory and Implementation:A proof of retrievability (POR) is a concise proof by a file system to a client that a destination file is complete, the client will recover. PORs have low communication complexity than transmission.The important advantage is client can start and check unlimited number of challenges.PORs into two main types:1.PORs that enable unlimited number of verifications 2.PORs that can verify a limited number of queries.In this paper, a new framework enables design of protocols with large range of parameter tradeoffs. A java implementation of encoding algorithm has been given where files are processed and encoded. Here the future work is to design different encoding techniques with less number of disk access for large files and efficient POR protocols to support file updates and publicly checkable PORs are to be designed.

Remote Data Checking for Network Coding-based Distributed Storage Systems: Remote Data Checking (RDC) is a method by which clients can establish the data at unknown servers remains unflawed over time. RDC is useful as a prevention tool which allow clients to check whether data is damaged and has to be detected. A technique was proposed to add redundancy based on network coding, which provides interesting tradeoffs because of its remarkably low communication overhead to repair corrupt servers.The proposals for using network coding in storage have one drawback though: the code is not systematic; it does not embed the input as part of the encoded output. Small portions of the file cannot be read without reconstructing the entire file.The performance properties of remote data checking protocols, such as provable data possession and proofs of retrieval, also abide to read-rarely workloads.Data recovery condition: The original file can be recovered as long as at least k out of the n coded blocks are not corrupted.We are now ready to present the network coding-based RDC scheme (RDC-NC) that provides defense against both direct data corruption attacks and replay attacks, and is able to maintain constant client storage.In this paper, we propose a secure and efficient RDC scheme for network coding-based distributed storage systems that rely on un- trusted servers. Our RDC-NC scheme can be

used to ensure data remains intact when faced with data corruption, replay, and pollution attacks. The performance evaluation shows that RDC-NC is inexpensive for both clients and servers.

Remote Data Checking Using Provable Data Possession: Provable data possession (PDP) can be used for remote data checking.A client has stored some data at an unknown server can easily verify that server possess original data without retrieving.PDP provide data format independence and have no restriction on challenges to prove data possession. PDP also provide public verifiablility.A PDP protocol checks and storage site retains a file which consists of blocks.The problem of auditing has been focused whether an unknown server store the client data.We also define robust auditing which integrate remote data checking (RDC) with forward error correcting codes to mitigate small file corruptions. Previous techniques did not allow sampling are not practical when PDP is used to prove possession of large amounts of data.

Cumulus: Filesystem Backup to the Cloud: In this paper Cumulus, a system for efficiently implementing file system backups over the Internet. Cumulus is particularly designed under a thin cloud assumption that the remote data centre storing the backups does not provide any special backup services.Cumulus aggregates data from small files for remote storage, and utilize LFS-inspired segment cleaning to maintain storage efficiency. Cumulus also effectively represents increase changes, including changes to large files.Cumulus will often group data from many smaller files together into larger units called segments. Segments changed into the unit of storage on the server, with each segment reserved as a single file. Filesystems typically contain many small files. Avoid inefficiencies associated with many small files.Avoid costs in network protocols: Provide additional privacy when encryption is used: Aggregation helps hide the size as well as contents of individual files.The Cumulus simulator models the process of backing up collections of files to a remote backup service. It utilizes signs of daily records of file metadata to perform back- ups by determining which files have changed, aggregating edited file data into segments for storage on a remote serviceMoreover, a thin-cloud approach to backup provides one to easily hedge against provider failures by backing up to multiple providers.

Cryptographic Extraction and Key Derivation, HKDF Scheme: In spite of the central role of key derivation functions (KDF) in applied cryptography, there has been little formal work addressing the design and analysis of general multi-purpose KDFs.We provide detailed rationale for the design of KDFs based on the extract then expand approach; we present the first general and rigorous definition of KDFs and their security that we base on the notion of computational extractors; we specify a concrete fully practical KDF based on the HMAC construction; and we provide an analysis of this construction based on the extraction and pseudorandom properties of HMAC. The resultant KDF design can support a large variety of KDF applications under suitable assumptions on the underlying hash function; particular attention and effort is devoted to minimizing these assumptions as much as possible for each usage scenario. Beyond the theoretical interest in designing KDFs, this work is intended to address two important and timely needs of cryptographic applications: (i) providing a single hash-based KDF design that can be standardized for use in multiple and diverse applications, and (ii) providing a stable, yet effective, design that exercises much care in the way it utilizes a cryptographic hash function.A Key derivation function (KDF) is a basic and essential component of cryptographic systems: Its goal is to take a source of initial keying material, usually containing some good amount of randomness.The main contrary in designing a KDF connects to the form of the initial keying material.

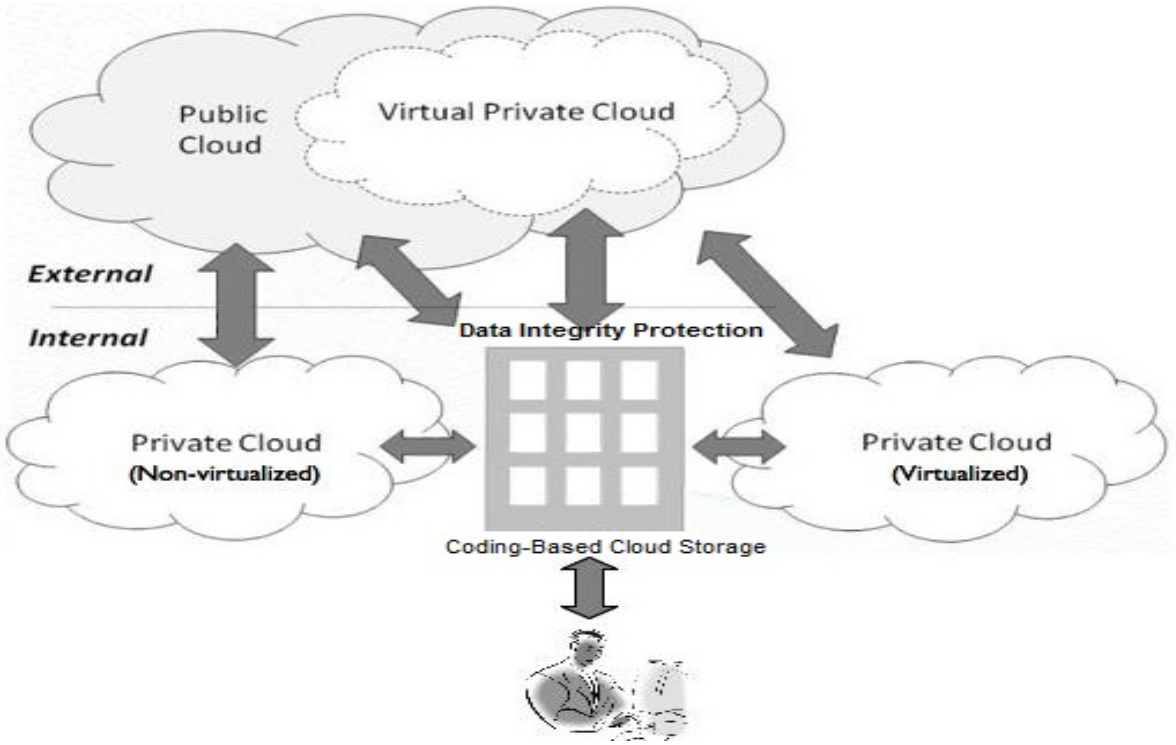
III EXISTING SYSTEM

However, security concerns proceed when data storage is outsourced to third-party cloud storage providers. It is passionable to enable cloud clients to check the integrity of their outsourced data, in case their data have been misfortunately untrustworthy or maliciously understood by insider/outsider attacks. As data generation is far outpacing data storage it proves costly for small firms to frequently update their hardware whenever additional data is created. Also preserving the storages can be a difficult task. It dispatch the file across the network to the client can consume heavy bandwidths. The problem is further tangled by the fact that the owner of the data may be a small device, like a PDA (personal digital assist) or a mobile phone, which have limited CPU power, battery power and communication bandwidth.

DISADVANTAGE

- The main pitfall of this scheme is the high resource costs it requires for the implementation.
- They proposed for a single-server setting.
- Also computing hash value for even a ordinary large data files can be computationally burdensome for some clients.
- Data encryption is huge so the disadvantage is small users with limited computational power.

IV PROPOSED SYSTEM



We study the issue of remotely checking the integrity of regenerating-coded data against corruptions under a real-life cloud storage setting.We design and execute a practical data integrity protection (DIP) scheme for a specific regenerating code, while conserving its intrinsic properties of fault tolerance and repair-traffic is saving.

Our DIP scheme is depicted under a mobile Byzantine adversarial model, and authorize a client to feasibly verify the integrity of random subsets of outsourced data against general or malicious corruptions.It is desirable to enable clients to verify the integrity of their data in the cloud. We depict and execute a DIP scheme for the FMSR codes under a multiserver setting. We establish FMSR-DIP codes, which preserve the fault tolerance and repair traffic saving properties of FMSR codes.

4.1 Advantage

- Apart from depletion in storage costs data outsourcing to the cloud also helps in reducing the maintenance.
- Avoid local storage of data.
- Decrease the costs of storage, maintenance and personnel.
- It decreases the chance of losing data by hardware failures.
- Not cheating the owner.

4.2 System Requirements

4.2.1 Hardware

- System : Pentium IV
- Hard Disk : 40 GB.
- Floppy Drive: 1.44 Mb.
- Monitor : 15 VGA Colour.
- Mouse : Logitech.
- Ram : 512 Mb.

4.2.2 Software

- Operating system : Windows XP.
- Coding Language: ASP.Net withC#
- Data Base : SQL Server 2008

V CONCLUSION

We legalized data integrity protection in renovating coding based cloud storage by designing and implementing a DIP scheme for the FMSR codes under a multiserver setting. We built FMSR-DIP codes, which preserve the fault tolerance and repair traffic saving properties of FMSR codes. To recognize the practicality of FMSR-DIP codes, we examine the security strength via mathematical modeling and evaluate the running time overhead via testbed experiments. We show how FMSR-DIP codes trade between performance and security under different parameter settings.

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MICROSTRUCTURE, HARDNESS AND TENSILE PROPERTIES OF Al7%Si0.35%Mg ALUMINUM ALLOY

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ABSTRACT

In this work, the effects of composition on the microstructure, tensile and hardness properties of modified A356 aluminum alloy had been investigated. The alloy was produced by stir casting. Microstructures of the samples were investigated using the optical microscopy. The results showed that the modification of Al-7%Si-0.35%Mg decreased hardness values of the alloy. Also, the ultimate tensile strength (UTS) and elongation values decreased from 230 to 182MPa and 6% to 3.8% respectively.

Keywords: A356 aluminium alloy, Hardness, Microstructure, Tensile property.

I INTRODUCTION

Aluminum alloys are widely used in automobile and aerospace industries due to low densities, excellent cast ability, good mechanical properties such as: hardness, ultimate tensile strength and weld-ability as well as high wear resistance and corrosion resistance[1].

In these alloys, Mg is added into Al-Si alloys as a key alloying element in order to induce aging hardening behavior by the precipitation of Mg_2Si [2].A356 (Al-7%Si-0.35%Mg)aluminum alloy is a very commonly Si containing Alalloy used as the matrix in MMCs. It is characterized by: low cost, ease of handing, good strength and ductility and resistance to atmospheric corrosion. Hard particles such as Al_2O_3 and SiC are commonly used as reinforcement phases in the composites. The application of Al_2O_3 or SiC particle reinforced aluminum alloy matrix composites in the automotive and aircraft industries is gradually increasing for pistons, cylinder heads, connecting rods etc.,[3-6].

Further improvements in the strength and ductility of the alloy are frequently accomplished through the addition of elements that modify the eutectic silicon phase compounds. The inter-metallic β-Al_5FeSi phase that forms during solidification of aluminum alloy is detrimental to the mechanical properties because it is brittle and exists as thin plates [7].

Sharp edges of these platelets act as stress concentration sites, which facilitate crack initiation and thus decrease the ductility of the castings. It has been reported that the nature, composition and structure of iron rich intermetallic compounds can be modified with addition of Sr and Mn[8]. Reinforcement is good choice to modify the eutectic Si phase in Aluminum alloy [9]. In this work, the effects of reinforcement addition on the microstructure, tensile and hardness properties of modified A356 alloy have been studied.

II EXPERIMENTAL PROCEDURE

Thechemicalcompositionofaluminumalloystudiedinthisworkisgiveninthe Table1.

Table 1 Composition of modified A356 alloy (mass fraction, %)

Si	Mg	Fe	B	Sn	Zr	Ti	Al
3.15	0.49	0.91	0.0002	0.002	0.008	0.024	Balance

Samples of the metal matrix composites were prepared by stir casting route. The amounts of the matrix material and the reinforcements were determined using the weight percentage. The melting was carried out in a resistance furnace. The reinforcement particles were also preheated to before adding aluminum matrix. The aluminum material was melt into 750 °C. They were then slightly cooled to below the liquids, to maintain the slurry in the semi-solid state. This procedure had been adopted while stir casting aluminum composites with single reinforcement. The preheated reinforcement was added Zr in various percentage like 0%, 0.25%, and 0.5% along with A356. The composite slurry was then reheated to a fully liquid state and mechanical mixing was carried out for about 10–15 min at an average mixing speed of 150–300 rpm. The final temperature was controlled to be within 800°C±10°C.Themelting material can be transformed to the die.Quantitative data on the microstructure were determined using an optical microscope equipped with an image analysis system.

Dimensions	Subsize Specimen
	6 mm [0.250 in.] Wide
	mm [in.]
G—Gage length (Note 1 and Note 2)	25.0 ± 0.1 [1.000 ± 0.003]
W—Width (Note 3 and Note 4)	6.0 ± 0.1 [0.250 ± 0.005]
T—Thickness (Note 5)	
R—Radius of fillet, min (Note 6)	6 [0.250]
L—Overall length, min (Note 2, Note 7, and Note 8)	100 [4]
A—Length of reduced section, min	32 [1.25]
B—Length of grip section, min (Note 9)	30 [1.25]
C—Width of grip section, approximate (Note 4 and Note 9)	10 [0.375]

Figure 1 Size of tensile Specimen

Tensile test bars were machined, according to ASTME8m-13aa sub-size specimen is shown in Fig. 1and the test was performed on a computer controlled tension machine. Four tensile specimens of each alloy were tested and

the average value obtained. Hardness tests were carried out Rockwell hardness machine (Model TRSD-N, Load: 100, indicator: 1/16" ball).First, surface finish was completed and five measurements were taken randomly in each sample and averaged to obtain the hardness value of the specimen.

III RESULTSANDDISCUSSION

3.1 Microstructures

A microstructural examination of the modified A356 was carried out to conform the microstructure. A cross section of the sample revealed that microstructure consists of interdendritic network of eutectic silicon particles (mostly rounded, less angular) and Mg_2Si particles distributed in a matrix of aluminum solid solution throughout structure is shown in Fig. 2.

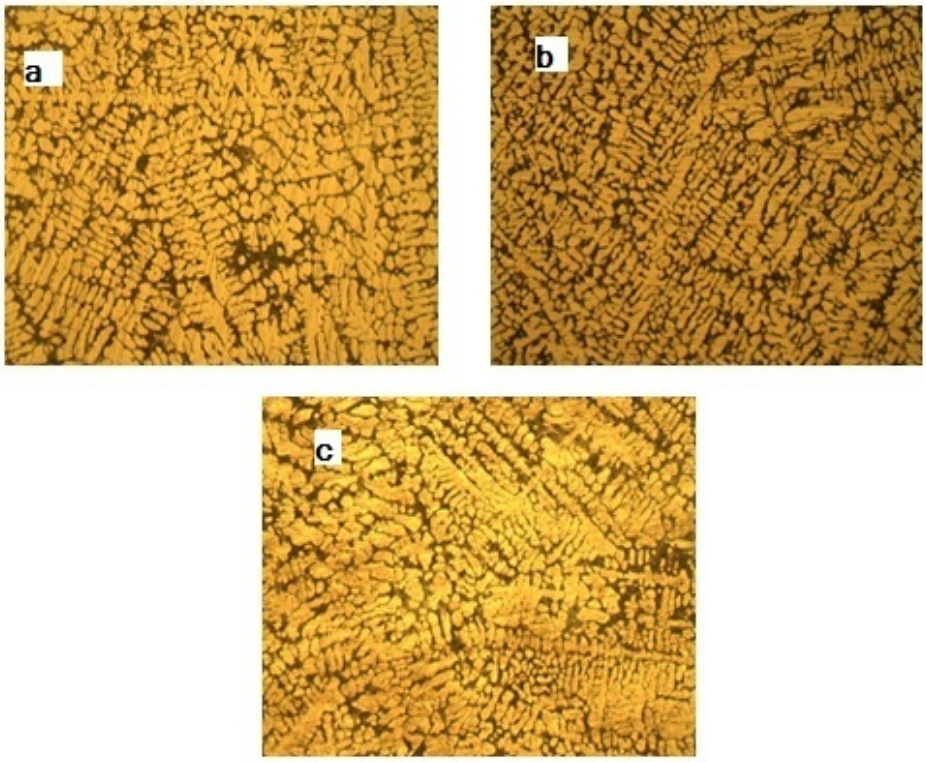

Figure 2 Microstructures of the modified A356 type aluminum alloys(a) reinforcement-free, (b) 0.25 wt% reinforcement and (c) 0.5 wt% reinforcement

3.2 Hardness

The results of hardness tests are shown in Figure 3.It can be seen that the initial hardness of the unmodified alloy was 60HRB that decreased to 43 HRB after addition of 0.5 % reinforcement. According to the microstructure modification of β intermetallic, hardness should increase with the rise of reinforcement contents. But the results indicate that hardness obviously declines. Because hardness appears to be much sensitive to the porosity volume fraction [10] and the most important material property factor that influences the hardness is the porosity [1],the increase of the porosity amount would result in the decrease of the hardness of the samples. As mentioned before,

with increasing of reinforcement content, the amount of the porosity increased.

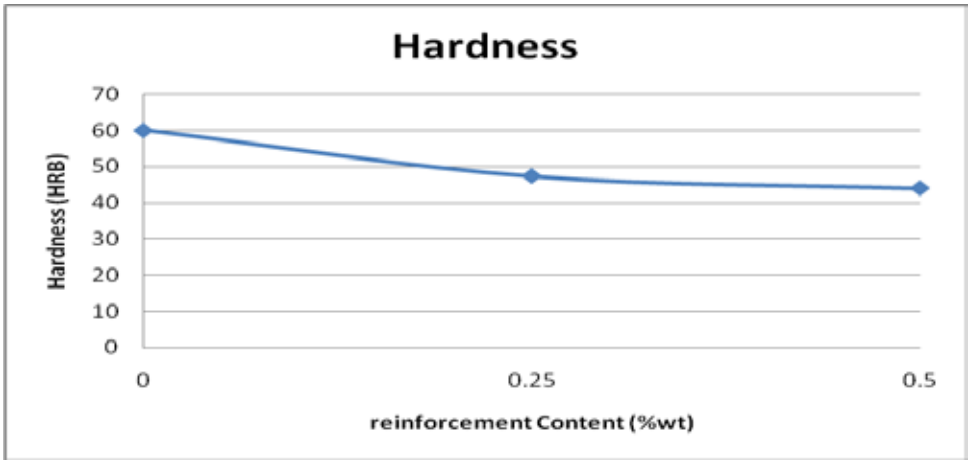

Figure 3Hardness of modified A356 type aluminum alloys

3.3 Tensile properties

The average ultimate tensile strength (UTS) and elongation values of alloys with and without reinforcement additions are illustrated in Fig. 4. It is evident that reinforcement additions reduced both UTS and elongation values of the samples. UTS isdeceased form 230 to 182MPa and elongation percentage is reduced from 6% to 3.8%. Among the reinforcement containing A356 aluminum alloys, which addition of 0.5 % exhibits the reduced UTS and elongation; High reinforcement content have lower UTS and elongation, in comparison with modified alloys with lower reinforcement content (0.25%). This can be attributed to the amount of porosity. As it can be seen form Figure 4. When the amount of reinforcement is increased the level of porosity is so high that the negative effective of reinforcement on the porosity prevails the positive effect on the modification of secondary phases.

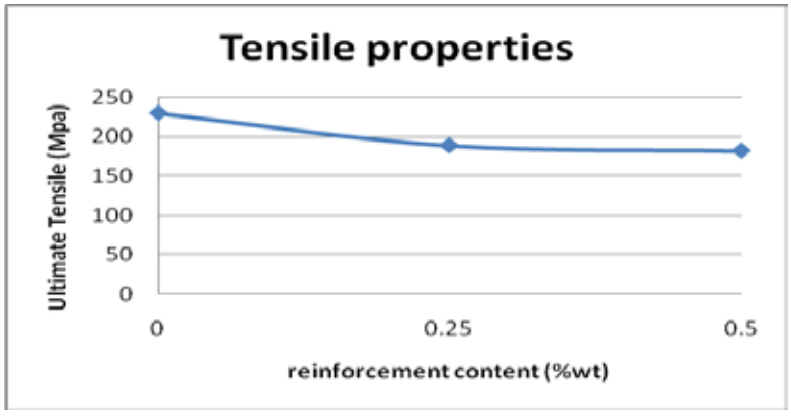

Figure4Ultimate tensile strength of modified A356 type aluminum alloys

IV CONCLUSIONS

The influences of reinforcement on the microstructure and mechanical properties of modified A356 aluminum alloys were investigated. The following conclusions were drawn:

1. Adding 0.25%-0.5% reinforcement to the aluminum alloy decreased the hardness values of the alloys.
2. In presence of 0.25%-0.5% reinforcement UTS and elongation of the A356 aluminum alloys were decreases. The reinforcement-containing A356 aluminum alloys, specimens with addition of 0.5% reinforcement exhibit the poor mechanical properties.

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WEB BASED PHARMACY SUPERVISION SOFTWARE

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ABSTRACT

The elaborate a good and significant pharmacy management system available in the market. The improvement of management in a pharmacy by using software designed especially for a pharmacy will be elaborated. A computer pharmacy system could be designed for both the single store and the multi-store chain. Real-time inventory updates, it provides the information systems infrastructure necessary to meet the retailing challenges of the future. Point of Sale technology will be reviewed which explain the advantage of its usage a solution to increase profit. A complete pharmacy computer system should be a package of services, including the following: Point of sale retail management, pharmacy management integration, Credit/debit card processor integration, prescription verification,inventorymanagement.

Keywords: Credit/Debit Card Processor Integration, Inventory Management, Pharmacy, Management Integration, Sale Retail Management, Verification Process

I. INTRODUCTION

More troubles are taking in keep records of medicine, head wait in maintaining stocks, bills and other administrative work. Today's independent pharmacy owners face tough challenges in the middle of growing customer demands and increasing competitive threats. A computer pharmacy system could be designed for both the single store and the multi-store chain. Real-time inventory updates,itprovidesthe information systems information will also elaborate pharmacy system application will benefit in reducing labour costs, better pricing control, reduce inventory investment, improve cash flow, improve patient service, and reduce clerical work and easier compliance with regulations.

II. PROBLEM DESCRIPTION

- The maintenance of records such as medicine details, sales details are very difficult to track manually.
- The customers have to go to the pharmacy to purchase the medicines in person.
- Medicines are accessed and used safely patients, professionals both the environments.
- Retrieving information from one file and using to compare, update, or display information from another file.
- Accurate data for managing patient care perform expanding list of daily tasks efficiently.

2.1 Disadvantages

- Time waste

- Ø Travelling charges
- Ø Paper work
- Ø Not flexible

III. PART OF WEB BASED PHARMACY

Admin can upload and view medicines.

Admin can update the medicines.

Admin can view expired medicines.

Admin can view available and not available medicines.

User can login and view price list.

User can select the particular category medicines and can view that.

User can give feedback about pharmacy services.

Fig 1: System Architechture

3.1 Module Description

In this part upload the medicines into the database and view the medicines from the database.

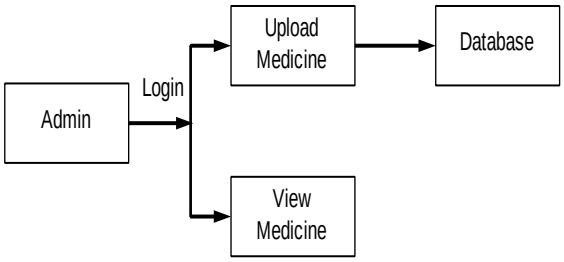

Fig 2: Admin Can Upload And View Medicines.

In this part the valid username and password and then update the medicines into the database and view the updated information about the medicines from the database.

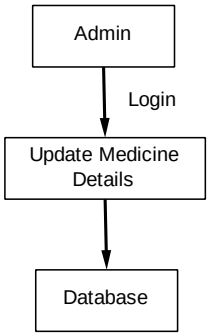

Fig 3: Admin Can Update The Medicines

In this part the valid user name and password and then view expired medicines from the database.

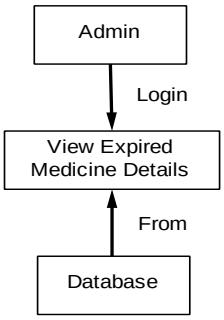

Fig 4: Admin Can View Expired Medicines

In this part check the medicines are available or not from the database

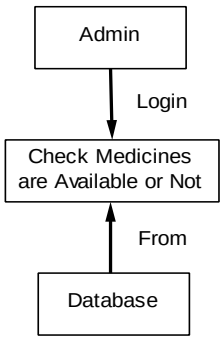

Fig 5: Admin Can View Available And Not Available Medicines

In thispart The valid username and password and **D VIEW PRICE LIST** then view all type of medicines from the database.

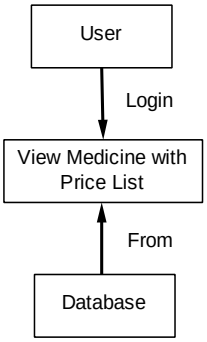

Fig 6: User Can Login An

In this part Order the particular selected medicines from the database.

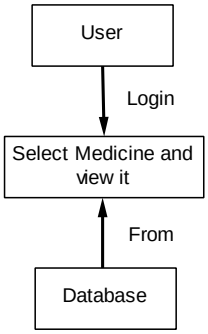

Fig 7:User Can Select The Particular Category Medicines And Can View That.

In this part the valid user name and password and then send a feedback about the pharmacy service to the database.

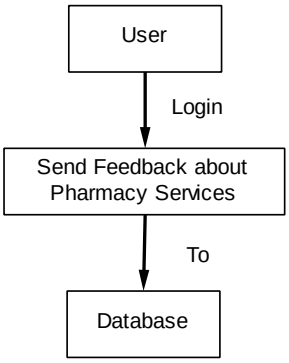

Fig 8:User Can Give Feedback About Pharmacy Services

IV. FUTURE PLAN

- Distributed pharmacy management system is a web application and it maintains pharmacy details in branches provide medicines for customer and doctors.
- The maintenance of pharmacy branches records such as medicine details, sales details, are done easily through the system. The customer can buy the medicines their own needs at home itself.
- This system consists of four users' administrator, pharmacy assistant, doctor, and customer. Admin can maintain all the branch pharmacy details. Registered user only can log into the system and also view the medicine details.
- Simply customer have to upload the prescription and their details like medicine name, medicine power etc., into the website. Then the customer can place their order and get the medicine.
- Doctors can also purchase medicines they can place bulk order. The placed orders are verified and enter the invoice entry details by the pharmacy assistant and also search the available medicine for branch pharmacy.

4.1 Advantages

- Low cost
- Reduce time waste
- User friendly
- More flexible
- Time saving

V.CONCLUSION

Pharmacy Information System is very useful especially when it comes in handling patient's healthcare information. By using this application, pharmacists spend less time on repetitive and manual tasks and have more time for critical patient care activities.

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CHILD PRODUCTION SYSTEM

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ABSTRACT

The project entitles child protection system is essentially software that allows parents to monitor the child's cell phone. All incoming and outgoing texts and multimedia messages can be seen and interrupted by the parents, who can also monitor and access the history. This system uses Sun java wireless toolkit for accessing mobile and JSP and Servlets are used for monitoring the process. The parents are receives the alerts from the children in mail format only. For Convenience the alerts are also stored in the centralized server. Parents may later login into the server and view the details.

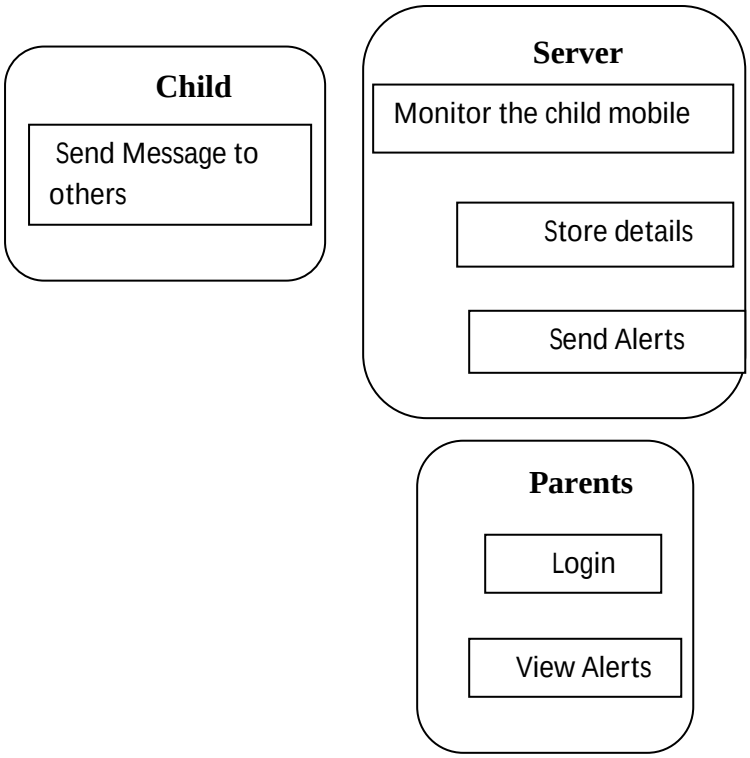
Keywords: Java, J2me, Java Wireless Technology, Monitoring Application, Java Mobile Emulator

I. INTRODUCTION

Latest inventions of science has made life easy and turned the world into a global village. Today's man has access to the world and can have information of the latest happenings in any part of the world. It is because of the latest inventions of science that a man, even on the move, can talk to a person or can have access to any other person who is thousands of miles away. The invention of computer, internet and mobile phones has brought revolution in the human life. The IT developments have made life easy and of course accessible. It is said that any new invention can prove either fruitful or otherwise. Same is true for internet and mobile phones. Unless used in positive direction, internet and mobile phones can prove fatal. Mobile phone is an important gadget in the present day world, and it has become almost a necessity. Mobile phones are world over and almost every person owns a mobile phone. Mobile service companies, under different schemes have made it easy for people to own mobile phones. In our state mobile phone service was introduced five years back for the benefit of the people of the valley. Given the tremendous response of the people, other service providers in mobile telecom sector entered into valley and in a short span spread their services to the remote areas of the valley. During this short period, majority of the valleyiets became mobile phone users. Some people in the valley are seen having more than one mobile phone, being subscribers of different service providers. Although some people have the need, but most of the people possess more than one mobile phone just to show their status. Even children and teenagers own their personnel mobile phones. It is a fact that mobile phone is a basic necessity but excessive and negative use of any good thing can create problems. Now if we talk of mobile phone service with regard to our valley, its negative use is at its peak. It is said that in our valley a maximum number of school and college going students and even teenagers use mobile phones. Children are usually seen busy talking on mobile phone on the streets. Many children own expensive mobile phone sets costing more than twenty thousand rupees. Parents should understand that mobile phones can be misused by their children if parents don't keep a

vigil on their children. Children give preference to chatting rather than their studies, and most of the children as a result don't concentrate on their studies. Some parents maintain that mobile phones help in keeping track of their children, but parents should make it a point to enquire about the usage of mobile phones by their children. If parents have provided mobile phones to their children then it is their duty to enquire about the use of mobile phone. Parents have to make their children answerable otherwise mobile phones can prove harmful for their children. Mobile phone in itself is not a problem but its wrong use can create problems. And negative use of mobile phone particularly by children can ruin not only their future but also their moral and social values. It is high time that we understand the importance of mobile phone in the present day world and take maximum benefits from this technology

1.1 System Architecture



II SYSEMSTUDY

2.1 Existing System

There is no perfect existing system that monitors a child's phone, some of them allows only monitor logs of the mobile activity and keeps copies of the text messages. But the services are wont work with the multimedia messages and the parents can't stop the child from receiving unwanted mms from anonymous but they only can see the log of it

Disadvantage

- Some traditional system Only Can View Call logs and doesn't supports logging text messages.
- Some allows to log text messages but not multimedia messages.
- Controlling any of the service was not possible.

2.2 Proposed System

The proposed system was a better tool that works with java which is a platform independent so it can run in any device. The parent whom wants to monitor the Childs activity can control the multimedia messages. The parent gets alerts of the mobile activity via email. For Reference the logs of the Childs mobile activity was stored in server, the parent can check them later by login into the server.

Advantage

- Supports logging any kind of mobile activities like calls, messages and multimedia messages.
- The parent can control the multimedia messages that are the parent can see the message and then they can decide to send the message to their children or not.
- Supports e-mail alerts incase of mms so if the parent has a smart phone that is pre-configured with email then the alert message will be notified immediately.

III MODULES

1. User Module

2. Server Module

3. Back Link Module

4. Send / Receive logger

5. MMS permission manager

6. Alert Module

IV.MODULE DESCRIPION

1. User Module

In this project there are two types of users: children and parents.

The following step are applied

- User login
- User registration
- activity monitor

2. Server Module

In this module the server maintains all the details about children and parents. If the child sends any message to other user the server stores the message details in server log. The parents can see the details later.

3. Back Link Module

The back link module connects the user module and server module for getting permission a for immediate updates of incoming and outgoing messages its necessary to connect user and server module.

4. Send / Receive logger

For synchronizing messages server maintains this send / receive the sent messages are stored in send and vice versa.

5. MMS permission manager

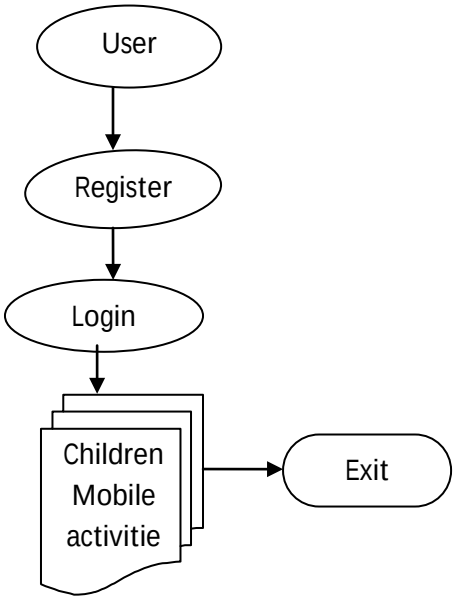
The multimedia message stored in individually for parents permission the mms will be sent to the user if only the parents allows it.

6. Alerts module

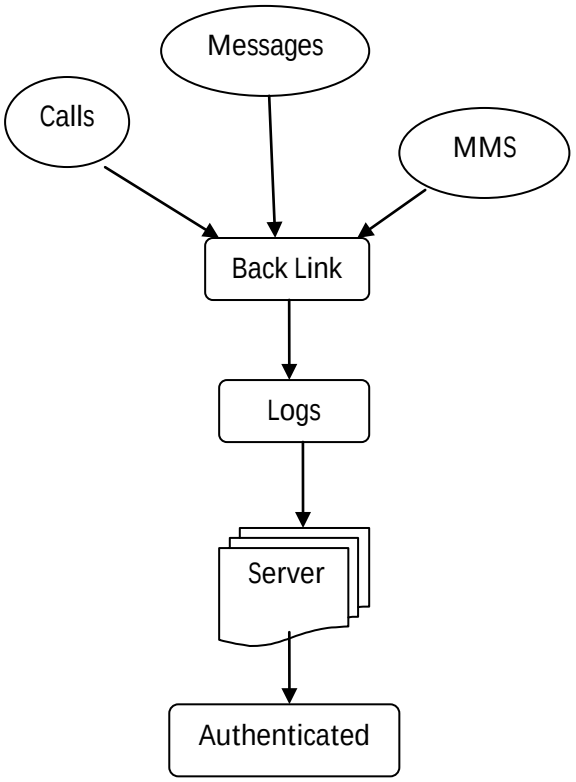
After storing the message details, the server sends an alert message to the parents. Through email the alerts messages is send. The parents can login on the mail and see the alerts details

DATA FLOW DIAGRAM

Level 1:



Level 2



V.CONCLUSION

The proposed scheme‘s motive was achieved and it out performs all the other related schemes. The proposed scheme becomes notable system to monitor all the mobile activities so it was essential to monitor and protect children’s from misbehaving other mobile phone users. The proposed scheme was not just a monitoring tool it also helps the user to control multimedia messages, the MMS was only sent to the children f only the parent allow.

VI. FUTURE ENCHANCEMENT

The effective and essential system already proposed but some of the features can be added like monitoring internet activities, call duration and application installation monitoring. Microsoft already have implemented a system as parental control for mobile users under 18 years but it not allows parents to manage apps.and additionally location monitoring feature can also be added for GPS enabled handheld devices.

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SELECTION AND RANKING OF MULTIFACETED CRITERIA FOR THE PRIORITIZATION OF MOST APPROPRIATE CONVERSION TECHNOLOGY FOR BIOMASS TO BIOFUEL IN INDIAN PERSPECTIVE USING ANALYTIC HIERARCHY PROCESS

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ABSTRACT

In present Indian scenario, global warming, decrement of fossil fuel and other international issues have led to the decision to exploit renewable energy for the sustainable development. One of those Renewable sources is biomass energy which can provide a good quality Energy. Conversion of biomass to energy is undertaken using three main conversion technologies named as Thermo-chemical, Bio-chemical and Chemical. Each type of Biomass Conversion Process has its limitations, and thus choosing the most appropriate amongst them as per the requirement is very important to gain the optimal benefits. To deal with such complex decision making problems, The Analytic Hierarchy Process (AHP) a Multi criteria Decision Model introduced by Thomas Saaty, is an effective tool for dealing such situation .It may support the decision maker to set priorities and make the finest decision. The AHP helps to capture both subjective and objective aspects of a decision by sinking complex decisions to a series of pairwise comparisons and then combine the results. In this methodology selection and ranking of criteria is the most crucial step.

In this research, we have selected and ranked seven multifaceted criteria Technology Maturity, Conversion Efficiency, Availability of Technology Provider, Initial Cost, Operational Cost, Emissions and Land Requirement by using AHP (Super Decision Software) to determine the most appropriate Conversion Technology for Biomass to Biofuel in Indian Perspective.

Keywords: Biomass Energy, Multi criteria Decision Model, Biomass to Biofuel Conversion Technology, AHP, Super Decision Software

I. INTRODUCTION

In India increasing electricity demand had been planned to be met mostly by fossil-fuel based generation while ignoring the native renewable resources. It is clear from the potential of biomass in India that various feed stocks are available for conversion to the bio-fuels as well as for power generation applications. The biofuels produced from the renewable resources could help to minimize the fossil fuel consumption. Biofuels produced from biomass such as plants or organic waste could help to reduce the India's dependence on fossil fuel and it would mitigate global warming. This may due to the CO_2 released in burning equals the CO2 tied up by the plant during photosynthesis and thus does not increase the net CO_2 in the atmosphere [1]. In Indian context, Biomass is mainly obtained from as Agriculture Residue, Animal Excreta, Energy Farming, Sewage Waste, Tannery Waste, Brewery Waste, Slaughter House Waste and food &Vegetable Waste.

Conversion of biomass to Biofuel can be done by means of three main conversion technologies named as thermo-chemical, bio-chemical and Chemical. In Thermo chemical conversion Technology, the biomass is converted in biofuel by the process of combustion, gasification and pyrolysis. In Bio Chemical conversion Technology two main processes are used, fermentation and an-aerobic digestion while in Chemical conversion technology Transesterification Process is used [2].

Each type of Biomass Conversion technology has its advantages and disadvantages. Due to difficulty in selecting the optimal option amongst various Biomass Conversion Technology, a powerful multi-criteria decision analysis model is needed. It is necessary that such a model can analytically break a complex decision problem into smaller but related sub problems; a model that can incorporate qualitative and quantitative information on conversion Technology.

Therefore, Analytical Heirchical Process (AHP) introduced by Thomas Saaty is considered to be an appropriate methodology to be employed for developing the required model. The AHP model formulated in this study consists of three levels. At the top level is the goal of the model followed by the criteria at level two while conversion Technologies are at the Third level, named, alternatives. In this methodology selection and ranking of criteria is the most important step.

In this study seven multifaceted criteria **Technology Maturity** (Reliability of Technology in present time)**, Conversion Efficiency** (Biomass to Energy conversion efficiency)**, Availability (**Number of Available Technology providers)**, Initial Cost (**Initial Installation Cost)**, Operational Cost** (Recurring Cost ,Excluding cost of Biomass)**, Emissions** (Air, Water & Land) in Conversion process and **Land Requirement (**Land Requirement for Plant Setup)are selected from the literature review and discussion with experts from different sectors that are related to the problem. A selection methodology based on **AHP (Super Decision Software)** is used to rank these criteria.

II. VARIOUS METHODS OF CONVERSION TECHNOLOGY FOR BIOMASS TO BIO FUEL

The vast stores of biomass available in India have the potential to displace significant amounts of fuels that are currently derived from fossil fuels. Energy security, energy flexibility, and rural development are other drivers that support the use of biomass to produce fuels, chemicals, and other products. There are various conversion technologies that can convert biomass resources into power, heat, and fuels for potential use. Figure 1 summarizes the various bio energy conversion processes.

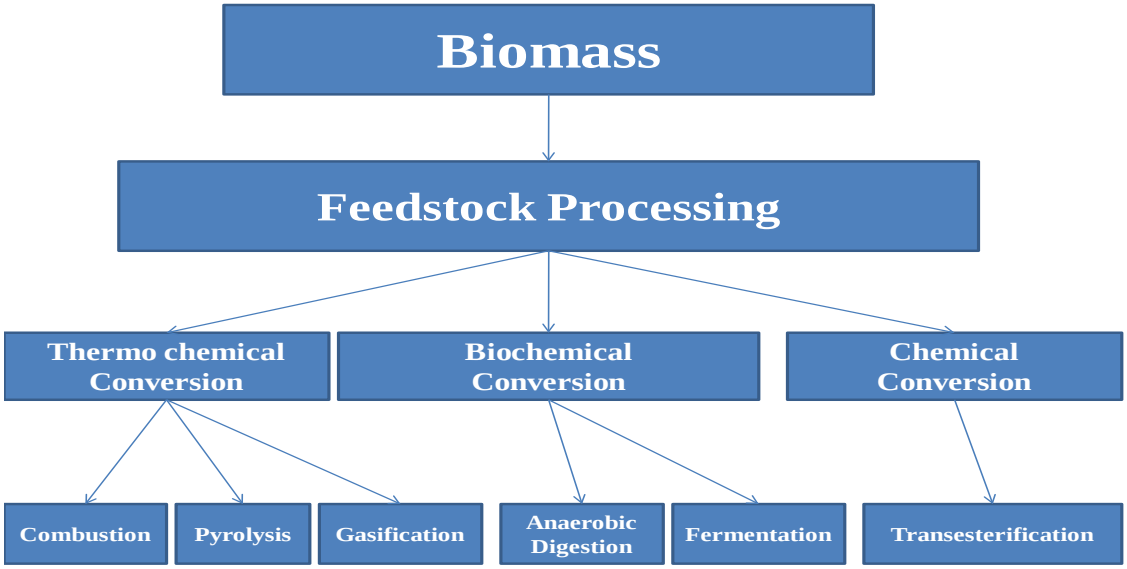

Fig-1: Various methods of Conversion Technology for Biomass to Bio Fuel

As shown in fig-1, Conversion technologies of biomass to Biofuel can be categorized into three main conversion technologies named as thermo-chemical, bio-chemical and Chemical. A Brief discussion of above mentioned Conversion Technologies for Biomass to Biofuel is given below.

2.1. Combustion

The world fuel consumption is continuously increased in past and will strongly increase in the future.Combustion systems for electricity and heat production are similar to most fossil-fuel fired power plants. With the help of this process the chemical energy stored in biomass is converted into heat energy, mechanical power and also in electricity by different process. The biomass fuel is burned in a boiler to produce high-pressure steam. The steam produced is introduced into a steam turbine, which cause causes the turbine blades to rotate. The turbine is connected to an electric generator. It is possible to burn any type of biomass but in practice combustion is reasonable only for biomass with moisture content less than 50%. Biomass with high moisture content is better suited to biological conversion processes [3].This process is a extensively available and viable technology. Combustion boilers are available in diverse designs, depending on relevance and biomass characteristics.

2.2. Gasification

In Gasification Process biomass is converted into a combustible gas mixture by the partial oxidation of biomass at high temperatures. The low calorific value gas produced with this process can be burnt directly or used as a fuel for gas engines and gas turbines. The gases produced by this process can be used as a feed stock for the production of chemicals[4].There are a large number of different biomass feedstock types for use in a gasifier, each with diverse characteristics, including dimension, shape, bulk density, moisture content, energy content, chemical composition, ash fusion characteristics. Feedstock with higher moisture contents result in a lower gasification thermal efficiency, as energy is needed to evaporate the water, with the resulting steam also affecting the gas composition. Ash is the inorganic material (or mineral content) in biomass which cannot be gasified. Besides feedstock moisture and ash properties, the size of the biomass fed into the gasifier can have a large influence on the gasification reaction – the required sizing is mainly a function of feeding rate, residence time, tar production, temperature and gasifier efficiency, which need evaluation for each individual gasifier and feedstock. Preparation of biomass, such as drying and/or sizing is needed to some extent for most combinations of feedstock and gasifier type. Gasification produces almost zero emissions and its non-hazardous by-products (nitrogen, argon, sulphur and slag) are very marketable. Gasification plants use significantly less water than traditional coal-based plants and, using commercially proven tec hnology [5].

2.3. Pyrolysis

Pyrolysis is one of a number of possible paths by which we can convert biomass to higher value products. Pyrolysis of biomass is obtained from primary products like char, gases and vapors. At ambient temperature the vapors condensed into a dark brown viscous liquid. The practice of charcoal manufacture from biomass is generally referred to as a slow pyrolysis process based on the rate in which heat is imparted to the biomass. Whereas under “fast pyrolysis” conditions the product distribution is noticeably altered and shifts the distribution primarily to a liquid bio-oil product. To achieve the high bio-oil yields of fast pyrolysis it is also necessary to prepare the solid biomass feedstock in such a manner that it can facilitate the required heat transfer rates. There are three primary heat transfer mechanisms available in designing reaction vessels: convection, conduction, and radiation. To adequately exploit one or more of these heat transfer mechanisms as applied to biomass fast pyrolysis requirements, it is necessary to have a relatively small particle for introduction to the reaction vessel. This ensures a high surface area per unit volume of particle. Because of small linear dimensions the whole particle achieves the desired temperature in a very short residence time. Preparation of biomass is important for better performance of this process. [6].

2.4. Fermentation

Fermentation processes from any Biomass that contains sugar could derive Bioethanol. The various raw materials used in the production of ethanol via fermentation are suitably classified into three main types of raw materials: sugars, starches, and cellulose materials. Sugars (from sugarcane, sugar beets, molasses, and fruits) can be converted into ethanol directly. Starches (from corn, potatoes, and root crops etc.) must first be hydrolyzed to fermentable sugars by the action of enzymes from malt or molds. Cellulose (from wood, agricultural residues and industrial waste) must similarly be converted into sugars. Once simple sugars are formed, enzymes from microorganisms can

voluntarily ferment them to ethanol. The most widely used sugar for ethanol fermentation is molasses which contains about 50 wt. % of sugar and about 50 wt. % of organic and inorganic compounds, including water. Since molasses contains microorganisms which can disturb the fermentation, the molasses is taken initially to the sterilizer and then to the fermenter [7]. Most agricultural biomass containing starch can be used as a potential substrate for the ethanol fermentation by microbial processes.

2.5. Anaerobic Digestion

In Anaerobic digestion (AD) organic material is directly converted to a Biogas which is a mixture of mainly methane and carbon dioxide with small quantities of other gases such as hydrogen sulphide. The biomass is converted in anaerobic environment by bacteria, which produces a gas with energy of about 20–40% of the lower heating value of the feedstock [8]. It is a series of processes in which microorganisms break down biodegradable material in the absence of oxygen to manage waste and/or to produce energy. The digestion process starts with bacterial hydrolysis of the input materials in order to break down insoluble organic polymers and make them available for supplementary bacteria. Then sugars and amino acids are converted into carbon dioxide, hydrogen, ammonia, and organic acids by Acidogenic bacteria .These resulting organic acids are converted into acetic acid, along with additional ammonia, hydrogen, and carbon dioxide with the help of Acetogenic bacteria. As a final point, methanogens convert these products to methane and carbon dioxide.

Anaerobic Digestion is a commercially proven technology and is widely used for treating high moisture content organic wastes, i.e.80-90% moisture. Biogas can be used directly in spark ignition gas engine and gas turbines and can be upgraded to higher quality i.e. natural gas quality, by the removal of CO2. The overall conversion efficiency can be21% [9]. As with any power generation system using an internal combustion engine as the prime mover, waste heat from the engine oil and water-cooling systems and the exhaust could be recovered using a combined heat and power system.

Almost any biomass except lignin (a major component of wood) can be converted to biogas including animal and human wastes, sewage sludge, crop residues, industrial processing byproducts, and landfill material.

2.6 Transesterification

Biodiesel, which refers to fatty acid alkyl esters, has attracted considerable attention as an environmentally friendly alternative fuel for diesel engines. Since the oil produced from biomass resources have high viscosity, it is necessary to reduce the viscosity in order to use them in a common diesel engine. There are various methods used to solve this problem, amongst these methods the transesterification reaction produce the products commonly known as biodiesel. Biodiesel can be synthesized by the transesterification reaction of a triglyceride with a primary alcohol in the presence of catalysts. Amongst primary alcohols, methanol is favored for the transesterification due to its high reactivity and the least expensive alcohol [10]. Furthermore, methanol has a low boiling point, thus excess methanol from the glycerol phase is easily recovered after phase separation. The choice of a catalyst for the transesterification

mainly depends on the amount of Free Fatty Acid (FFA) and of raw materials. Biodiesel has several advantages as a renewable, biodegradable, and nontoxic fuel.

III. SELECTION OF MULTIFACETED CRITERIA AND METHODOLOGY

There is a big variety of Multi criteria Decision Making methods, but all have the same goal, to estimate the best alternative among several options, based on predefined criteria. One of possible methods is AHP method, which offers a frame of effective tools in complex decision situations, and helps to simplify and speed up natural process of decision making. AHP method is based on breakdown of a complex situation into simple components, where hierarchical system of the problem and pairwise comparisons are made in order to ensure the quantification of qualitative judgments.

The Selection of multifaceted criterion is very crucial step of this process. Various criteria like **Technology Maturity, Conversion Efficiency, Availability of Technology Provider, Initial Cost, Operational Cost, Emissions and Land Requirement** are selected from the literature review and discussion with experts from different sectors that are related to the problem improves the effectiveness and correctness of the decision as shown in Table no.1.

Table No.1- Multifaceted Criteria and Its Description

Criteria	Description
C1.Maturity	Reliability of Technology in present time
C2.Efficiency	Biomass to Energy conversion efficiency
C3.Availability	Number of Available Technology providers
C4.Initial Cost	Initial Installation Cost
C5.Operational Cost	Recurring Cost (Excluding cost of Biomass)
C6.Emissions	Emissions (Air, Water & Land) in Conversion process
C7.Land Requirement	Land Requirement for Plant Setup

The benefit of the proposed model is that it increases the effectiveness of the decision by allowing participation of different experts. Multiple decision makers are often preferred rather than a single decision maker, to avoid bias and minimize partiality in the decision process. Since decisions made in the energy sector affect all society and sectors, these decisions should not be made by the initiative of one man or through one sector. The criteria will be pairwise compared for importance to establish their priorities with respect to the goal. The Conversion Technologies will be

pairwise compared for preference to establish their priorities with respect to each criterion. The results of all these comparisons will be combined to give the best alternative with the highest priority. The goal and criteria are one comparison group with the goal as the parent and the criteria as the children. The criteria will be pairwise compared with respect to the Goal for importance. Each criterion connected to the alternatives forms a comparison group with that criterion as the parent and the alternative as children [11, 12, 13]. The alternatives will be pairwise compared with respect to the criterion for preference as shown in Fig.2 given below.

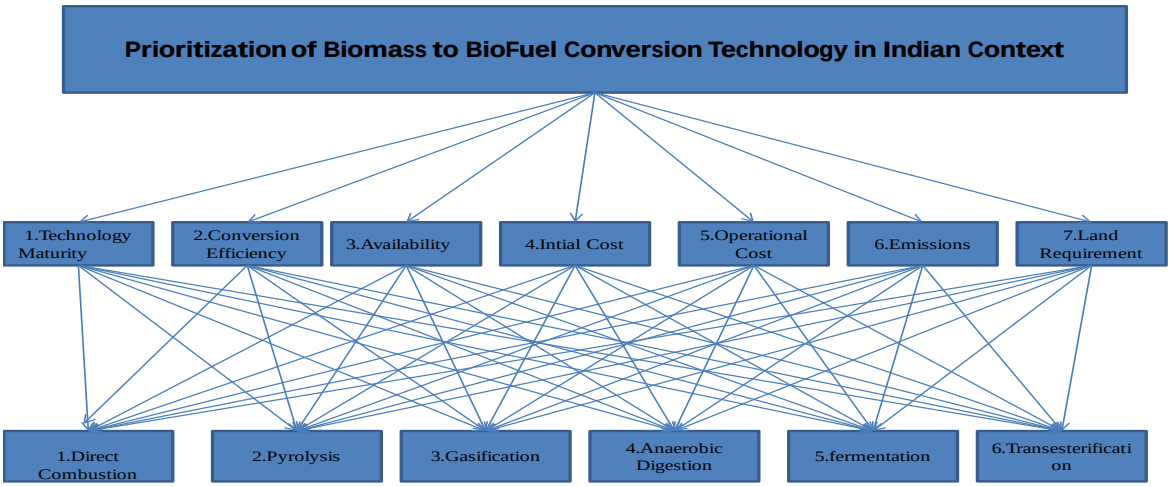

Fig 2: The hierarchy of biomass priority

In this research SuperDecisions software designed by **William J. Adams** is used for the implementation for decision making. It decomposes a problem systematically and incorporates judgments on intangible factors alongside tangible factors. In the SuperDecisions software a decision model is made up of clusters, nodes and links. Clusters are groupings of nodes which are logically related factors of the decision. Connections are made among nodes to establish comparison groups. In a hierarchy the links go only downward: from the goal node to the criterion nodes and from each Criterion node to the alternative nodes. Below is a screenshot of the Biomass Conversion technologies hierarchy as it appears in the software in Fig.3

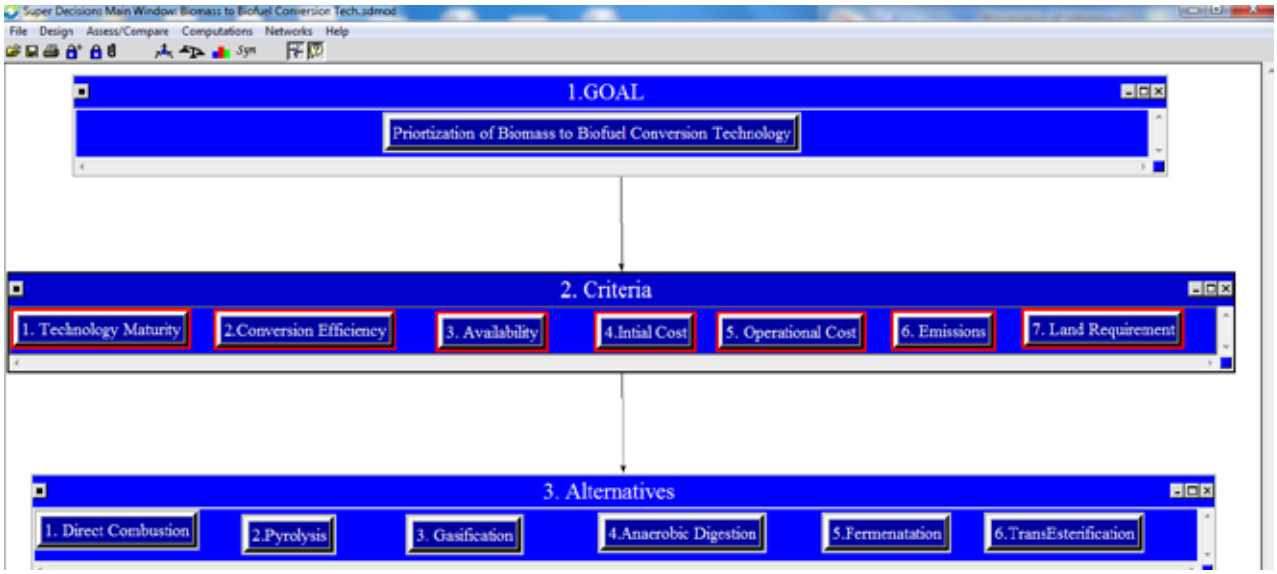

Fig 3: The hierarchy of links in Super Decision Software

The pairwise comparison judgments are made using the Fundamental Scale of the AHP and the judgments are arranged in the pairwise comparison matrix. The pairwise comparison judgments used in the AHP pairwise comparison matrix are defined as shown in the Fundamental Scale of the AHP given by Thomas Satty below in Table 2.

Table .2: The Fundamental Scale of the AHP

Intensity of importance	Definition	Explanation
1	Equal importance	Two elements contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one element over another
5	Strong importance	Experience and judgment strongly favor one element over another
7	Very strong importance	An activity is favored very strongly over another
9	Absolute importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2,4,6,8	Used to express intermediate values	
Decimals	1.1, 1.2, 1.3, …1.9	For comparing elements that are very close

In AHP, the numbers in the cells in a matrix, by convention, indicate the dominance of the row element over the column element; a cell is named by its position (Row, Column) with the row element first then the column element. While using AHP with the help of Super Decision Software only the judgments in the unshaded area need to be made and entered because the inverse of a judgment automatically entered in its transpose cell. The diagonal elements are always 1, because an element equals itself in importance. If the number of elements is *n* the number of

judgments is *n* (*n*-1)/2 to do the complete set of judgments. As per discussion with experts from different sectors that are related to the problem Intensity of importance are provided for Pairwise Comparison as shown in Table-3.

Table 3: Matrix showing Pairwise Comparison

Goal	1. C1	2. C2	3. C3	4. C4	5. C5	6. C6	7. C7
1.Technology Maturity (C1)	1	1/2	1/3	1/3	1/2	5	3
2.Conversion Efficiency (C2)		1	1/2	1/3	1/2	4	5
3.Availability (C3)			1	3	4	5	4
4.Initial Cost (C4)				1	3	4	3
5.Operational Cost (C5)					1	3	3
6.Emissions (C6)						1	1/3
7. Land Requirement (C7)							1

As per above discussion, in Super Decision software, the rest of the judgments are filled automatically as shown in table-4

Table-4: Complete Matrix showing Pairwise Comparison in Super Decision Software

	1. C1	2.C2	3.C3	4.C4	5.C5	6.C6	7.C7
1. Technology Maturity (C1)	1	0.5	0.333	0.333	0.5	5	3
2.Conversion Efficiency (C2)	2	1	0.5	0.333	0.5	4	5
3. Availability (C3)	3	2	1	3	4	5	4
4.Intial Cost (C4)	3	3	0.333	1	3	4	3
5. Operational Cost (C5)	2	2	0.25	0.333	1	3	3
6. Emissions (C6)	0.2	0.25	0.2	0.25	0.333	1	0.333
7. Land Requirement (C7)	0.333	0.2	0.25	0.333	0.333	3	1

The priorities of an AHP pairwise comparison matrix are obtained by solving for the principal eigenvector of the matrix. The mathematical equation for the principal eigenvector *w* and principal eigenvalue λmax of a matrix *A* is given below. Matrices have had more than one eigenvector; the principal eigenvector which is associated with the principal eigenvalue λmax (that is, the largest eigenvalue) of *A* is the solution vector used for an AHP pairwise comparison matrix. $Aw = \lambda max\ w$. The priorities for the criteria in the goal column, when normalized, are the original priorities derived by pairwise comparison [14].

IV.RESULTS AND DISCUSSION

As per literature review and discussion with experts from different sectors that are related to the problem seven multifaceted criteria **Technology Maturity** (Reliability of Technology in present time)**, Conversion Efficiency** (Biomass to Energy conversion efficiency)**, Availability (**Number of Available Technology providers)**, Initial Cost (**Initial Installation Cost)**, Operational Cost** (Recurring Cost ,Excluding cost of Biomass)**, Emissions** (Air, Water & Land) in Conversion process and **Land Requirement (**Land Requirement for Plant Setup) are selected.

A selection methodology based on AHP (Super Decision Software) is used to rank these criteria. This methodology involves a procedure for the aggregation of expert opinion using the seven selection criteria related to conversion Technology of Biomass to Biofuel ,that are appropriate for India.

Experts involved in the assessment found that the **Availability of Technology providers** is the most important criteria having the priority of **0.3213,** followed by **Initial Cost** , **Conversion Efficiency and Operational Cost, with** the priorities of **0.2242, 0.1352 and 0.1323** respectively. While other criteria **Technology Maturity, Land Requirement and Emissions** have lower scores **0.0974, 0.0542 and 0.0351** respectively. The Results above mentioned is shown below in the screenshot from super decision software in Fig.4.

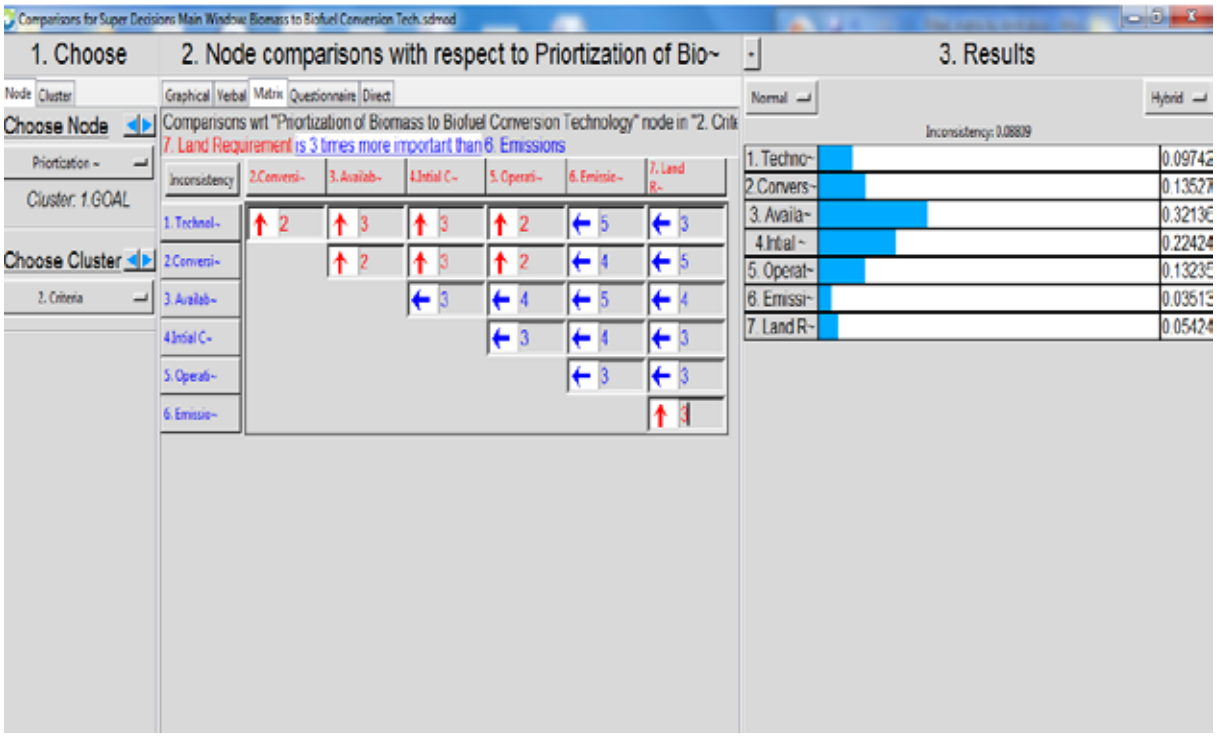

Fig.4: The screenshot from super decision software showing priorities.

The results of the above decision can also be shown as below in Table 5.

Table 5: Priorities of Different Criteria

Inconsistency	0.08809	
Name	Normalized	Idealized
1. Technology Maturity	0.097417579	0.303139053
2.Conversion Efficiency	0.135267202	0.420917581
3. Availability	0.32136268	1
4.Intial Cost	0.224239283	0.697776366
5. Operational Cost	0.1323508	0.411842471
6. Emissions	0.035127162	0.10930691
7. Land Requirement	0.054235294	0.168766621

It is very clear from the above results that the criteria related to **Availability of Technology Provider** is more important than any other criteria followed by **Initial Cost** , **Conversion Efficiency and Operational Cost** . While **Technology Maturity, Land Requirement and Emissions** are given least Priority. The benefit of the proposed model is that it increases the effectiveness of the decision by allowing participation of different experts. Since decisions made in the energy sector affect all society and sectors, these decisions should not be made by the initiative of individual or through one sector.

V. CONCLUSION

It is predictable that electricity demand in India is going to rise in future. To develop a sustainable electricity generation system country has to incorporate renewable resources for electricity generation. Sustainable development balances the energy production and consumption with minimal negative impact on the environment Renewable energy systems as a part of sustainable development bring environmental, energetic and economic benefits such as reduction of GHG, reliable energy supply ,economic saving by using natural resources and wastes as feedstock. Production of biofuels from organic material is one of the alternative renewable energy systems. Biofuels can be produced and converted to energy in different kinds of conversion plants with different scales that use various conversion technologies. Biofuels can be used for generating centralized as well as decentralized heat, electricity and energy [15].

In this study, an overview of various Conversion Technologies of Biomass to Biofuel in Indian Context is given. It was found that there are sufficient conversion Technologies are available but each option has its own limitations. In this type of situation Multi criteria Decision Making (MCDM) methodologies increasingly popular in decision making for sustainable energy systems because of their ability to integrate the multi-criteria and complex nature of these systems. One of possible methods is AHP method, which offers a frame of effective tools in complex decision situations, and helps to simplify and speed up natural process of decision making. In AHP method Selection and ranking of Criteria is most critical and important step.

In this study Selection and ranking of Criteria for Prioritizing Conversion Technology of Biomass to Biofuel in Indian Context has been done. The criteria identified are such that a holistic evaluation of a particular Conversion Technology is provided to a decision-maker. An AHP (Super Decision Software) model is developed to meet out the purpose..

The model framework consisted selection and ranking of criteria and on which each Conversion Technologies of Biomass to Biofuel was appraised. The study classified these criteria as **Technology Maturity, Conversion Efficiency, Availability of Technology Provider, Initial Cost, Operational Cost, Emissions and Land Requirement**. The Priorities of Biomass to Biofuel are shown below in **screenshot from super decision software in fig-5.**

The model results showed criteria related to **Availability of Technology Provider** is most important than any other criteria followed by **Initial Cost**, **Conversion Efficiency and Operational Cost**. While **Technology Maturity, Land Requirement and Emissions** are given least Priority. The emphasis on these criteria demonstrates that availability of Technology provider,financial and Conversion efficiency are vital in Biomass to Biofuel Conversion in Indian Scenario.

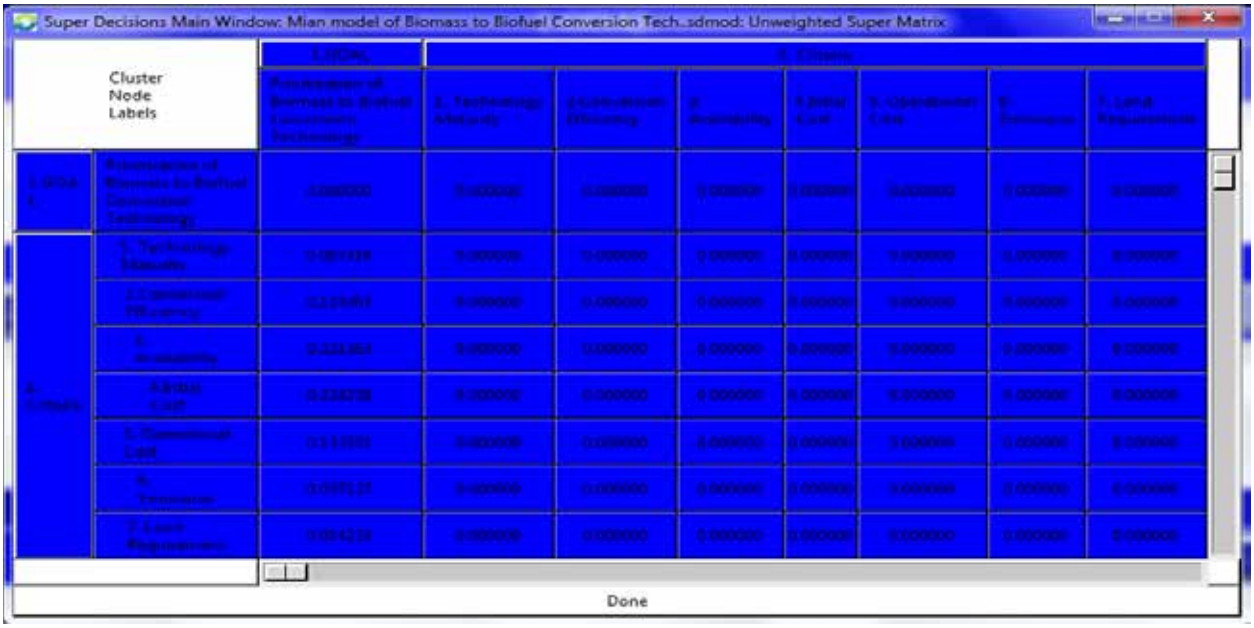

Fig.5: The screenshot from super decision software showing priorities in unweigthed Matrix

It should be noted that the model's application is country-specific, since the strategic criteria depend on the countries specific Biomass energy characteristics and development needs. In terms of Biomass Energy Planning, the ranking of Criteria involved in this study is useful to Energy Planners in determining investment priorities in the field of Biomass Energy. The method used and the results obtained from this study can be used in the further research.

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DEVELOPMENT OF MATHEMATICAL MODEL AND SPEED CONTROL OF BLDC MOTOR

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ABSTRACT

An electronically commutated Brushless DC motors are enormously used in many industrial applications which increases the need for design of efficient control strategy for these noiseless motors. This paper deals with a closed loop speed control of BLDC motor and performance of the BLDC motor is simulated. The duty ratio is regulated by PI controller, which governs the duty cycle of the PWM pulses applied to the switches of the inverter to run the motor at steady state speed. The simulation of the proposed scheme was done using MATLAB software package in SIMULINK environment. In order to highlight the effectiveness of the speed control of BLDC motor, the studies are conducted at different load torques and the corresponding speed is recorded using MATLAB/SIMULINK.

Keywords: BLDC Motor, Closed Loop Speed Control, Duty Ratio, Hall Effect Sensors, PI Controller

1. INTRODUCTION

The Brushless DC (BLDC) motor is rapidly gaining popularity by its utilization in various industries, such as appliances, automotive, aerospace, consumer, medical, industrial automation equipment and instrumentation [1]. As the name implies, the BLDC motors do not use brushes for commutation instead of they are electronically commutated. BLDC motors have many advantages over brushed DC motors and induction motors a few of these are better speed versus torque characteristics, high dynamic response, high efficiency long operating life, noiseless operation [2]. The major disadvantage of BLDC motor is their higher cost and relatively greater degree of complexity introduced by the power electronics converter [3]. The speed of the motor is directly proportional to the applied voltage across the winding the speed can be altered, by varying the duty cycle of PWM signal [4].

A Brushless DC motor has a rotor with permanent magnets and a stator with windings. The brushes and commutator have been eliminated and the windings are connected to the control electronics energize the winding with particular sequence of switching pulses [5]. The energized stator winding leads the rotor magnet, and switches just as the rotor aligns with the stator [6].

A permanent Magnet AC motor, which has a trapezoidal back EMF, is referred to as brushless DC motor (BLDC) [7]. The BLDC drive system is based on the feedback of rotor system at fixed points for commutation of the phase currents [8]. The BLDC motor requires quasi-rectangle shaped currents fed into the machine.

Alternatively, the voltage may be applied to the motor every 120°, with current limit to hold the current within motor capabilities [9]. Because the phase currents are excited in synchronism with the constant part of the back EMF, constant torque is generated. The electromagnetic torque of the BLDC motor is related to the product of phase, back EMF and current. The back EMF in each phase is trapezoidal in shape and is displaced by 120 electrical degrees with respect to each other in 3 phase machine [10]. A rectangle current pulse is injected into each phase so that current coincides with the back EMF waveform. Hence the motor develops an almost constant toque.

In this paper proposed a simulation model of a BLDC motor with using a PI controller, which responsible to govern the duty cycle of PWM pulses to inverter switches. The studies were conducted at different load torques and the corresponding speed is recorded using MATLAB/SIMULINK. In this model the trapezoidal back EMF waveforms are mathematically modeled a function of rotor position.

II DYNAMIC MODELING OF BLDC MOTOR

Modeling of a BLDC motor can be developed in the similar manner as a three-phase synchronous machine. Since there is a permanent magnet mounted on the rotor, some dynamic characteristics are different. Consider a cylindrical rotor and the stator have 3 phase winding a, b, and c. The rotor is the permanent magnet rotor, and hence the air gap is uniform. Stator has 3 phases with distributed winding structure with star connected. The dynamic equation of phase a, phase b, phase c, are follows as

$$V_{an} = R_s + L\frac{di_a}{dt} + M\frac{di_b}{dt} + M\frac{di_c}{dt} + e_a \quad (1)$$

Similarly for phase b and phase c

$$V_{bn} = R_s + L\frac{di_b}{dt} + M\frac{di_c}{dt} + M\frac{di_a}{dt} + e_b \quad (2)$$

$$V_{cn} = R_s + L\frac{di_c}{dt} + M\frac{di_c}{dt} + M\frac{di_b}{dt} + e_c \quad (3)$$

Where

L is armature self-inductance [H],

M is armature mutual inductance [H],

R is armature resistance [Ω],

V_{an} , V_{bn} and V_{cn} are terminal phase voltage [V],

i_a , i_b and i_c are motor input current [A],

e_a , e_b and e_c are motor back -EMF [V].

These are stator three equations, the rotor is a permanent magnet, and the rotor does not have any winding. So, rotor structure not having any equation. These three equations can be represented in the form of a matrix.

$$\begin{bmatrix} v_{an} \\ v_{bn} \\ v_{cn} \end{bmatrix} = \begin{bmatrix} R_S & 0 & 0 \\ 0 & R_S & 0 \\ 0 & 0 & R_S \end{bmatrix} \begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix} + \begin{bmatrix} L & M & M \\ M & L & M \\ M & M & L \end{bmatrix} P \begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix} + \begin{bmatrix} e_a \\ e_b \\ e_c \end{bmatrix} \quad (4)$$

In the BLDC motor, the back –EMF is related to a function of rotor position and the back –EMF each phase has 120 degrees phase angle difference so equation of each phase should be as follows as:

$$e_a = K_a f_a(q)w_r, e_b = K_b f_b\left(q - \frac{2p}{3}\right)w_r, e_c = K_c f_c\left(q - \frac{2p}{3}\right)w_r \quad (5)$$

$$V_{an} = R_s + L\frac{di_a}{dt} + M\frac{d(i_b + i_c)}{dt} + e_a \quad (6)$$

$$V_{an} = R_s + L\frac{di_a}{dt} - M\frac{di_a}{dt} + e_a \quad (7)$$

$$V_{an} = R_s + (L - M)\frac{di_a}{dt} + e_a \quad (8)$$

$$V_{an} = R_s + L_S\frac{di_a}{dt} + e_a \quad (9)$$

$$V_{bn} = R_s + L_S\frac{di_b}{dt} + e_b \quad (10)$$

$$V_{cn} = R_s + L_S\frac{di_c}{dt} + e_c \quad (11)$$

$$\begin{bmatrix} v_{an} \\ v_{bn} \\ v_{cn} \end{bmatrix} = \begin{bmatrix} R_S & 0 & 0 \\ 0 & R_S & 0 \\ 0 & 0 & R_S \end{bmatrix} \begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix} + L_S \begin{bmatrix} \frac{di_a}{dt} \\ \frac{di_b}{dt} \\ \frac{di_c}{dt} \end{bmatrix} + \begin{bmatrix} e_a \\ e_b \\ e_c \end{bmatrix} \quad (12)$$

$$\begin{bmatrix} \frac{di_a}{dt} \\ \frac{di_b}{dt} \\ \frac{di_c}{dt} \end{bmatrix} = \left\{ \begin{bmatrix} v_{an} \\ v_{bn} \\ v_{cn} \end{bmatrix} - \begin{bmatrix} R_S & 0 & 0 \\ 0 & R_S & 0 \\ 0 & 0 & R_S \end{bmatrix} \begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix} - \begin{bmatrix} e_a \\ e_b \\ e_c \end{bmatrix} \right\} \frac{1}{L_s} \quad (13)$$

So, these three simultaneous differential equations which can be solve by any numerical technique. For example, we can solve this equation using Runga Kutta fourth order method to solve the 3 equations and get the values of i_a , i_b and i_c . The value of the total torque as follows.

$$e_a = K_a w_r \quad (14)$$

$$P_m = (e_a i_a + e_b i_b + e_c i_c) \quad (15)$$

$$T_e = \frac{P_m}{w_{rm}} = \frac{(e_a i_a + e_b i_b + e_c i_c)}{w_r}\frac{P}{2} \quad (16)$$

$$T_e = \frac{(K_a i_a + K_b i_b + K_c i_c) w_r}{w_r}\frac{P}{2} \quad (17)$$

$$T_e = \frac{P(K_a i_a + K_b i_b + K_c i_c)}{2} \quad (18)$$

The equation of mechanical part is represented as follows

$$T_e - T_L = \frac{J dw_{rm}}{dt} + B w_{rm} \quad (19)$$

$$\frac{J dw_r}{\frac{P}{2}dt} + \frac{B w_r}{\frac{P}{2}} + T_L = T_e \quad (20)$$

$$\frac{dw_r}{dt} = \frac{P}{2J}\left(T_e - T_L - \frac{2B}{P} w_r\right) \quad (21)$$

III PROPOSED CONTROL SCHEME

Block diagram of closed loop speed control of BLDC motor using with PI controller as shown in fig.1.

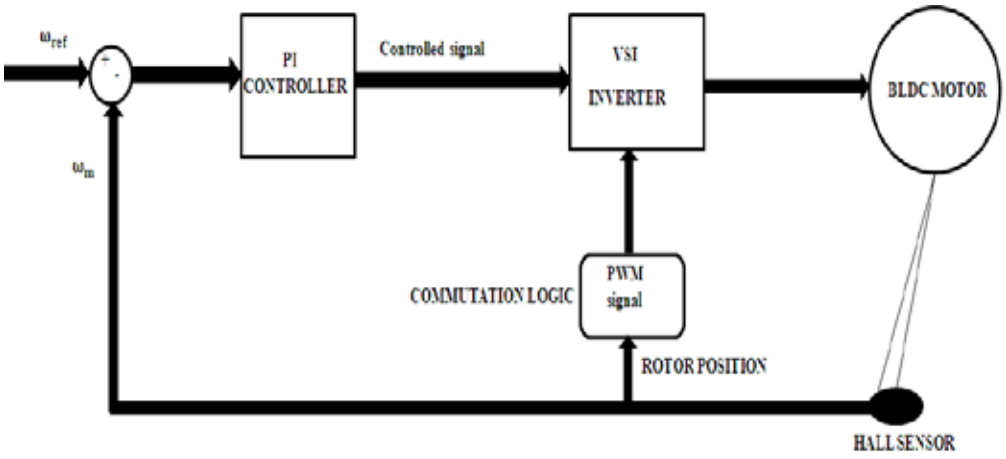

Fig1: Block diagram of closed loop speed control of BLDC motor

The BLDC motor is used in electromechanical actuator in the real time applications. The electromechanical actuator should be controlled in closed loop where only speed loop is to be closed in this application. The hall sensor is used as feedback element for closing the speed loop. Summer compare the reference speed and measured speed. The value of error generated according to measured speed. Using a proper proportional and integral gain the error is amplified and duty cycle is modified to drive the motor to desired speed until the error becomes zero. The relation between error and duty ratio is

$$\text{Duty ratio} = \text{error}^* K_p$$

Where

K_p = proportional and integral gain

The error magnitude determines the duty ratio and according to that output voltage of inverter varies and speed of motor controlled.

IV RESULTS AND DISCUSSIONS

The developed MATLAB/SIMULINK model in fig.2 provides the speed control of BLDC motor using PI controller and the simulation results provide necessary waveforms for the analysis of closed loop speed control of BLDC drives.

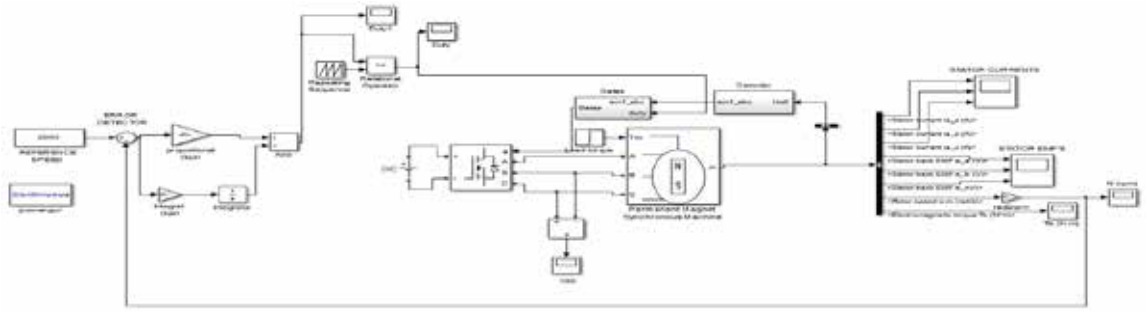

Fig 2: Simulation model of closed loop speed control of BLDC motor

4.1. Back EMF detection from hall sensor

The back EMF detection from hall sensor based on logic sequence which is given in Table1.The model implemented in simulation as show in fig.3 to generate trapezoial nature of back EMF from hall sensor.

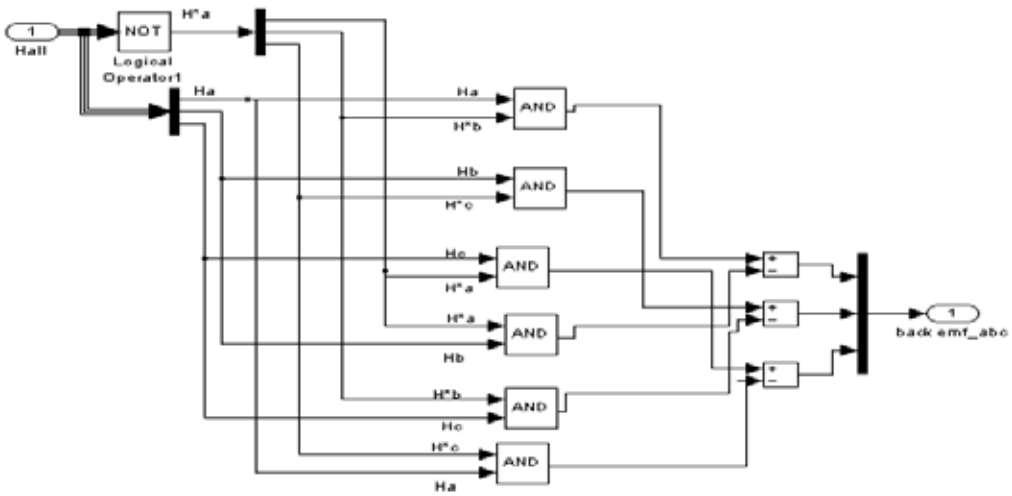

Fig3: Back EMF detection from hall sensor

Table1: Truth table for Back EMF detection from hall sensor

H_a	H_b	H_c	E_a	E_b	E_c
0	0	0	0	0	0
0	0	1	0	-1	+1
0	1	0	-1	+1	0
0	1	1	-1	0	+1
1	0	0	+1	0	-1
1	0	1	+1	-1	0
1	1	0	0	+1	-1
1	1	1	0	0	0

4.2. Commutation signal generation

Based on truth Table2, the model developed to generate appropriate commutation signal which is controlled by duty ratio signal as shown in fig.4.

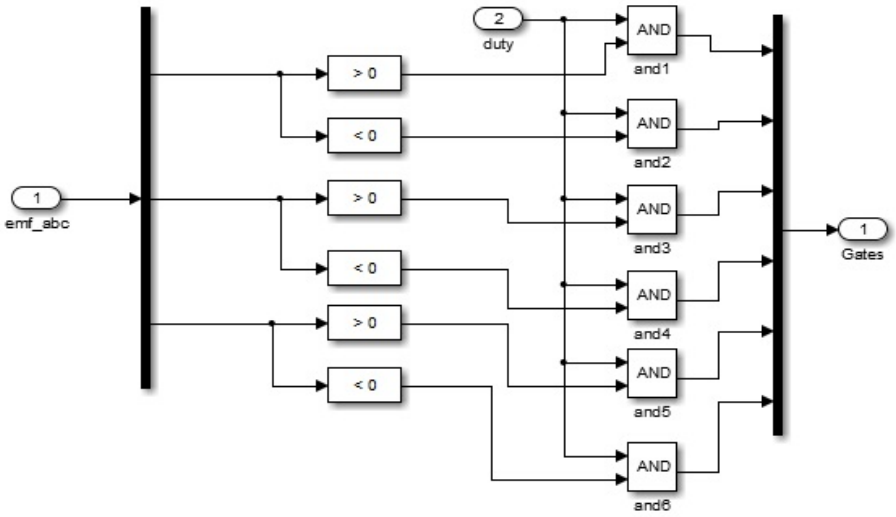

Fig4: commutation signal from back EMF and duty ratio

Table2: Truth table for to generate commutation signal from back EMF and duty ratio

E_a	E_b	E_c	Q1	Q2	Q3	Q4	Q5	Q6
0	0	0	0	0	0	0	0	0
0	-1	+1	0	0	0	1	1	0
-1	+1	0	0	1	1	0	0	0
-1	0	+1	0	1	0	0	1	0
+1	0	-1	1	0	0	0	0	1
+1	-1	0	1	0	0	1	0	0
0	+1	-1	0	0	1	0	0	1
0	0	0	0	0	0	0	0	0

4.3. Duty Ratio And Switching Pulses

Fig.5 & fig.6 shows duty ratio generated according to PI controller and the switching pulses generated for inverter switches from Q1toQ6.

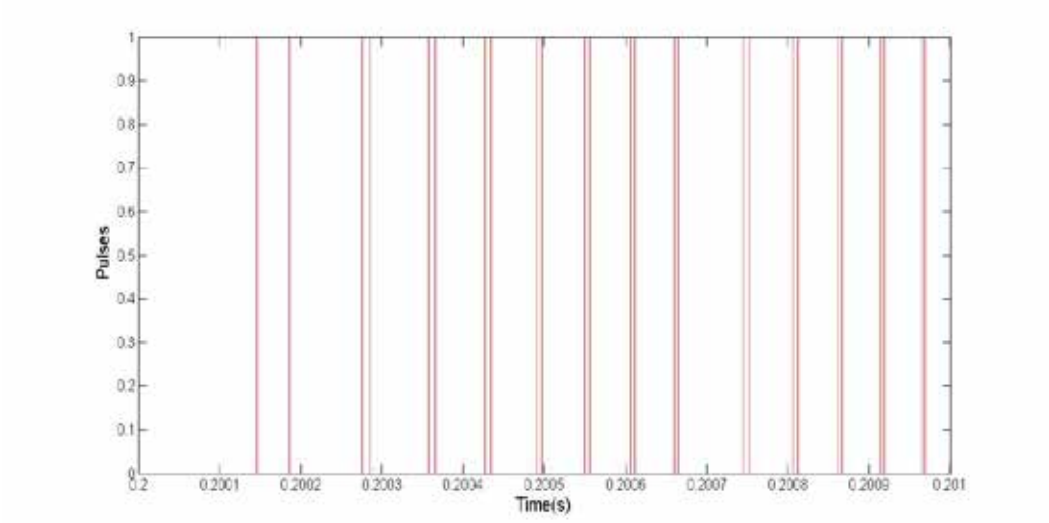

Fig5: Duty ratio generated according to PI controller

The phases of stator winding in BLDC motor at a time two winding should be energized for this inverter switches every time two switches turn ON , one switches from upper group and another from lower group of inverter. Phase displacement between pair to pair of switches 60 degree mode operation. The switching pulses from Q1 to Q6 as shown in figure 6.

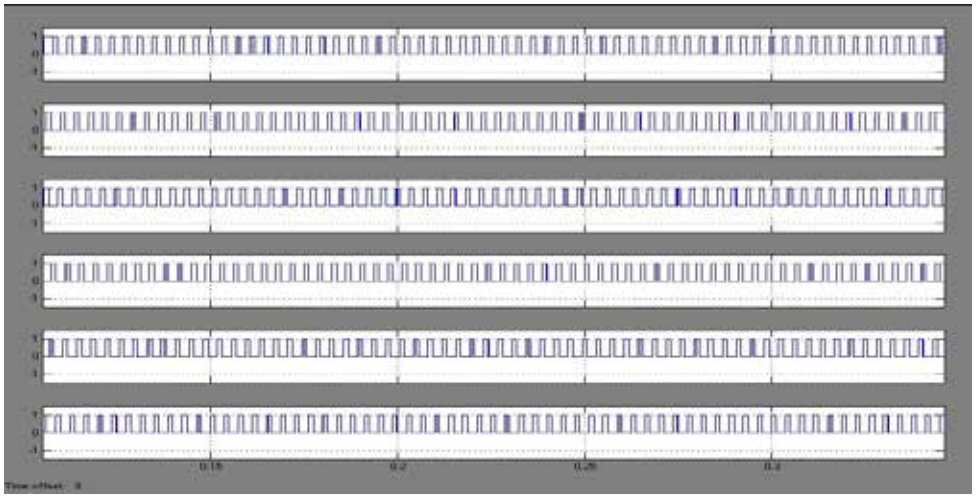

Fig6: switching pulse for Q1 to Q6

4.4. Rotor speed without load

Rotor speed at no load condition as shown in fig.7

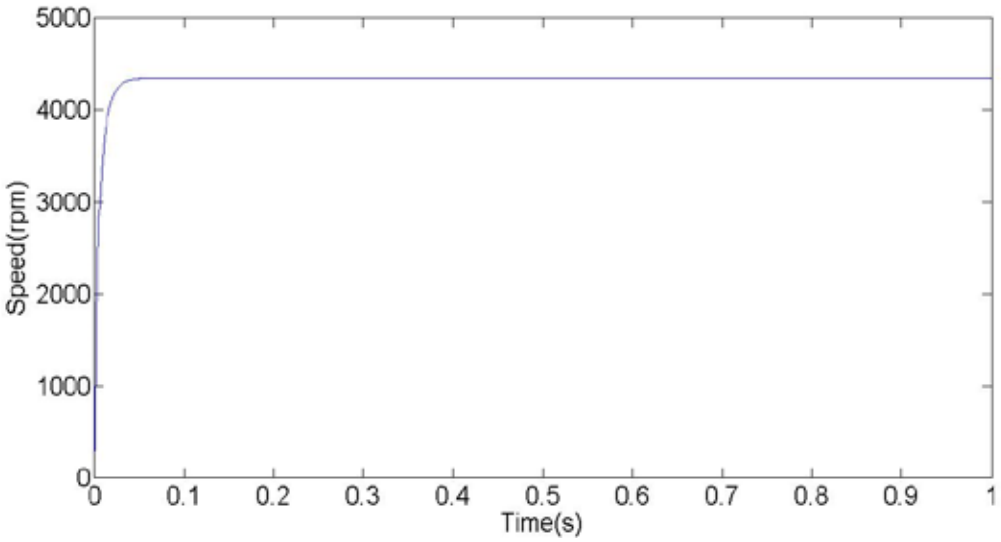

Fig7: Rotor speed at no load condition

4.5. Rotor different speed with constant torque load

The different speed of motor with constant load is shown in fig.8. Rotor different speed are 4000rpm , 3500rpm, 3000rpm given as load torque disturbance at t = 0.1sec the generated error from measured speed with respective reference speed then error compensated by PI controller, speed response settled to steady state.

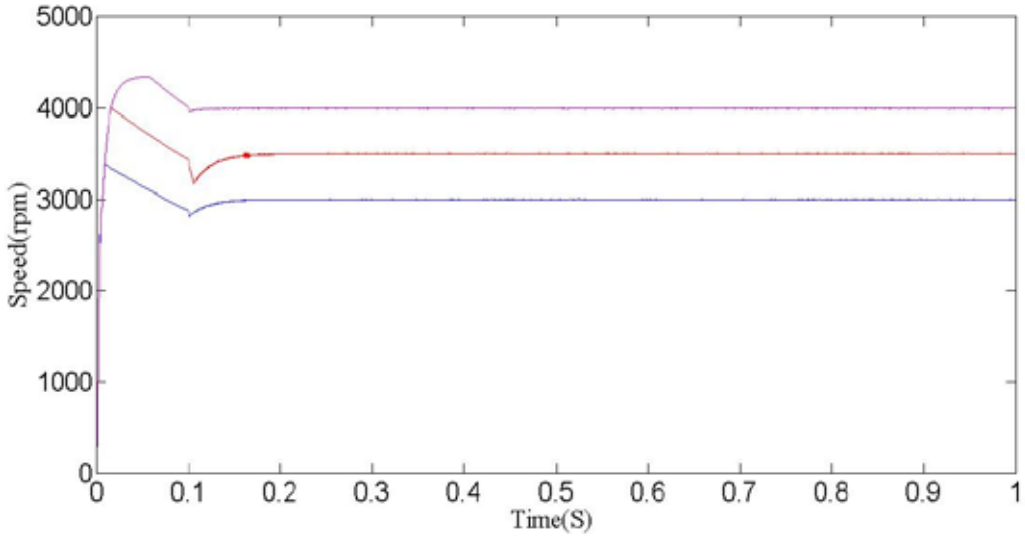

Fig8: Rotor different speed with constant load torque

4.6. Rotor speed with different load torque

Fig.9 shows 2000rpm as normal speed with different load torque disturbance at t = 0.1sec, t = 0.2 sec and t = 0.3 sec. the every instant load torque is not constant at t = 0.1sec load torque 0.5N-m similarly at t = 0.2sec load torque 1 N-m and t = 0.3sec load torque 1.5N-m. The closed loop system brings the speed to the normal value by adjusting the output voltage of the inverter.

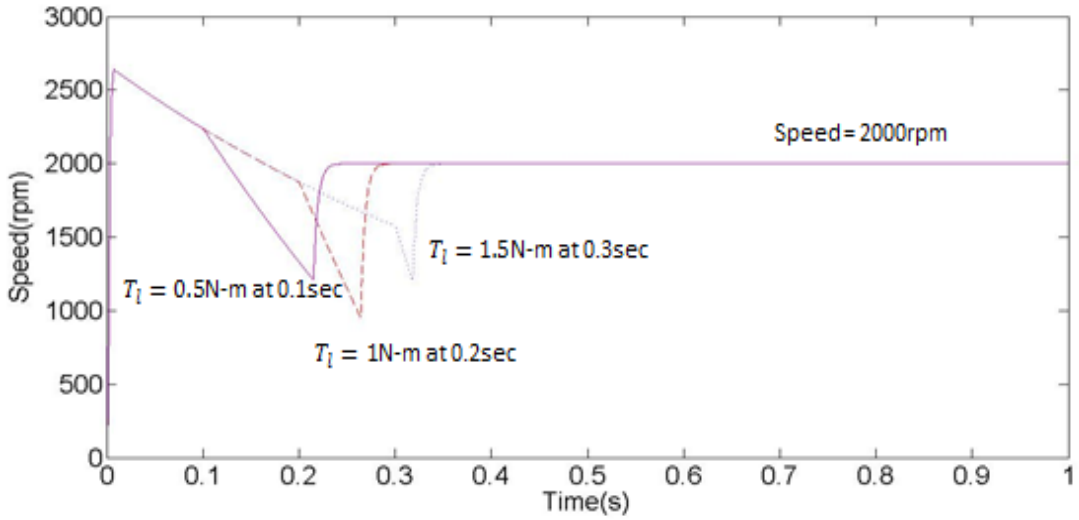

Fig 9: Rotor speed with different load torque at different instant.

V CONCLUSION

In this paper the control scheme for speed control of BLDC motor using PI controller is proposed. The performance of the BLDC motor shows satisfactory performance under no- load and variable load condition. The simulation of PI controller, using MATLAB/SIMULINK to control the speed of flexible BLDC motor, proves that the desired speed is attained with shorter response time. The dynamic characteristic of motor is

obtained and the analysis reveals that PI controller is capable of controlling the motor drive over wide speed range.

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THE NEED FOR LIGHTWEIGHT LOCATION VERIFICATION ALGORITHMS FOR WIRELESS SENSOR NETWORKS

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ABSTRACT

The Sensor nodes are important components in Wireless Sensor Networks. Authentication of nodes is a major concern because such nodes are more susceptible to various attacks. The main goal of this paper is to verify whether data coming from sensor is authenticated or not. The two different techniques namely an On Spot Verification and In-Region Verification are discussed. In the On spot verification, the location of the sensor nodes is verified with that of the registered value of that node. In the In-Region verification, the current location of the sensor nodes with respect to its neighbouring nodes is verified with the registered value of the node. If no change in the value has been taken place, then the data coming from that particular sensor is authenticated. The Two algorithms namely GFM (Greedy Filtering using Matrix) and GFT (Greedy Filtering using Trust ability indicator) are discussed. These techniques can be executed with the help of Android phones which have the built-in components that allow these phones to work in the manner similar to that of the sensor nodes. The Personal Computer (PC) is used as the Verification Centre or a Server to monitor the Android phones. This implementation should be cost effective, accurate and easily understandable.

Keywords: In-region, Localization ,Security, Sensor systems, On-spot, Verification Centre (VC), Wireless Sensor Networks(WSN's).

I. INTRODUCTION

WIRELESS sensor networks (WSNs) are a significant technology that has scope in research field [26]. Wireless sensor nodes operate in a cooperative and distributed manner. Such nodes are usually embedded in the physical environment and report sensed data to a central base station; however, for a sensor network to achieve its purpose, it is essential to know where the information is sensed [27].

Wireless Sensor Network is the network of sensors which are connected via Radio Signals. These sensors are controlled in the location known as the Verification Centre (VC). It contains information like GPS Location of the sensors, the location of its neighbouring sensors. Any data coming from the sensors are recorded in the VC. The data coming from the sensors may be hacked or sensors might be misplaced due to environmental changes. The existing system does not have this facility to identify these changes. This project intends to overcome these disadvantages the On spot verification, the location of the sensor nodes is verified with that of the registered value of that node, whereas in the second technique called the In-region verification, the current location of the sensor nodes with respect to its neighbouring nodes is verified with that of its registered value of that node. To deceive the VC into accepting wrong locations, multiple attackers can even collude together. For example, if a sensor has five neighbours and more than three of them are compromised, then the chance that the VC could still correctly verify the sensor's location is small [17].

LOCALIZATION in wireless sensor networks i.e., knowing the location of sensor nodes, is very important for many applications like environment monitoring, target tracking, and geographical routing [17]. The sensor nodes after the deployment cannot be manually maintained and monitored, security becomes critical. In such a scenario maintaining and monitoring of sensor node and their network of communication becomes a major issue in WSN. The data can be sent or accessed by any node in the network and providing authentication to access this data is critical preventing unauthorized users from gaining the information and hence the security becomes the major issue in Wireless Sensor Networks [18][19]. The attackers can compromise sensors and inject false location information; they can also interrupt signal transmission between sensors and contaminate distance measurements. Hence, the locations estimated in the localization process are not always correct sensor nodes typically employ low cost commodity hardware components unprotected by the type of physical shielding that could prevent access to a sensor's memory, processing, sensing and communication components[10].

Although some secure localization algorithms were proposed to help enhance sensors' resistance to attacks they cannot completely eliminate wrong location estimations. Therefore, the location verification is a necessary second line-of-defence against malicious attacks, which becomes the focus of this paper, which classifies previous location verification algorithms into two categories, namely, on-spot verification and in-region verification. On-spot verification is to verify whether a sensor's true location is the same as its estimated location (or with very small errors) whereas, In region verification is to verify whether a sensor's true location with respect to its neighbours is same as the estimated location with them. Since existing verification algorithms either require deployment knowledge or depend on hardware that are expensive a lightweight verification algorithm should be designed that can effectively perform on-spot verifications. Based on the application, the system can use either on-spot or in-region verification results. For On-spot verification, two algorithms can be used namely, the Greedy Filtering by Matrix (GFM) algorithm and the Greedy Filtering by Trust ability indicator (GFT) algorithm [17][14]. Both algorithms exploit the inconsistency between sensors' estimated locations and their neighbourhood observations. To perform in-region verification, initially the sensor is checked as to whether it is in the given range of verification region using probabilistic algorithm.

II. PROBLEM STATEMENT

In the existing system, the sensor nodes in WSN's are the major source of information in various applications. Such nodes should not be corrupted. But in the current scenario, these nodes are subjected to various attacks and also there is no provision to check the authentication of such nodes. The various ways in which these nodes can

be corrupted are hacking, misplace of nodes due to environmental issues, complications within the sensor nodes such as Hardware malfunction, Software crash, virus attack etc. And also these nodes are generally placed in remote areas because of which frequent manual monitoring is not possible. Due to all the above stated reasons, sensor nodes are very vulnerable and sensitive. But in the existing system has new mechanisms to prevent the nodes from these hurdles. Hence, there is a need for a mechanism which can protect these nodes. This paper concentrate on the method which is simple, cost-effective and provides authentication to the sensor nodes that sense the data and send it to the controlling station.

III. RELATED WORKS

In recent years, a large number of localization schemes were proposed for wireless sensor networks. Localization refers to locating the position or area in which the sensor or object to be tracked. Based on the localization, many applications are emerging in the sensor network. One of main challenge in localization is that the process can be made erroneous by launching various attacks. Secure localization [1][2][13] has become a great concern in WSN's. In order to achieve this, various localization schemes have been designed. And also, existing localization schemes of WSNs are classified into two categories: range-based schemes and range-free schemes [1]. For range-based localization schemes, the distance or angle information is measured by RSSI (Received Signal Strength Indicator), TOA (Time of Arrival), Time Difference on Arrival (TDOA) and AOA (Angle of Arrival) [1]. For range-free localization schemes, the localization is realized based on network connectivity or other information, which can be obtained by DV-Hop, Convex Optimization and MDS-MAP [1].

In many tasks like as search, rescue, disaster relief, target tracking, node localization is inherently one of the system parameters. Node localization is required to report the origin of events, assist group querying of sensors, routing and to answer questions on the network coverage [3]. This paper reviews different approaches of node localization discovery in wireless sensor networks. When localization system [4] is node-centric, location verification is needed to verify the claimed locations of sensors. Wireless networks are vulnerable to spoofing attacks [5], which allows for many other forms of attacks on the networks. This project is designed to overcome such attacks. A method for both detecting spoofing attacks and spotting the positions of foes performing the attacks are introduced [6].The main aim is to overcome these hindrances with less software requirements. Due to the decreasing cost and the ease of installation of access points, indoor localization using WiFi signal strengths are becoming more and more popular [25].

Sensor nodes are spatially distributed to sense and monitor the physical changes throughout the environment to collect the data. The nodes also collect data from its surrounding nodes and the environments. These collected data are transmitted from one node to other through the wireless medium. Sometimes nodes are requested data from other nodes, in some cases the collected data of a node may be confidential and only visible to the authenticated nodes [20]. Wireless sensor have special characteristics because of total absence of infrastructure or administrative support these are wireless networks. They have limited bandwidth, energy constraints, self configurable, low computational capabilities and easy to deploy [22]. Such networks provide a variety of consumer applications such as emergency rescue, disaster relief, smart homes, and patient monitoring, as well as industrial applications such as distributed structural health monitoring and environmental control, and military applications such as target identification and tracking. Many of the applications proposed for WSNs require knowledge of the origin of the sensed information [7].

In [8][12], Smart phones are used as a Sensors. It consists of two components namely Accelerometer and Gyrometer which is used to send the vibrations through Wi-Fi to the location centre(PC) [8]. A probabilistic procedure is designed to supply the self-assurance that a sensor is inside the verification region [9]. Security is important for many sensor network applications. As a result, WSNs are susceptible to many application-dependent and application-independent attacks like node replication attacks [10]. WSNs are often deployed in harsh environments, where an attacker node can physically capture some of the sensor nodes. Once a sensor node is captured then the attacker node can collect all the credentials like keys, identities etc . The attacker can modify the message and replicate in order to overhear the messages or interrupt the functionality of the sensor networks. Sensor network localization is not just trivial extensions to the traditional localization techniques like GPS and LPS. Hence Node self localization [11] is also an important criteria in WSN's.

The algorithm which is being implemented in this project has high fault tolerance to various attacks in WSN's [15]. This project can also be extended to provide a new approach for securing localization and location verification in wireless networks based on hidden and mobile base stations [16].

IV. ALGORITHMS USED

4.1. GFT and GFM

In this section, two algorithms discussed for on-spot verification are Greedy Filtering using Matrix and Greedy Filtering using Trustability-indicator. Both algorithms utilize the inconsistency between sensors' estimated locations and neighbourhood observations. They can be used in different scenarios according to the application's requirements. Suppose there are totally n sensor nodes in the field denoted by S1,S2,.....,Sn. For convenience, we assume sensor Si's ID is integer i where i = 0,1,2,..... [17]. In GFM algorithm, five n*n square matrices are calculated based on the reported information from sensors. In each round, if a sensor's indicator is higher than the threshold, the sensor is accepted as correctly localized sensor. Such iteration stops when all sensors' indicators become stable. Finally, the sensors that have indicator values lower than the threshold are detected and revoked. First, GFM explores the inconsistency directly by comparing the elements in two matrices, i.e., the Estimation Matrix and the Observation Matrix, while GFT detects the location anomalies indirectly based on the indicators which indicate the inconsistencies. Second, the GFM algorithm filters out bad locations as soon as one of the metric values is not accepted according to the threshold. Sensors not revoked will be verified in the final round. In GFT algorithm, instead, the good location claims are accepted first, and after multiple rounds when indicators of remaining sensors become stable, the sensors with indicators below the threshold will be revoked [17].

4.2 Centralized Localization Algorithms

In this section, the major centralized localization schemes are summarized.

4.2.1 Area Localization Scheme (ALS)

For large scale UWSNs [21], identifying the exact location of every unknown node may not be feasible. Therefore, an efficient Area Localization Scheme (ALS) is proposed for UWSNs. ALS was firstly proposed for terrestrial WSNs . This scheme estimates the position of every unknown node within a certain area rather than

its exact location. The main responsibility of anchor nodes is to send out signals with different levels of power to localize unknown nodes. Unknown nodes simply listen to the signals and record the anchor nodes' IDs and their corresponding power levels. Together with collected data, the recorded information is sent to sink node. Sink node is assumed to know the positions of all anchor nodes and their respective transmitted power levels. Therefore, with proper signal propagation algorithms, sink node is able to draw out the map of areas divided by all the anchor nodes' transmitting signals. Then, sink node can localize unknown nodes [29].

4.2.2 Hyperbola-Based Localization Scheme (HLS)

Instead of using the commonly adopted circle-based detection and least squares algorithm based location estimation, this scheme utilizes the hyperbola-based approach for localization and a normal distribution for estimation error modelling and calibration [29].

4.2.3 Sensor Arrays-Based Localization Approach (SLA)

In this approach, the UWSN consists of sensor arrays. Each sensor array is equipped with an array of sensor nodes that are attached to the sensor array via wired connections. Each target waiting to be localized periodically emits a narrow-band acoustic signal. For each sensor array, using the negative log-likelihood function, sensor nodes which have received the signal can obtain the target locations and signal amplitudes. The maximum likelihood estimate of the target location is obtained based on the global likelihood function, which is the sum of the local likelihood function. MLSL approach does not need distance measurement and time synchronization [29].

4.2.4 An Probabilistic Localization Method (PLM)

To mitigate distance measurement error in localization process, multi-iteration measurement and least squares scheme are often adopted in terrestrial applications. However, in underwater applications, the multi-iteration scheme is not practical due to high communication cost. Meanwhile, it has been observed that the probability distribution of distance measurement error often follows a certain pattern, which can be utilized to further improve the localization accuracy. Both the uniform error distribution and normal error distribution are considered. Then, a Probabilistic Localization Method (PLM) is proposed to improve localization accuracy [29].

4.2.5 Large-Scale Hierarchical Localization (LSHL) Approach

In this approach [29], Surface buoys drift on water surface and get their locations from GPS. Anchor nodes can directly communicate with the surface buoys to get their absolute positions. Unknown nodes cannot directly communicate with the surface buoys but can communicate with anchor nodes to localize themselves. The whole localization process is divided into two sub-processes: anchor node localization and unknown node localization [29].

4.2.6 Reactive Localization Algorithm (RLA)

Instead of localizing every single node in the network, RLA localizes a node that detects an event. Once a sensor node detects an event, RLA which consists of two steps starts. The first step is to find anchor nodes. The sensor

node first broadcasts a hello message with its ID and energy level to its neighbours. By the K-Node Coverage Algorithm at least 4 non-coplanar anchor nodes are found. The second step is reactive localization of the sensor node. Once the selected anchor nodes receive localization request message, they reply with their location information. The sensor node hence localizes itself by quadrilateration. Due to additional process for anchor nodes' localization, energy consumption and communication overhead of RLA are high. Furthermore, accumulated localization error exists [29].

V. PROPOSED WORK

Currently, researchers have proposed many techniques to solve the above 2 issues. In this paper, the common attacks against localization are described.

- The verification system that overcomes the shortcomings of previous research.
- The verification system that verifies whether sensor's estimated locations are trustable.
- The verification system to provide On-Spot verification service.
- The verification system to provide In-Region verification service.
- Lightweight systems that do not require any dedicated hardware or infrastructures, and they do not incur high computation overhead at the sensor side, so that the verification system can be applied to low cost wireless sensor networks.

We use Android Phones as sensors, as it contain 2 components called Accelerometer and Gyrometer which are used to sense the vibrations. PC is used as the VC. All the Information will be recorded in PC.

5.1. STEPS TO BE FOLLOWED

We will place the Android Phone that we are using as sensors at the location where the vibrations or movement has to be sensed.

1. The location at where these sensors are placed are recorded in the Location Center(LC) with the help of GPS System by calculating its Latitude and Longitude values.
2. In the next step, if any activities that causes vibration occurs, then sensor will sense those vibrations and sends these signals to LC. Activities that cause the vibrations are footsteps, wind and any motion effect.
3. The VC on receiving these signals, verifies the authentication of data received. In On-spot verification, the authentication of data is carried out by comparing the location of the sensors with the recorded values. In the In-region verification, the location of the sensors is calculated with respect to its neighboring sensors.
4. The location center records the location of the sensors from which data is received, along with the location of its neighbors.
5. The distance between the sensor node and the neighbouring sensor nodes are also recorded. They are compared with the stored values.
6. Comparison is done based on the current GPS location of the sensor by calculating its latitude and longitude. If they are found to be same, then the data is authenticated or else the data is either hacked or misplaced. Such data is rejected.

The Fig .1 represents the general operation of a Wireless Sensor Networks. In this, S1, S2, S3, S4 represents the Sensor nodes.

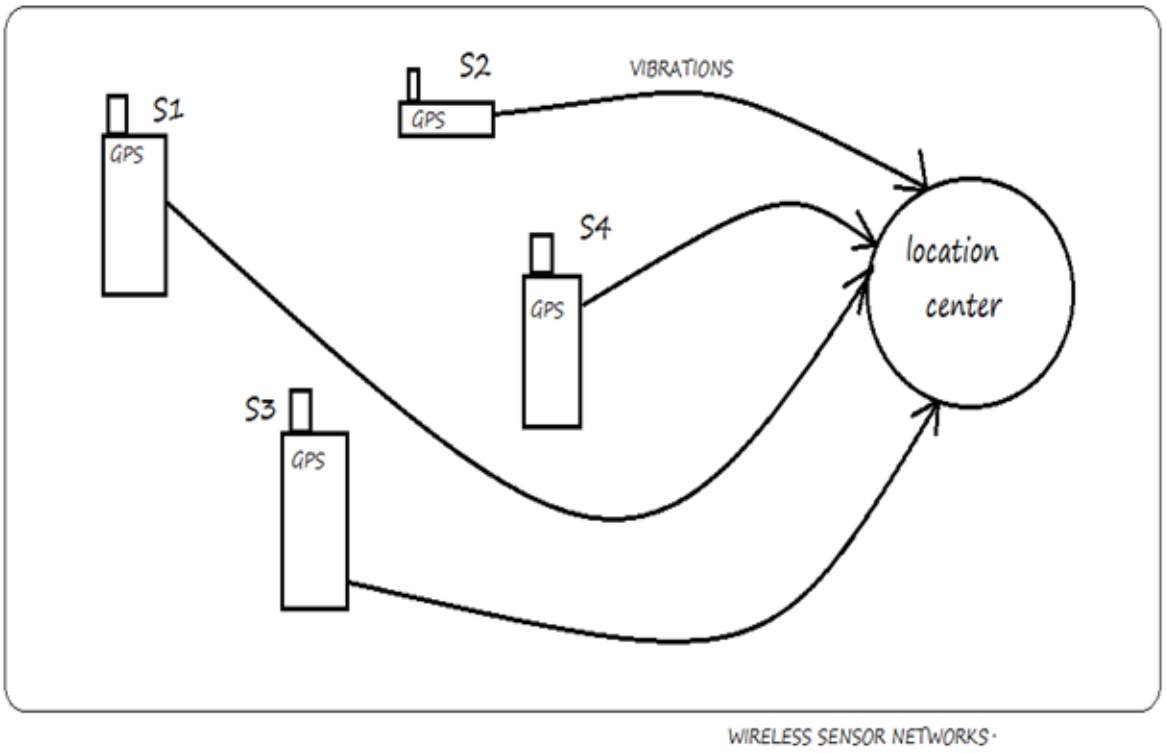

Fig 1. General operation of the sensor network

i). Module—1

Android app

Accelerometers are used as hardware sensors. They are the simple MEMS (Micro Electro Mechanical System) devices which are used to measure position, motion, tilt, shock, vibration, and acceleration (the rate of change of velocity – m/s2). They are available with one, two, or three axes. A 3-axis accelerometer senses the orientation of the phone and changes the screen, images, web browser, music player accordingly, allowing the user to easily switch between portrait and landscape mode. In this module data read from the accelerometer is encrypted using Symmetric algorithm using IMEI number and at the verification centre decrypt using IMEI number.

ii) Module-2

Symmetric key encryption is a cryptography technique that uses a shared secret key to encrypt and decrypt data. Symmetric encryption algorithms are very efficient at processing large amounts of information and computationally less intensive than asymmetric encryption algorithms. Having agreed upon and exchanged a shared secret key, the sender and the recipient are able to exchange encrypted data.

The steps are as follows:

- Create a Symmetric Algorithm derived object and specify the Key (IMEI).
- Create Stream objects that will interface with the Symmetric Algorithm object.
- Create an ICryptoTransform object by calling the SymmetricAlgorithm.CreateEncryptor method (when encrypting) or SymmetricAlgorithm.CreateDecryptor method (when decrypting).

- Create a CryptoStream object using the Stream object and the ICryptoTransform object as defined.
- Read from or write to the Crypto Stream object depending on the context of the operation.

iii) Module-3

At the verification centre it is necessary to register all the remote devices from where we are excepting sensitive data. This module is used while receiving data , we need to decrypt using all the IMEI stored at VC with the data received as symmetric key , whichever IMEI matches , we will treat as Valid sensor nodes to receive data. In this module, we have sub modules like Device registration (XML serialization) Google map association with device input Update or Delete or Modify Device parameters.

VI. METHODOLOGY

6.1 Localization Techniques

Self-localization capability is a highly desirable characteristic of wireless sensor networks. In environmental monitoring applications such as bush fire surveillance, water quality monitoring and precision agriculture, the measurement data are meaningless without knowing the location from where the data are obtained. Sensor network localization algorithms estimate the locations of sensors with initially unknown location information by using knowledge of the absolute positions of a few sensors and inter-sensor measurements such as distance and bearing measurements. Sensors with known location information are called anchors and their locations can be obtained by using a global positioning system (GPS), or by installing anchors at points with known coordinates. Because of constraints on the cost and size of sensors, energy consumption, implementation environment (e.g., GPS is not accessible in some environments) and the deployment of sensors (e.g., sensor nodes may be randomly scattered in the region), most sensors do not know their locations. These sensors with unknown location information are called non-anchor nodes and their coordinates will be estimated by the sensor network localization algorithm [26].

6.1.1 Measurement Techniques

Measurement techniques in WSN localization can be broadly classified into three categories: AOA measurements, distance related measurements and RSS profiling techniques [26].

6.1.1.1 AOA measurements

The angle-of-arrival measurement techniques can be further divided into two subclasses: those making use of the receiver antenna’s amplitude response and those making use of the receiver antenna’s phase response. Beam forming is the name given to the use of anisotropy in the reception pattern of an antenna, and it is the basis of one category of AOA measurement techniques. The measurement unit can be of small size in comparison with the wavelength of the signals. The beam pattern of a typical anisotropic antenna is shown in Fig. 2. One can imagine that the beam of the receiver antenna is rotated electronically or mechanically, and the direction corresponding to the maximum signal strength is taken as the direction of the transmitter. Relevant parameters are the sensitivity of the receiver and the beam width [26].

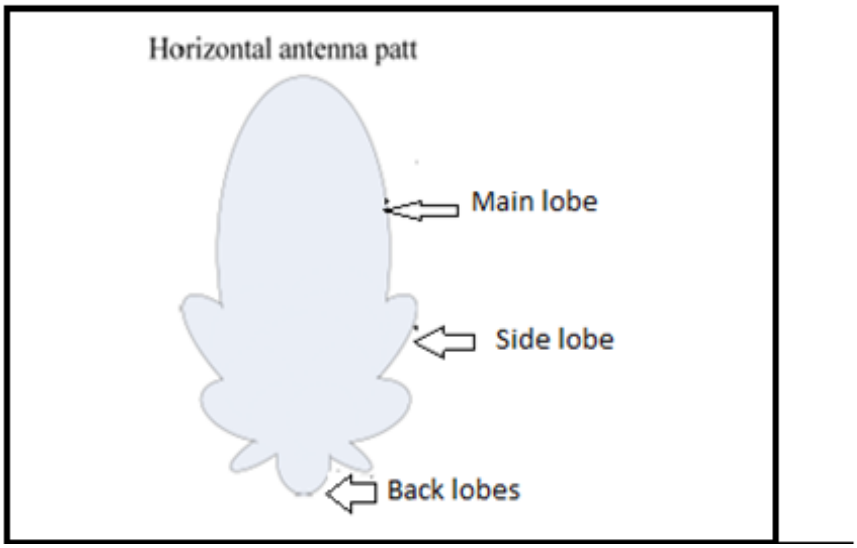

Fig 2. An illustration of the horizontal antenna pattern of a typical anisotropic antenna

6.1.1.2 Distance Related measurements

Distance related measurements include propagation time based measurements, i.e., one-way propagation time measurements, roundtrip propagation time measurements and time difference-of-arrival (TDOA) measurements, and RSS measurements [26]

1). One-way propagation time measurements: It measures the difference between the sending time of a signal at the transmitter and the receiving time of the signal at the receiver. It requires the local time at the transmitter and the local time at the receiver to be accurately synchronized. This requirement may add to the cost of sensors by demanding a highly accurate clock and/or increase the complexity of the sensor network by demanding a sophisticated synchronization mechanism. This disadvantage makes one-way propagation time measurements a less attractive option than measuring roundtrip time in WSNs [26].

2). Roundtrip propagation time measurements: It measures the difference between the time when a signal is sent by a sensor and the time when the signal returned by a second sensor is received at the original sensor. Since the same clock is used to compute the roundtrip propagation time, there is no synchronization problem. The major error source in roundtrip propagation time measurements is the delay required for handling the signal in the second sensor [26].

- There is a category of localization algorithms utilizing TDOA [26] measurements of the transmitter's signal at a number of receivers with known location information to estimate the location of the transmitter. Fig. 3 shows a TDOA localization scenario with a group of four receivers at locations r1*;* r2*;* r3*;* r4 and a transmitter at r*t*. The TDOA between a pair of receivers *i* and *j* is given by:

FORMULA:

$$\triangle t_{ij} \triangleq t_i - t_j = \frac{1}{c}\left(||\mathbf{r}_i - \mathbf{r}_t|| - ||\mathbf{r}_j - \mathbf{r}_t||\right), \quad i \neq j \tag{1}$$

Where ti and tj are the time when a signal is received at receivers i and j respectively, c is the propagation speed of the signal, and jj ¢ jj denotes the Euclidean norm [26].

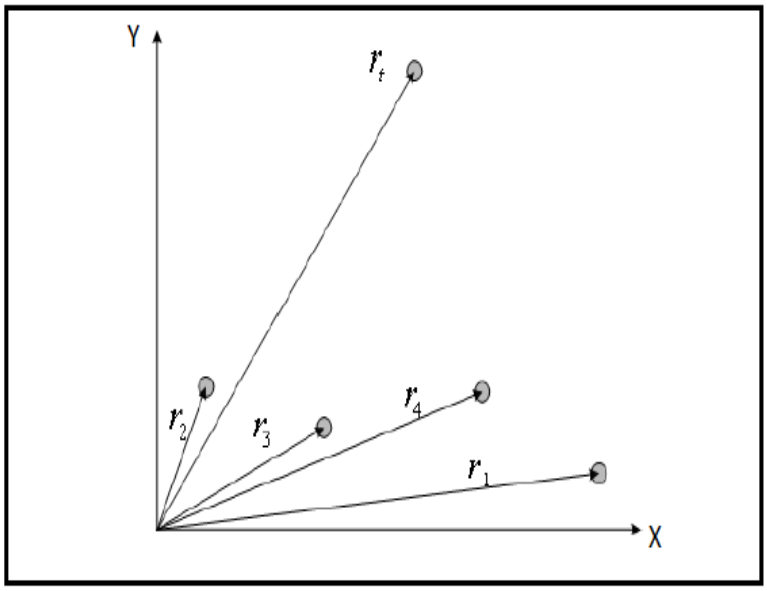

Fig 3- localization using time difference of arrival measurements [26].

- Yet another category of localization techniques, i.e., the RSS profiling-based localization techniques, work by constructing a form of map of the signal strength behaviour in the coverage area. The map is obtained either offline by a priori measurements or online using sniffing devices deployed at known locations. They have been mainly used for location estimation in WLANs, but they would appear to be attractive also for wireless sensor networks. In this technique, in addition to there being anchor nodes (e.g., access points in WLANs) and non-anchor nodes, a large number of sample points (e.g., sniffing devices) are distributed throughout the coverage area of the sensor network. At each sample point, a vector of signal strengths is obtained, with the jth entry corresponding to the jth anchor's transmitted signal. Of course, many entries of the signal strength vector may be zero or very small, corresponding to anchor nodes at larger distances (relative to the transmission range or sensing radius) from the sample point. The collection of all these vectors provides (by extrapolation in the vicinity of the sample points) a map of the whole region[26].

6.1.2 Probabilistic Approach

The probabilistic position estimation algorithm is used that considers the range measurement inaccuracies. Nodes in a sensor network can belong to two different classes, namely beacons and unknowns. It is assumed that the beacons have known positions (either by being placed at known positions or by using GPS), while the unknown nodes estimate their position with the help of beacons. The first step in RF-based localization is range measurement, i.e., estimating the distance between two nodes, given the signal strength received by one node from the other. The unknown node initializes its position estimate to the entire space. The node then waits to receive beacon packets from its neighbouring nodes, and upon receiving a beacon packet, updates its position estimate by computing the constraint and intersects it with the current estimate to obtain the new estimate. If the position estimate improves, it will wait for a specific period of time and will broadcast its new estimate to all of its neighbours . If the unknown node estimates mean and standard deviation from the signal strength of the beacon message, the constraint is a Gaussian normal distributed surface of mean and standard deviation. This is

equivalent to a Gaussian function rotated 360 degrees around the coordinates of the beacon [27]. If S1 and S2 are the two consecutive measurements, then the new shifted measurement is computed as:

S1= (μ_1,σ_1) S2= (μ_2,σ_2)

$$\mu_{shift} = \frac{\mu_1\sigma_2^2 + \mu_2\sigma_1^2}{\sigma_1^2 + \sigma_2^2}$$

$$\sigma_{shift} = \frac{\sigma_1\sigma_2}{\sqrt{\sigma_1^2 + \sigma_1^2}}$$

(2) , (3)

The Current Estimate is given by the formula:

$$P(x,y) = \frac{P(x,y) \times C(x,y)}{\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} P(x,y) \times C(x,y)dxdy} \quad (4)$$

6.2 Localization in Open Space

6.2.1 Visual Localization

To expand the working range of this localization system, it is sufficient to provide occasional on-demand Updates only when the open-space configuration fails. Visual pose estimation algorithms are well poised to do that. By acting less frequently and on demand, they can be allowed more time for image processing operations which can be used to increase the robustness of the overall system [23].

6.2.2. Localization Using All Sensors

Finally, a test will be performed to confirm that the entire localization system works well together, that is, it uses the visual localization as needed and that it actually improves the performance [24].

6.2.3 Mobile beacon based localization

The proposed localization approach starts from the stage of sensor node deployment. After the sensor deployment planning process, the user that carries the mobile beacon starts to deploy sensor nodes. When a sensor node is placed, the user turns its power on, and sets the mobile beacon to transmit a set of beacon signals. Any previously deployed nodes that are within the transmission range of the mobile beacon will receive the beacon signals and estimate their distances to the current mobile beacon location (or the location of the sensor node under deployment). The user then moves to deploy the rest of the sensor nodes and repeats the same procedures until all sensor nodes are deployed. After all sensor nodes are deployed, each sensor node will have a set of distance measurements to its neighbours, which are then passed to a central node for localization using the MAP localization algorithm [28].

6.3 Programming Approaches for WSNs: A Classification

In the following subsections the characteristics of each group are detailed and several proposals are identified.

6.3.1. Programming Languages

The first option to develop an application for WSNs is to directly use an existing programming language. They are also used to implement the runtime support and infrastructures needed in most of the approaches discussed in the following sections [23].

6.3.1.1. Programming Abstractions

By programming abstractions we mean high-level abstractions that, supported by a suitable programming model, compiler and runtime support, liberate the programmer from having to address the low-level WSN mechanisms such as messaging and routing protocols, data caches and neighbour lists. Basically, we can establish two main types of programming abstractions: Node-centric or local behaviour approaches, which are centred on individual nodes, and macro programming or global behaviour approaches, which focus on the behaviour of a WSN as a whole. In node-centric programming, the programmer has to translate the global application behaviour in terms of local actions on each node, and individually program the sensor nodes using the corresponding programming model. Proposals such as Hood, Abstract Regions, Logical Neighbourhoods and Virtual Nodes belong to this class. In a WSN, a node is able to exchange data directly only with the surrounding nodes located within its communication radius (physical neighbourhood)[23].

6.3.1.2. Middleware

The middleware is used to support the development, maintenance, deployment and execution of applications, filling in the gap between the application layer and the hardware, operating system and network stack layers. In the case of a WSN, this includes mechanisms for formulating complex high-level sensing tasks, communicating them to the WSN, coordination of sensor nodes to split tasks and distribute them to the individual nodes, data fusion for merging the sensor readings into high-level result, and reporting it. Moreover, appropriate abstractions and mechanisms for dealing with the heterogeneity of sensor nodes should be provided [23].

Virtual Machines

Virtual machines provide a run-time environment that isolates the execution of applications from the underlying platform. The execution engine proposes a set of high level instruction set, enabling a compact representation of the application code. Therefore, size of applications is reduced in this way and software updates can be distributed more easily. However, since execution takes place within a virtual machine, execution cost is higher compared to native code.

This category allows the developers to write applications in separate, small modules. The system injects and distributes the modules through the network using tailored algorithms, and therefore overall energy consumption and resource use are minimized [23].

VII CONCLUSION AND FUTURE ENHANCEMENT

The Security is one of the major concern in the area of Wireless Sensor Networks . This paper presents a method of providing authentication to the sensor nodes thereby enhancing the trustability of the network. We discussed two familiar verification algorithms that brings out easy method of data authentication. These methods would be simple, effective and resistant to various attacks. But, there is still a requirement for Light Weight Algorithms. The advantage of designing a Lightweight systems is that they do not require any dedicated hardware or infrastructures, and they do not incur high computation overhead at the sensor side, so that the

verification system can be applied to low cost wireless sensor networks. Finally, we can conclude that this paper presents a simple way to protect the data of sensor nodes.

FUTURE ENHANCEMENT

- A webpage application can be created through which the authentication of data from various sensors can be displayed.
- This application can be uploaded to the cloud to allow the users from various locations to access it.

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DEVELOPMENT OF CW AND Q-SWITCHED DIODE PUMPED ND: YVO_4 LASER

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ABSTRACT

The development and parameter of continuous wave and Q-switched diode pumped Nd: YVO_4 laser is discussed. End pumping configuration has been used in this process. Suitable laser diode of wavelength 808nm was selected in accordance with the material chosen to obtain the required output. Resonator length and radius of curvature of mirror were selected to have a stable resonator cavity. Its power was observed to be 297mW at 834mW input power. The output power and peak intensity were stable over a period of operation. Passive Q-switch Cr^{4+}: YAG was used to obtain the Q-switch laser and its pulse width was recorded to be around 20-25 ns.

Keywords: Diode pumped, Nd: YVO_4 laser, Q-switch

I. INTRODUCTION

Diode-pumped solid-state (DPSS) lasers are gaining acceptance in industrial applications due to improved performance and reducing price. There is an expected growth rate of 24%, twice that of flash lamp-pumped solid-state lasers in the same period [1][2]. It is expected that DPSS lasers will continue to penetrate the flash lamp-pumped solid-state laser market at a rapid rate. Recently there has been great interest in the Nd: YVO_4 crystal as a lasing media. Neodymium-doped yttrium orthovanadate (often called just "vanadate") has several spectroscopic properties that are particularly relevant to laser diode pumping. The two outstanding features are a large stimulated emission cross section that is five times higher than Nd: YAG, and a strong broadband absorption centered at 809 nm with a useful range (at 50% of the peak) of 801 to 821 nm [3]. The vanadate crystal is naturally birefringent. Nd: YVO_4 laser performance is more tolerant to diode temperature variations because of the large pump bandwidth. If one defines this bandwidth as the wavelength range where at least 75% of the pump radiation is absorbed in a 5 mm thick crystal, then one obtains for Nd:YVO_4 a value of 15.7 nm, and 2.5 nm for Nd: YAG [4]. Nd: YVO_4 crystal is selected over Nd: YAG as it has absorption coefficient three times and absorption bandwidth two times that of Nd: YAG crystal. It exhibits a much lower laser threshold compared to a similar size Nd: YAG crystal. This is due to the fact that the product of its lasing cross section and upper state lifetime is twice that of Nd: YAG [5]. Compared with Nd: YAG for diode laser pumping, Nd: YVO_4 lasers possess the advantages of lower dependency on pump wavelength and temperature control of a diode laser, wide absorption band, higher slope efficiency, lower lasing threshold and single-mode output. The properties of Nd: YVO_4 can best be exploited in an end-pumped configuration. In end pumped systems the pump beam is usually highly focused, and it is difficult to maintain a small beam waist over a distance of more than a few millimeters. In this case a material such as Nd: YVO_4, which has a high absorption coefficient combined with high gain, is very advantageous. Nd: YVO_4 is capable of highly efficient laser operation, high

repetition rate Q-switching and intra-cavity frequency doubling. The diode laser-pumped Nd: YVO_4 compact laser and its frequency-doubled green, red or blue laser light will be the ideal laser tools of machining, material processing, spectroscopy, wafer inspection, light show, medical diagnostics, laser printing and the most widespread applications.

A mode of laser operation extensively employed for the generation of high pulse power is known as Q-switching. It has been so designated because the optical *Q* of the resonant cavity is altered when this technique is used. The quality factor *Q* is defined as the ratio of the energy stored in the cavity to the energy loss per cycle [6]. Consequently, the higher the quality factor, the lower the losses.

In the technique of Q-switching, energy is stored in the amplifying medium by optical pumping. Although the energy stored and the gain in the active medium are high, the cavity losses are also high, lasing action is prohibited, and the population inversion reaches a level far above the threshold for normal lasing action. When a high cavity *Q* is restored, the stored energy is suddenly released in the form of a very short pulse of light.

A passive Q-switch consists of an optical element, such as a cell filled with organic dye or a doped crystal, which has a transmission characteristic. The material becomes more transparent as the fluence increases, and at high fluence levels the material “saturates” or “bleaches,” resulting in a high transmission. The most common material employed as a passive Q-switch is Cr^{4+}: YAG. The Cr^{4}+ ions provide the high absorption cross section of the laser wavelength and the YAG crystal provides the desirable chemical, thermal, and mechanical properties required for long life [7]. Cr^{4+}: YAG offers several significant advantages over active acousto-optic and electro-optic devices including elimination of high voltage power supply, improved reliability and reduced package size. Cr^{4+}: YAG is more robust than dyes or color centers and is the material of choice for Nd lasers. [8]

II. EXPERIMENTAL SETUP

The laser cavity consist of neodymium-doped yttrium vanadate crystal (3% Nd doping of dimensions 3x3x1 mm), a lens of 15 mm diameter (focal length: 25 mm) and a 100 mm radius of curvature output coupler. One face of the lens forms one end of the resonator and has been coated for high transmission at 808 nm pump wavelength. The lens focuses the pump beam so that high intensity beam was obtained. So to obtain high efficiency and better beam quality, the Nd: YVO_4 crystal was placed at the focus of the lens. One face of mirror has high reflection coating (reflectivity: 95%) at the laser wavelength of 1064 nm, which forms the other end of the resonator. A hemispherical cavity was designed in this experiment. Laser diode of wavelength 808 nm was used for pumping. RG 850 filter was used to filter out the output beam from the pump beam. Cr^{4+}: YAG passive Q-Switch was placed between the output coupler and Nd: YVO_4 crystal. The pumping scheme, together with the experimental setup, are shown in Fig. 1. The apparatus were fixed with the help ofmagnetic base and mounts. Laser diode, lens, crystal and mirror were aligned with respect to each other with the help of already aligned He-Ne Laser. The maximum available pump power incident on the crystal is ~3W.

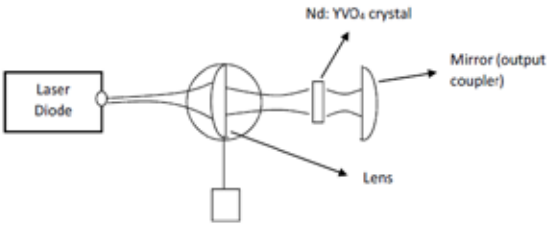

Fig 1: Layout of Experimental Setup

The stability of the resonator cavity depends on the resonator length, L and radius of curvature of the mirror (output coupler), R_1. It depends on two factors g_1 and g_2 [9].

$$g_1 = \left(1 - \frac{L}{R_1}\right), g_2 = \left(1 - \frac{L}{R_2}\right) \quad (1)$$

R_2 equals infinity ($g_2 = 1$) in our case since there was a hemispherical resonator. The cavity configuration is said to be stable if g_1 and g_2 correspond to points located in the area enclosed by branch of hyperbola $g_1g_2 = 1$ and the coordinate axis.

III. EXPERIMENTAL RESULTS

Fig. 2 shows the 3-D and 2-D profile of Nd: YVO_4 laser obtained using New Port LBP series beam profiler. The red color indicates the maximum intensity, which is at the center of the beam and as the intensity decreases, the color change from red to blue. This was obtained when all the components are properly aligned with respect to each other. The resonator length was observed to be ~65mm (0.065 m) for a near perfect beam. The wavelength of the laser was measured using wavelength spectrometer with the combination of filters so as to obtain maximum peak and was found out to be 1064 nm, which is represented in Fig. 3. The output power (measured with Ophir Nova II Power meter) of the laser at a constant input was observed to be consistent over the period of observation. The consistency can be seen in Fig. 4. Fig. 5 shows that the output power linearly varies with the input power. The laser was observed to have ~36% efficiency. The minimum pumping power necessary to produce an output was less than 0.22W, which is in conformity of the fact that Nd: YVO_4 has low lasing threshold.

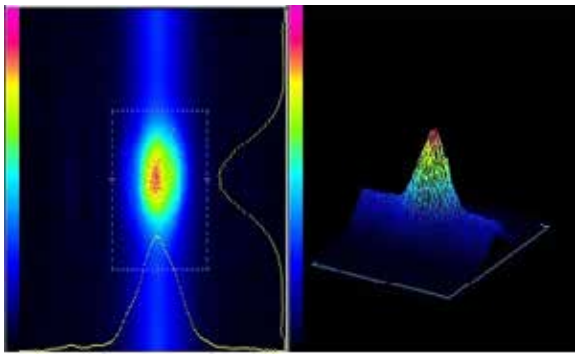

Fig.2 : 2-D (left) & 3-D (right) profile of Nd: YVO_4 laser

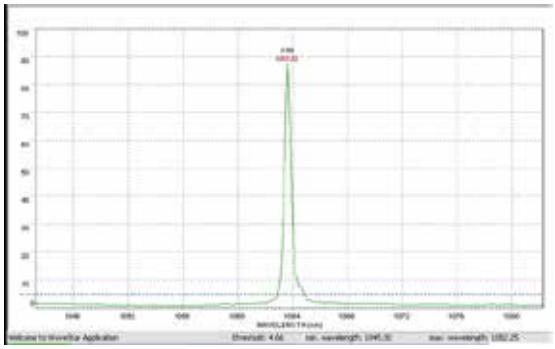

Fig 3: Wavelength of output laser

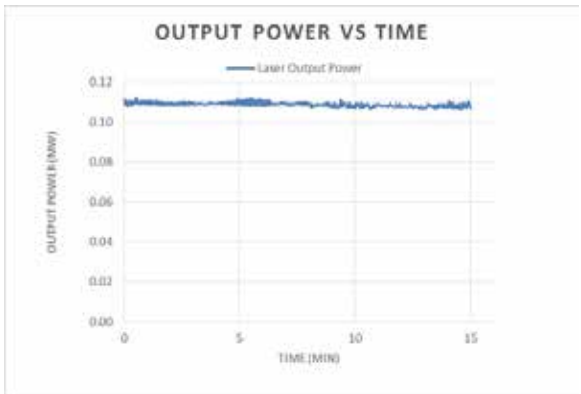

Fig 4: Consistency of Output Power

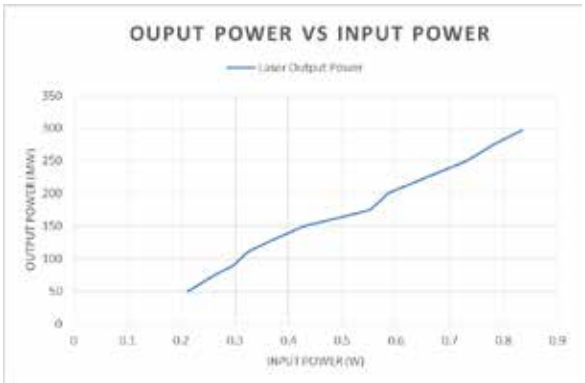

Fig 5: Output Power Vs Input Power

In order to observe a refined laser beam, RG850 filter (diameter: 76.2 mm) was used. This filter prevent the transmission of pump beam through it. So, the beam finally obtained was just the required laser.

When Cr^{4+}: YAG Q-Switch was inserted between the crystal and the output coupler, Q-Switched laser was obtained. The pulse width of the obtained laser was recorded to be around 20-25 ns. Fig. 6 shows one of the pulses that was recorded. The frequency of the laser is in the range of kHz.

The laser was obtained since the resonator cavity was stable i.e. the factors g1 and g2 (discussed earlier) lie in the stability region. The stability graph plotted is shown in Fig. 7. Points corresponding to different value of R_1 werealso plotted to check whether stable cavity was obtained or not.

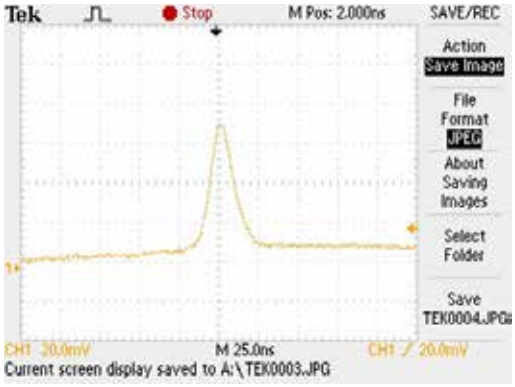

Fig 6: Pulse width of Q-Switch laser

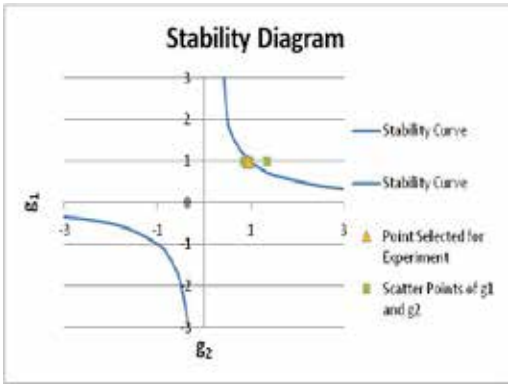

Fig 7: Stability Diagram

IV. CONCLUSION

A stable and efficient end diode pumped continuous wave and Q-Switch Nd: YVO_4 laser has been developed. In spite of all the disturbances from the external environment and internal temperature variations, it was able to generate a consistent output power at a wavelength of 1064 nm with the efficiency of ~36%. Nd: YVO_4 is extremely well suited for passively mode-locked lasers with very high pulse repetition rate and is finding much use in frequency doubled green laser pointers and other small diode laser modules. Neodymium doped laser can be made more effective by using Nd: $LaSc_3$ $(BO_3)_4$ or Nd: LSB. It has absorption bands five times wider, absorption coefficient three times higher and saturation intensity five time bigger than that of Nd: YAG. So, Nd: LSB has a great future prospect.

V. ACKNOWLEDGEMENTS

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IN SITU DIAGNOSTICS AND PROGNOSTICS OF LIVESTOCK MONITORING SYSTEM

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ABSTRACT

This paper proposes an adaptation of Wireless Sensor Networks (WSNs) to cattle health monitoring from a prototype telemonitoring system that utilizes wearable technology to provide continuous animal health data. The proposed solution facilitates the requirement for continuously assessing the condition of individual animals, aggregating and reporting this data to the farm manager. Clinical techniques for monitoring livestock health are insufficient, as they provide only sporadic information and require too much resource investment in terms of time and veterinary expertise. A sophisticated system capable of continuously assessing the health of individual animals, aggregating these data, and reporting the results to owners and regional authorities could provide tremendous benefit to the livestock industry. Such a system would not only improve individual animal health, but it would help to identify and pre vent widespread disease, whether it originated from natural causes or from biological attacks.

Keywords: Gait Sensor (ADLX330), PIC Microcontroller, Tarang, Temperature Sensor (LM335).

I. INTRODUCTION

Livestock are domesticated animals raised in an agricultural setting to produce commodities such as food, fiber and labor. In the industrial model of livestock production, animals are housed in close quarters inside massive climate-controlled buildings or on feedlots. Each confined animal feeding operation, may house tens or even hundreds of thousands of animals. There has always been a need for livestock producers to “observe” their animals as often as possible. Inattention to the wellbeing of the animals, whether its health or welfare issue can lead to reduced productivity and the death of valuable stock. Animal health condition and monitoring is now becoming even more crucial to the wider farming industry as both known and new diseases pose a risk of the global spread of diseases. It is thus important to develop monitoring systems that report a range of animal health conditions back to the farm manager or stockman in a timely manner. Current animal monitoring systems only allow data to the farm manager once at a fixed point.

This paper therefore reports on the health assessment by providing continuous data based on the biometric characteristics and the body temperature to the tarang transceiver which is then transmitted to the hyper terminal (central monitoring system).

II. RELATED WORKS

In [1] Wireless sensor network for cattle health monitoring by Ivan Andonovic,Craig Michie,Michael Gilroy,Hock Guan Goh,Kae Hsiang Kwong,Konstanios Sasloglou and Tsungta Wu investigates an adaptation

of Wireless sensor networks to cattle health monitoring. The proposed solution facilitates the requirement for continuously assessing the condition of individual animals, aggregating and reporting this data to the farm manager. There are several existing approaches to achieving animal monitoring, ranging from using a store and forward mechanism to employing GSM-based techniques; these approaches only provide sporadic information and introduce a considerable cost in staffing and physical hardware. The core of this solution overcomes the aforementioned drawbacks by using alternative cheap, low power consumption sensor nodes capable of providing real-time communication at a reasonable hardware cost. In this paper, both the hardware and software have been designed to provide real-time data from dairy cattle whilst conforming to the limitations associated with WSNs implementations.

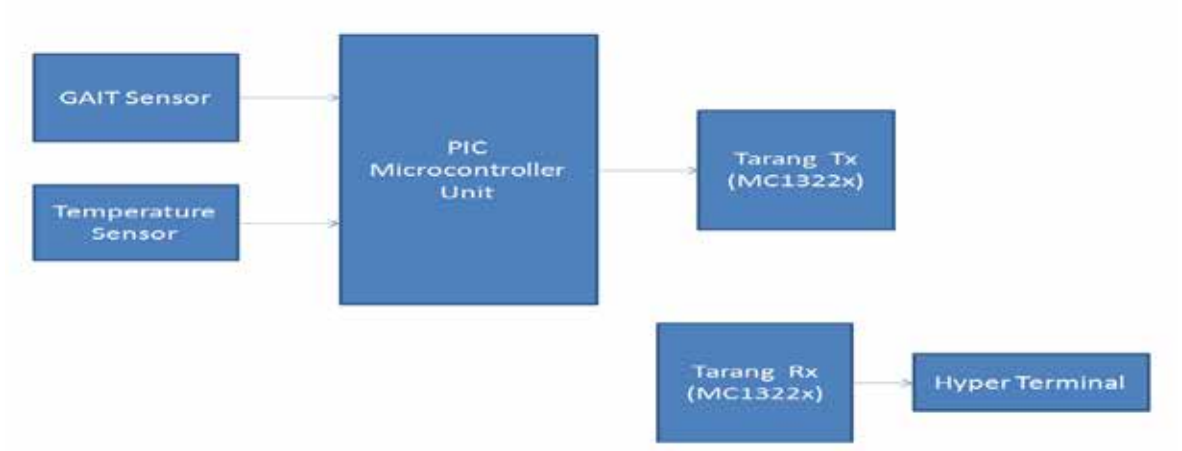
In [2] Monitoring Health and Looking for Sick Cows by Carlos Risco1, DVM, Billy Smith2, DVM, Mauricio Benzaquen1, DVM, Pedro Melendez1, DVM discusses the solution that facilitates a desired requirement of continuously assessing the condition of individual animal, aggregating and reporting these data to the farm manager. Although they are several strides in postpartum cow management by implementing postpartum health monitoring strategies, quite often we fail to find a sick cow early in the disease course, which leads to a delay in treatment. Further, there are different opinions on health monitoring strategies, which parameters to use and how to interpret them. This paper reviews parameters that can be used to monitor postpartum health and discusses clinical signs to look for in sick cows. A postpartum health monitoring program assures; that all cows are examined during the time when they are most susceptible to disease, allowing the opportunity for early identification of cows that are sick

In [3] Near-Field Wireless Magnetic Link for an Ingestible Cattle Health Monitoring Pill by Seth Hoskins1, Timothy Sobering discusses the Cattle health assessment is receiving increased attention due to threats that disease and bioterrorism pose to producer profits and to the safety of the food supply. Ingestible pill technology offers a promising means to obtain these physiologic data, since a bovine reticulum is an environment sheltered from outside elements that offers direct access to feed intake and heart/lung data. Traditional radio-frequency links are not well-suited for this application, as water absorption severely limits transmission ranges through tissue. This paper presents the initial design of a communications link that utilizes magnetic induction for signal transport and should be well suited for a tissue medium. The link consists of a transmitter/receiver pair that employs loop antennae frequency matched at 125 kHz. Optimization of the link design offers the potential to achieve transmission distances of several feet through tissue.

III. OVERVIEW OF PROPOSED SYSTEM

The livestock industry is an integral part of the world's economy. More benefits can be realized from this class of technology, such as the ability to identify the presence of disease early and thereby prevent its spread. An important element of health assessment is the ability to monitor vital data such as core body temperature and pattern of living. A wearable Health Sensors like temperature sensor, gait sensors are used to record and monitored using wireless monitoring system. Tarang module is used to transfer the collected data to the base station.

IV. BLOCK DIAGRAM

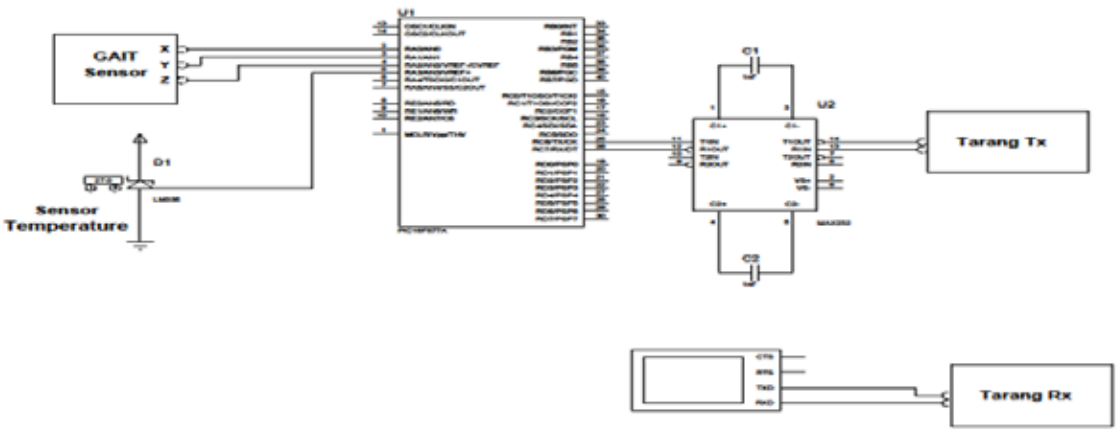


From the above diagram, temperature sensor LM335 is used to measure the body temperature which gives the normal and abnormal values. The LM335 is precision temperature sensor which can be easily calibrated. They operate as a 2-terminal Zener and the breakdown voltage is directly proportional to the absolute temperature at 10mV/^{o} K. The circuit has a dynamic impedance of less than 1Ω and operates within a range of current from 450µA to 5mA without alteration of its characteristics. Calibrated at +25^{o} C, the LM335 have a typical error of less than 1^{0}C over a 100 ^{0}C temperature range. Unlike other sensors,LM335 have a linear output and gait sensor is used to measure the biometric characteristics of the livestock.

This can be done by using ADXL330 which is a small, thin, low power, complete 3-axis gait sensor with signal conditioned voltage outputs, all on a single monolithic IC. The product measures acceleration with a minimum full-scale range of ±3g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. The user selects the bandwidth of the accelerometer using the CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis.

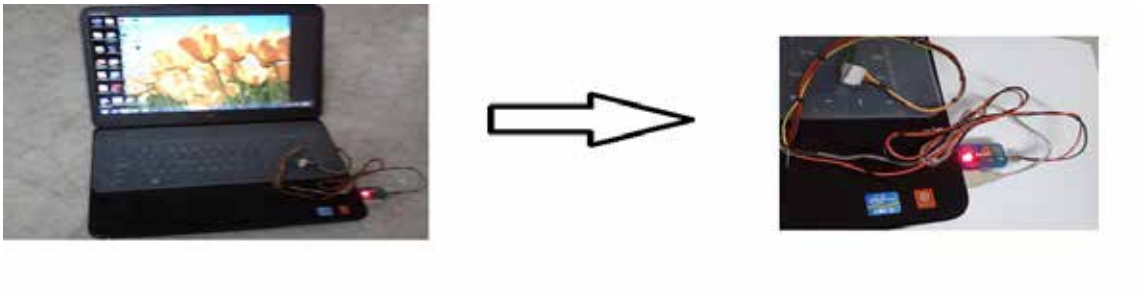
These two values are given as an input to the PIC microcontroller at IO ports. It is then processed and reported to the hyper terminal.

V. CIRCUIT DIAGRAM



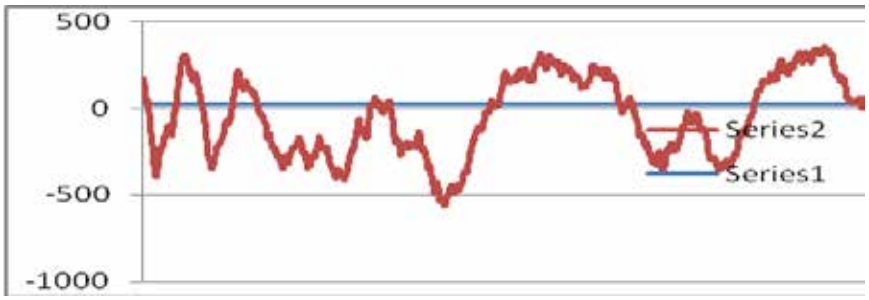
VI. RESULTS AND DISCUSSION

Animal walking and Running signal measured by MEMS accelerometer with help of Sigview software. MEMS sensor need 5V supply it is taken by pc USB port. Sigview measured the signal by using external sound card.

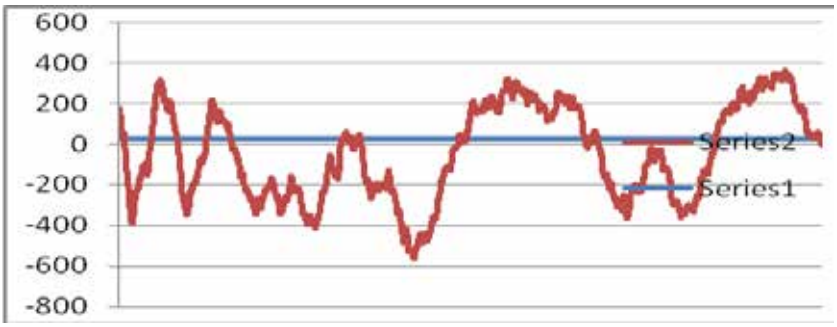


6.1 Waveform

6.1.1 Gait signal while animal walking



6.1.2 Gait signal while its running



VII. CONCLUSION

A design for a concept cattle health monitoring systems using gait sensor has been presented inorder to provide timely detection of any health issues and to achieve increased effectiveness and profit in an easy manner. It is very cheap and low power consumption that provides better health condition monitoring of the livestock.

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