

# WAR FIELD SPYING ROBOT WITH FIRE FIGHTING CIRCUIT: A MODEL

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## **ABSTRACT**

*This research paper is based on War Field Spying Robot which is made by using different technologies and sources. This paper is basically based on a project which is made by me. The main purpose of this paper is to describe how this war spy robot is made, what are the sources or technologies used to make this robot and how this robot is helpful in so many ways. Basically the project is designed to develop a robotic vehicle named War Field Spying Robot using RF technology for remote operation attached with smart cell phone having IP web cam application for monitoring purpose. The robot along with smart cell phone can wirelessly transmit real time video and will give confidential information regarding opposite parties. An 8051 series of microcontroller is used for the desired operation. The commands are sent to the receiver, at the transmitter side with push buttons, to control the movement of the Robot to move forward, backward and left or right. Two DC motors are interfaced, at the receiving side to the microcontroller, which control the movement of Robotic vehicle. A smart cell phone with IP web cam application is mounted on the robot body for spying purpose even in complete darkness by using infrared lighting. This will send the videos wirelessly at the transmitter side (laptop). This is kind of robot can be helpful for spying purpose in war fields and in order to minimize the attacks like 26/11 in Mumbai in future. It can also be helpful where living beings cannot reach.*

**Key Words:** *Robot, War Spying robot, RF Module, IP Web Cam (Smart Cell Phone), Technologies used, Different sources*

## **I. INTRODUCTION**

### **1.1 What is Robotics?**

It is a field of Engineering that covers the mimicking of human behaviour. Robotics includes the knowledge of Mechanical, Electronics, Electrical and Computer Science Engineering. It is the branch of technology that deals with the design, construction, operation, and application of robots well as computer systems for their control, sensory feedback, and information processing.

### **1.2 What is Robot?**

The word robot comes from the Slavic word robota, which means labour. A robot is usually an electro-mechanical machine that can perform tasks automatically. It is defined as an industrial machine that replaces the human to work in hazardous and unsafe condition. It is also defined as a machine that removes the mines in war all on its behalf. Basically a Robot means

- An automatic industrial machine replacing the human in hazardous work.
- An automatic mobile sweeper machine at a modern home.

- An automatic toy car for a child to play with.
- A machine removing mines in a war field all by itself and many more.

### **1.3 What is War Field Spying Robot?**

As its name suggests it is a robot which is used for the purpose of spying on enemy territories. This kind of robot can be helpful for spying purpose in war fields. This can be used in various places like

- At the time of war where it can be used to collect information from the enemy terrain and monitor that information at a far secure area, and safely devise a plan for the counter attack.
- Tracking locations of terrorist organizations and then plan attack at suitable time.
- Making a surveillance of any disaster affected area where human beings can't go.
- Patrol the surroundings with sharp camera-eye.
- Send video and data captured to the server wirelessly.
- Easy control by a remote through wireless network.
- Mobile in all directions with miniature size.

### **1.4 IP Webcam Application**

IP Webcam is defined as Internet Protocol Webcam. This application plays a very important role in this. This application is used to send and receive the data. Smart phone is placed at top of the receiver side and it made a video of enemy area and wirelessly sends to the laptop that is at other end.

## **II. OBJECTIVES**

- Ø To describe how this war field spying robot is made.
- Ø The sources or technologies used to make this robot.
- Ø To explain how this robot is helpful in so many ways.

## **III. WORKING**

### **3.1 Hardware Requirements in the Project**

8051 Microcontroller, Encoder, Decoder, Push Buttons/Switches, RF(tx-rx), Resistors, Antenna, Diodes, NPN Transistor, IR emitting Diode, LED's (Light Emitting Diode), Crystal Oscillator, Electrolytic Capacitor, Operational Amplifier(firefighting circuit)

### **3.2 Circuits of War Field Spying Robot**

This robot includes two types of circuit that are

- Ø Transmitter circuit
- Ø Receiver circuit

The block diagram and circuit diagram of both the transmitter and receiver are explained further in the paper.

### **3.3 Block Diagram of Transmitter and Receiver**

- Ø Transmitter

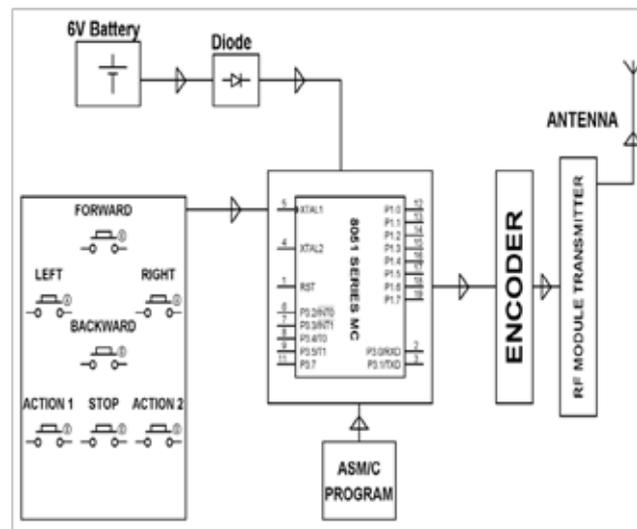


Fig. 1. Represents the Block Diagram of Transmitter

Ø Receiver

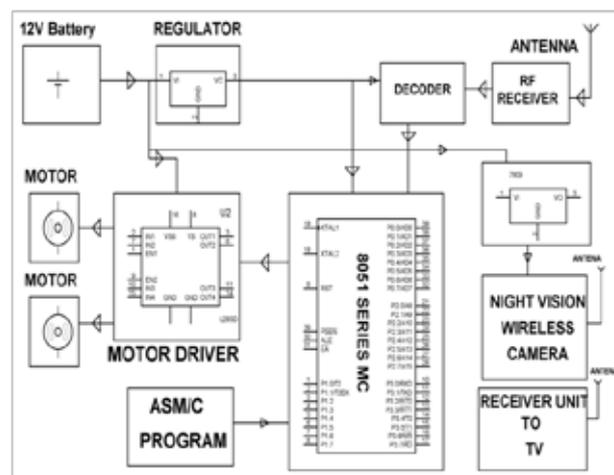


Fig. 2 Represents the block diagram of Receiver

3.4 Apparatus used at Transmitter Side

- HT12E/DIP18 --- Encoder / Dual in package (18 pin)
- Push buttons/Switches
- Resistor
- 433 MHZ RF module (Transmitting module)
- L7805 --Voltage regulator
- 9 V DC supply

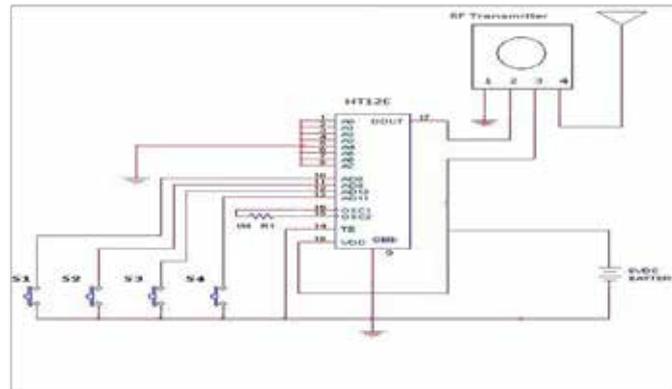
3.5 Apparatus used at Receiver Side

- 433 MHZ RF module(receiver)
- 8051 Microcontroller
- HT12D/DIP18--- decoder/dual in package 18 pins
- Switches/dual in package 8 pins
- L7805--- Voltage Regulator
- Battery--- 12 V power Supply

- IN4148--- diodes
- NPN transistor
- Motors

## IV. THEORY OF OPERATION

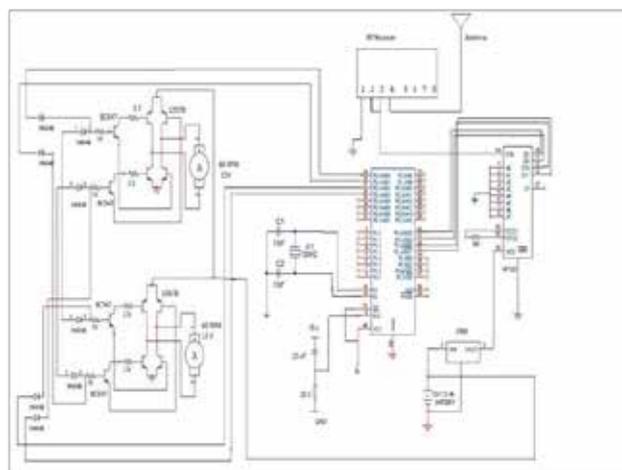
### 4.1 Operation at Transmitter Side



**Fig.3. Represents the Circuit Diagram of Transmitter**

In the transmitter circuit firstly we grounded the pin no. 1-9 of encoder than pin no. 10,11,12,13 are connected to push buttons or switches through resistors and then grounded it. The parallel input is provided to the encoder through the switches. The encoder encodes the parallel input into serial data which is obtained at pin 17 of the encoder than the Pin no. 14 (Transmission Enable) is Grounded (Active Low).than we connect pin 15 and 16 (Oscillator input and output) through a resistor. The external 1 ohm resistor connected at the pins 15 and 16 is used to generate oscillations in the encoder of a particular frequency. So the 4 bit serial data is fed to the transmitter module at the same frequency. Pin 17 (Serial data output) is connected to 2ndthe serial data wirelessly to the RF receiver at the receiving end. Once the data reaches the data pin i.e. pin no 2 of the RF Module then the data is transmitted through it, the transmission of data is through a very high frequency carrier, the data is further transformed into a suitable type and then it is transmitted out through antenna connected to the RF Module pin no 4 than to Pin 18 we supplied with 9 V DC voltage through a battery. Than the receiver antenna picks up the serial data sent by the transmitter. Antenna is connected to one of the pins of the receiver. And this data is further processed through the receiver module.

### 4.2 Operation at Receiver Side



**Fig. 4 Represents the Circuit diagram of receiver**

Pin no. 1-8 (Port 1) are not used and are left unconnected of microcontroller than its Pin 9 (Reset Pin) is supplied with an active high through a capacitor. A resistor is also connected in series which is further Grounded. Pin no. 10-13 (Port 3) is used as input port and is connected to output pins (Pin no.10-13) of the decoder. The output from decoder is given as input to the microcontroller which in turn executes the program. Its Pin 18 and 19 is used to connect a crystal oscillator to provide the clock signal to the microcontroller and are further Grounded through capacitors. Its Pin 20 is Grounded than the Pin no. 21-28 (8 bit Address Pins: Port 2) is not used and is left unconnected. Pin 29 and 30 are left unconnected. Its Pin 31 (External Access Enable) is given a +5 V power supply. Microcontroller Pin 32-39 (Port 0) is used as output port. Pin 36-39 are individually connected to the bases of four NPN BC547 transistors through diodes and resistors. The output from these pins determines the current flow to the base of the transistor. These four NPN transistors regulate the current flow to the further connected transistors. The eight NPN transistors form two H-bridges. The input to base of each transistor determines the On/Off state of each transistor which in turn determines the direction of rotation of DC motor connected to the collector of the transistors. Pin 40 is supplied with +5 V power Supply than the Pin no. 1-8 (8 bit Address pins for input) of decoder are Grounded. Pin no.9 is also grounded. Decoder Pin No. 10, 11, 12 and 13 (4 bit Data/Address pins for output) are connected with Microcontroller input port (port 3). The output from decoder instructs the microcontroller to execute the program. Decoder Pin 14 (Serial data input) is connected to 2nd received and converted into parallel data by the decoder. The serial data received at data in pin i.e. pin no 14 is internally converted in parallel form and the 4 bit data available at the 4 data out Pins of the decoder is similar to the status of data at data in pins of the encoder. The decoder IC will provide the data to the micro controller unit and the micro controller unit will recognize the signal and will respond accordingly as per the program fed into it. Decoder Pin 15 and 16 (Oscillator input and output) are connected through a resistor. Pin 17 is unused (Data Pin) of RF receiver. The serial data is Pin 18 is supplied with 5V DC voltage through a voltage regulator. The input to the voltage regulator is 12 V DC supply through a battery.

### **4.3 Fire Fighting Circuit**

It is attached to the robot so that it can detect the fire and there is small fan that is attached to the robot so that it can be used in extinguishing fire.

### **4.4 Apparatus used in firefighting circuit**

- Thermistor (heat sensor)
- LM358 (op amp)
- Fan
- Potentiometer
- Variable resistor
- Wires

## **V. APPLICATIONS**

Spy Robot is readily usable in many fields of application, some being scientific, military and many more. The explanation of some of the applications is as below:

### **5.1 Military**

In military, the wireless camera has been used as their first line force to survey the enemy location from their base. By using this robot, they can save their soldier live because before they move to enemy location they

already know the enemy situation and percentage of their win in the war will be increased. The main objective behind making this robot is to provide little or small help to our police department and army.

It can be used for spying purposes to get the confidential details of anybody from remote area without making our life in danger.

At the time of war where it can be used to collect information from the enemy terrain and monitor that information at a far secure area, and safely devise a plan for the counter attack.

These robots can be used to keep an eye on the border area to detect any criminal activity and alert the military of any intruders.

### **5.2 Disaster Affected Area Surveillance**

The spying robot can be used at the time of natural disasters such as earthquake to monitor the affected areas. The robot can reach the places which is not accessible to human beings. The wireless camera will send the live video streaming to the receiver which is monitored by human being. The bodies trapped under buildings can be detected and many lives could be saved.

### **5.3 Underground Tunnel/ Mines Surveillance**

This robot can be used for tunnels surveillance with wireless video communication system. The underground mines are usually rugged and it is very difficult for human beings to reach there and collect the information. Since the camera used with the robot has the ability to capture videos even in darkness (Night Vision), the detailed information of tunnel and mines can be easily monitored even if there is dark inside.

### **5.4 General Surveillance**

The robot can be placed at various shopping malls, jewellery shops etc. for surveillance purpose. This will help to keep a check on all visitors and in case of any mishappening, the recorded videos can be used as a significant help to identify the culprit.

### **5.5 Fire Fighting**

The robot also possesses a fire fighting system which can detect fire (or smoke) and can extinguish the fire itself. It can be used at oil mine fields which are usually inaccessible to humans and are prone to catch fire. These robots can be used to detect and extinguish fire at such places. Can be used in extinguishing fire where probability of explosion is high. For e.g. Hotel kitchens, LPG/CNG gas stores, etc.

It can be used in record maintaining rooms where fire can cause loss of valuable data.

## **VI. ADVANTAGES**

### **6.1 Speed**

Robots may be used because they are FASTER than people at carrying out tasks. This is because a robot is really a mechanism which is controlled by a computer - and we know that computers can do calculations and process data very quickly.

### **6.2 Hazardous Environment**

Robots may be used because they can work in places where a human would be in danger. For example, robots can be designed to withstand greater amounts of heat, radiation, chemical fumes than humans could.

### **6.3 Repetitive Tasks**

Sometimes robots are not really much faster than humans, but they are good at simply doing the same job over and over again. This is easy for a robot, because once the robot has been programmed to do a job once, the same program can be run many times to carry out the job many times. And the robot will not get bored as a human would.

### **6.4 Efficiency**

Efficiency is all about carrying out tasks without waste. This could mean not wasting time not wasting materials not wasting energy.

### **6.5 Accuracy**

Accuracy is all about carrying out tasks very precisely. In a factory manufacturing items, each item has to be made identically. When items are being assembled, a robot can position parts within fractions of a millimeter.

### **6.6 Adaptability**

Adaptability is where a certain robot can be used to carry out more than one task. A simple example is a robot being used to weld car bodies.

If a different car body is to be manufactured, the program which controls the robot can be changed. The robot will then carry out a different series of movements to weld the new car body.

## **VII. CONCLUSION**

As we all know, these days India is sick off massive terror attacks, bomb explosions at plush resorts. To avoid such disasters Technological power must exceed Human power. Human life and time are priceless. So we took an initiative to design a model of an apt robot that can be widely used so as to avoid terror attacks, to ensure more security at the border and high density areas. Even every nation needs its own defence system for their integrity and security. In such a way construction of these robots will carry nation's name, fame globally.

The Wireless spy camera Robot has been designed in such a way that it can fulfill the needs of the military, the police and armed forces. It has countless applications and can be used in different environments and scenarios. For instance, at one place it can be used by the armed forces, military purposes, while at another instance it can be used for spy purposes. Another important application is to provide up to date information in a Hostage situation.

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“He has eight International Publications and one Conference.”

# STUDY OF AUTOMATIC TRANSMISSION BASED ON ELECTRONIC CONTROL SYSTEM

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## ABSTRACTS

*Since 1980s, the electronic control units of automatic transmissions have been greatly advanced to make smooth gear shifting and improve fuel economy. Along with it, the solenoid valves as electro-hydraulic actuators have been rapidly developed which have high pressure and large flow capacity. In these days, it is not an expensive solution to adopt more electro-hydraulic actuators to get the better performance of the automatic transmission. This paper introduces a new scheme of full electronic control system, direct active shift control, using the proportional control solenoid valves to control the pressure of each friction element independently and without any passive hydraulic or mechanical component. At first, it reviews the structures of widely used control systems from the old-fashioned to the modern. Next, the concept of the direct active shift control scheme is introduced and the performance of the actuators discussed. Finally, you can show the simple test results compared with a commercially announced system recently developed and be sure that the proposed system will be feasible in the near future.*

**Keywords:** *Automatic Transmission, Full Electronic Control System, Direct Active Shift Control.*

## I. INTRODUCTION

The automatic transmissions for passenger cars have since 1930s. Starting from the 2-speed, the 3 and the 4-speed automatic transmissions have been commonly used until now. In 1990s, most of the major car and transmission manufacturers introduce 5-speed automatic transmissions successfully.

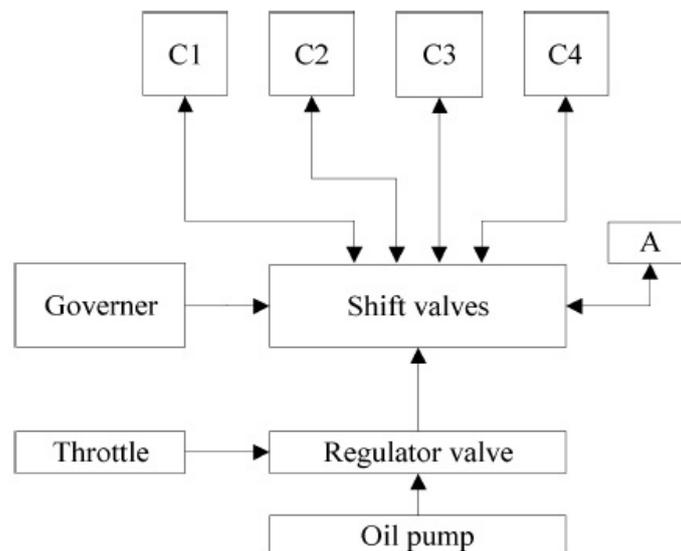
Until late 1970s, the automatic transmissions had adopted hydro-mechanical control systems for automatic gear shifting. From 1980s, the electro-hydraulic control systems of automatic transmissions have been greatly advanced to realize smooth gear shifting and improve fuel economy. Along with it, the solenoid valves as electro-hydraulic actuators have been rapidly developed which have high pressure and large flow capacity with small size and low cost. In these days, users require the better shift feeling and new functions like manual shift. To meet these needs, it is not an expensive solution to use more electro-hydraulic actuators and sensors.

This paper introduces the new scheme of a full electronic control system, direct active shift control (DASC), using proportional control solenoid valves (PCSVs). It can control the pressure of each friction element independently without any passive hydraulic and mechanical component such as second stage spool valves, accumulators, or one way clutches (OWCs), so that it is appropriate to the clutch-to-clutch shift with minimum friction members. At first, it will review the structures of widely used control systems from the old-fashioned to the modern. Next, the concept of the DASC will be introduced and the performance of the actuator, PCSV,

discussed. Finally, you will see the simple test results of the DASC system compared with those of a commercially announced system recently developed.

## II. REVIEWS OF CONTROL SYSTEM

### 2.1 Hydro-Mechanical Control System



**Fig (1) Hydro Mechanical Control System**

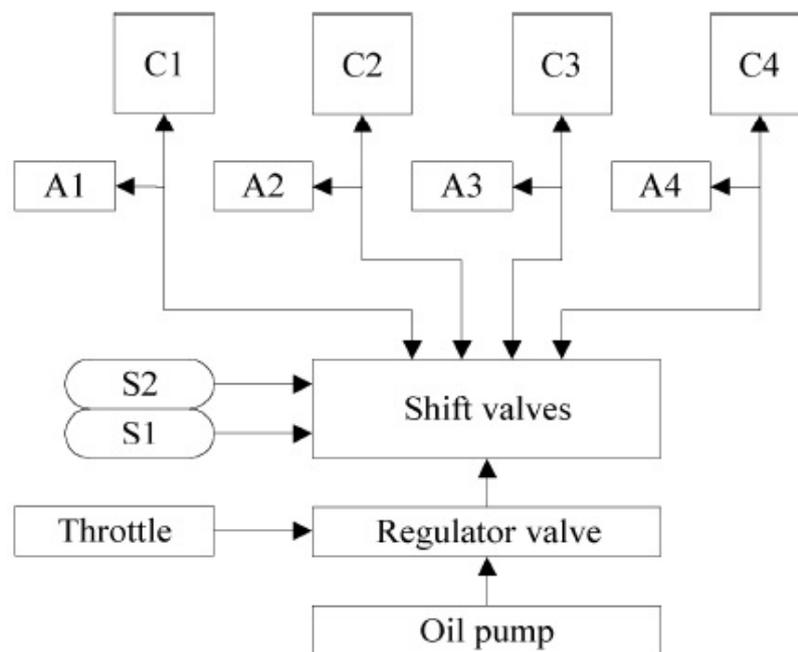
Figure (1) shows the schematic diagram for the hydro mechanical control system of an early automatic transmission. The throttle valve mechanically linked to the accelerator pedal determines the system pressure appropriate to the output torque of an engine. The governor on the output shaft of the transmission moves the shift valves to apply and release the clutches to change gear appropriately. To avoid the shock during shift, accumulate or makes some delay of the pressure rising and falling. It has been generally used until 1970s in most of the automatic transmissions.[1][2][3]

### 2.2 Electro-Hydraulic Control System

In early 1980s, electronic control units (ECUs) were introduced and rapidly spread over the automotive industries. It replaced the hydro-mechanical components with the electro-hydraulic ones only for a few years. This trend made the actuators and the sensors cheaper and cheaper, and changed the system architecture from the passive to the active with the more advanced actuators and sensors.

#### 2.2.1 Positive Shift Control

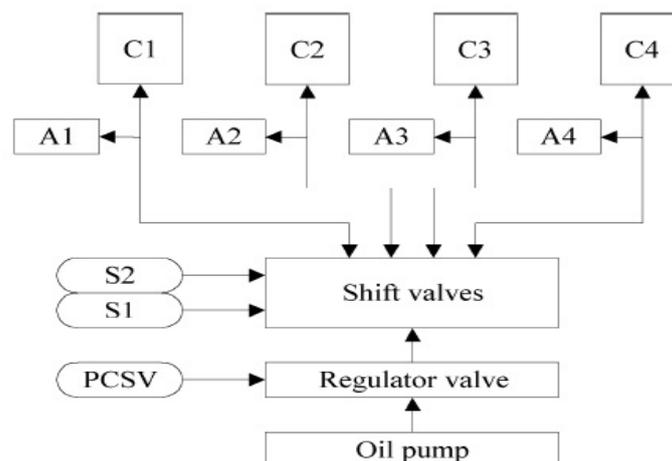
In early 1980s, the first electro-hydraulic control systems were introduced.[4][5] The on-off type solenoid valves replaced the function of the governor like figure (2). To determine the shift timing, the ECU should detect the angular velocity of the output shaft. Additionally, accumulators were applied to each friction elements to achieve optimal shift feeling. We can call this scheme passive shift control because the ECU has only a function of shift timing control.



**Fig (2) Electro-Hydraulic Control System passive Shift Control**

### 2.2.2 Semi Active Shift Control

From mid-80s, more electronic control functions had been applied to the automatic transmissions. An electronically controlled solenoid valve substituted for the mechanical link to the accelerator pedal. The ECU read the information such as the throttle opening and the vehicle speed from the various sensors, and determined the shift timing and controlled the pressure of friction elements to get a better shift feeling.



**Fig (3) Electro-Hydraulic Control System semi Active Shift Control**

So many variations of this system have been widely used until now from 3-speed to 5-speed. [6][7][8][9][10] In some of them, the back pressure of the accumulators are controlled by the system pressure according to the engine torque, but the shifting performance is mainly dependent on the characteristics of accumulators and orifices yet and the pressure cannot be controlled actively by the ECU. So that, we call the system semi-active. Figure 3 depicts the system schematic.

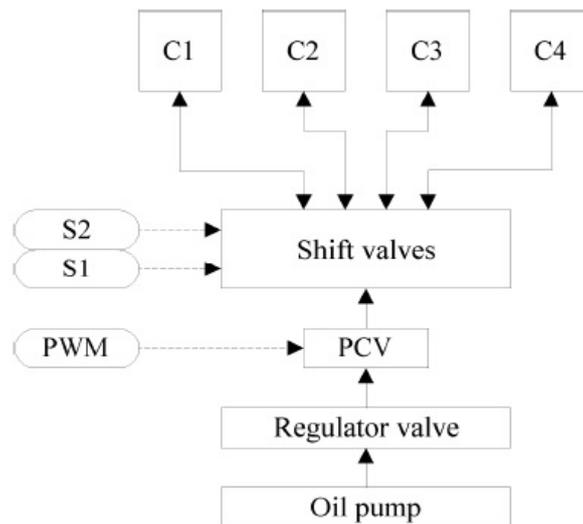
### 2.2.3 Active Shift Control

In figure 4, the active shift control scheme is illustrated.[11]The on-off solenoid valves carry out the shift timing control same as the case of the semi-active, but a pulse width modulation (PWM) solenoid valve or a PCSV controls the pressure of the friction elements. In most cases, because the solenoid valve outputs only limited pressure and flow rate, the second stage spool, pressure control valve (PCV), should be used.

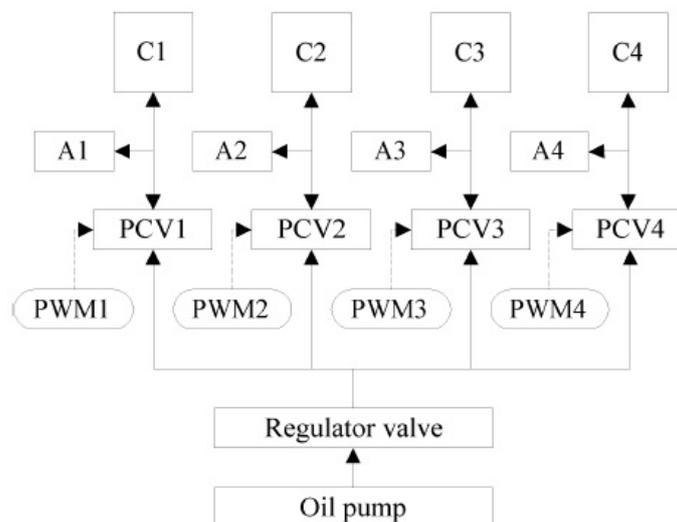
This is the mostly advanced scheme in the electro-hydraulic control systems. However, the changing gears in automatic transmissions needs to control at least 2 friction elements simultaneously. Because there is only one active actuator, one element has to be controlled by passive hydraulic parts, or an OWC involved for the smooth shifting.

### 2.3 Full Electronic Control System

Gott[12] used the terminology, full electronic control, in his book at the first time. In the viewpoint of hydraulic systems in automatic transmissions, the meaning of full electronic control is that each friction element can be controlled by the ECU independently. In 1990s, along with the advanced technologies of the electronic control and sensors and actuators, it is possible to realize this concept with low cost and high reliability.



**Fig (4) Electro-Hydraulic Control System – Active Shift Control**

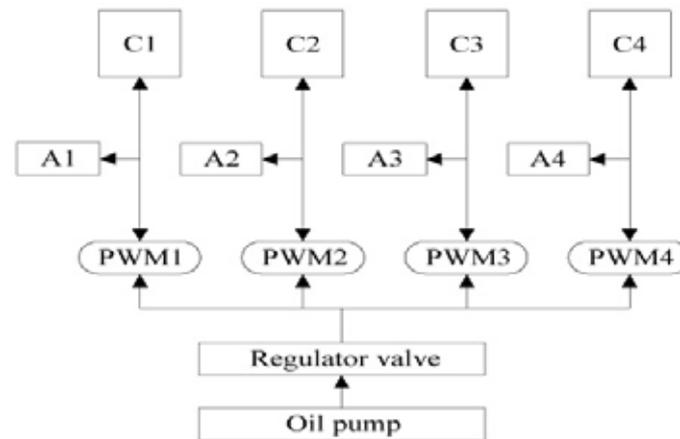


**Fig (5) Full Electronic Control System – Indirect Semi Active Shift Control**

### 2.3.1 Indirect Semi-Active Shift Control

The active electro-hydraulic control system which consists of a solenoid valve and a second stage spool valve can be expanded for each friction element. This system, shown in figure (5), offers the maximum degree of freedom to control the automatic transmission. Some of the manufacturers introduced it in 1990s.[13][14]

This system is good for the clutch-to-clutch shift combined with modern intelligent control algorithms such as model based robust control. [15] However, the control system of each friction elements consists of many devices, and as a result it is hard to design the system to satisfy the performance goal. In addition, there are so many pressure control valves and accumulators in the hydraulic system, so that the cost is high and the size is large. It may be not a good solution for 5 or more multi-speed automatic transmissions.



**Fig (6) Full Electronic Control System – Direct Semi Active Shift Control**

### 2.3.2 Direct Semi-Active Shift Control

Figure 6 shows the mostly advanced scheme until now, direct semi-active control. It is along the lines of the indirect concept with more improved actuators. It has a simple circuit, but needs the great performance of the actuators. The first commercial products with this concept were released in early 1990. [16][17]

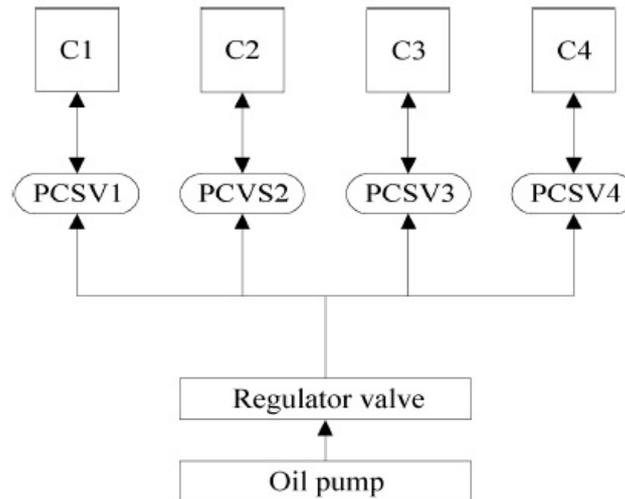
They adopted specially designed high capacity PWM solenoid valves as actuators. However, to reduce the pressure ripples, accumulators were used in each. Additionally, because PWM solenoid valves basically control the flow rate without any pressure compensation, it is hard to control the system pressure to optimize the fuel economy without additional sensors. [18]

## III. DIRECT ACTIVE SHIFT CONTROL

### 3.1 Concepts

As mentioned in introductions, it is the main subject of this study to introduce the full electronic control system for automatic transmissions with proportional control solenoid valves.[19] Figure 7 depicts the new concept, DASC scheme. For each friction element, only a PCSV is used, that is single stage control system. It has some advantages as followings:-

- The modern control theories can be applied to the full electronic control system with the high degree of freedom
- Simple structure without the second stage spools and accumulators reduces the weight, size, and cost of the hydraulic system.
- Minimum number of parts can guarantee the stable quality control in the mass production



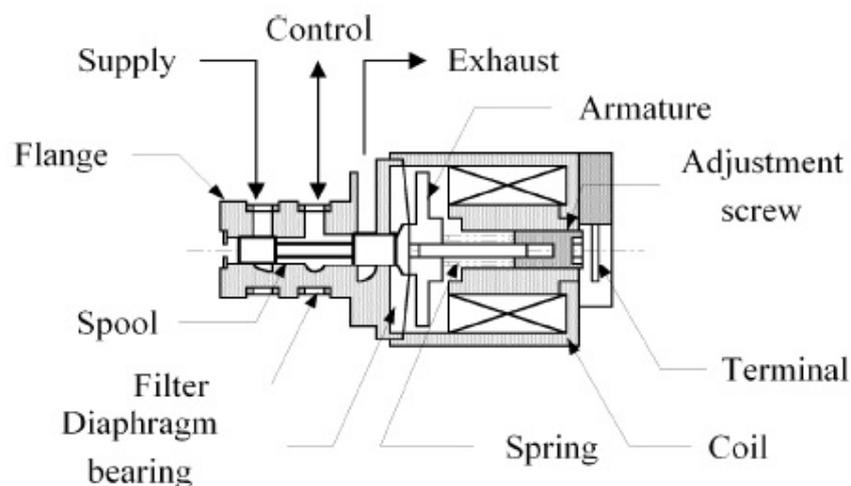
**Fig (7) Full Electronic Control System – Direct Active Control Scheme**

### 3.2 Type of Actuator

As seen in the previous section, most of the automatic transmissions adopt several electronically controlled solenoid valves to control the pressure. Two types of them are widely used, the PWM types and the PCSVs. We choose the PCSV because of the following advantages.

- The PCSV can accurately control the pressure proportional to the input current regardless of the supplying pressure variation.
- The PCSV is robust for the environmental disturbances such as oil temperature change.
- The PCSV has little pressure ripple and operating noise. Of course, there are some disadvantages.
- More complex electrical hardware is required to drive to feedback the current through the PCSV
- The PCSV has more complex structure, so that it is weak for contaminated oil
- The cost of PCSV is higher than that of the PWM solenoid valve yet

However, hardware of the ECUs and filtration technologies are being greatly improved, and the cost of erased parts can cancel the increased cost. Therefore, it is sure that this system is the competitive solution in the near future.



**Fig (8) Structure of the Proportional Control Solenoid Valve**

### 3.3 Performance of Actuator

Figure (8) shows the structure of the PCSV used in this Study.[20] Some characteristics of the PCSV are following.-

- Normally open type solenoid valve : Inverse characteristic between current vs. pressure
- Spool type PCSV : Solenoid valve combined with 3- way reducing type spool valve.
- Closed loop system : Internal feedback by the difference between pressurized areas of spool lands to the output pressure

Authors have studied the dynamic characteristics of the solenoid valve in past few years, and figure (9) shows the results of the PCSV. [21][22][23]

## VI. EXPERIMENTS

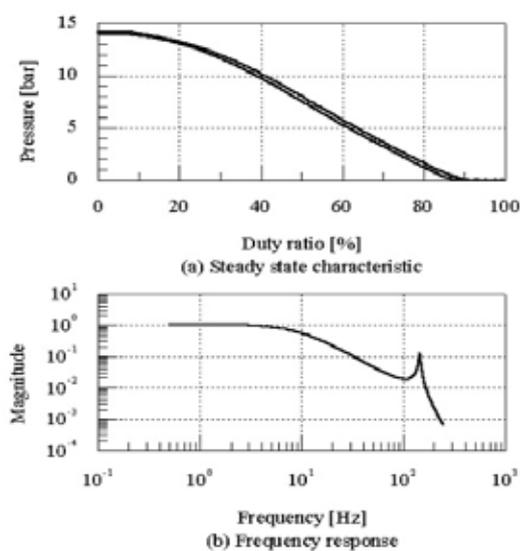


Fig (9) Characteristics of PCSV

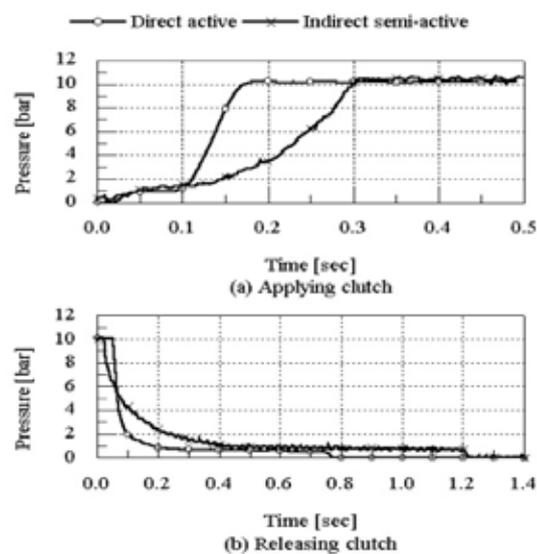


Fig (10) Comparison of Step Responses

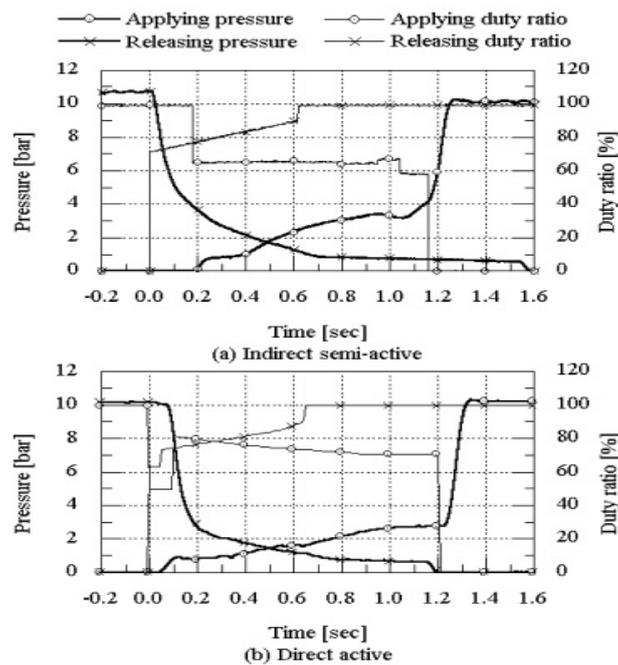
### 4.1 Comparison of Step Response

To evaluate the DASC system, we chose the available indirect semi-active system that has the clutch-to-clutch shift mechanism. Without any modification of the power train, only the hydraulic systems were switched and the step responses of these systems were compared. The results are shown in figure (10).

The response of the DASC system is faster than that of indirect semi-active system both in applying and releasing. In the semi-active system, the accumulators limit the system response. That is, the accumulators not only reduce the pressure ripple but also decrease the system bandwidth. The initial delay of the DASC may be caused by the electrical circuit to feedback current, and should be improved to achieve the better initial response.[24]

### 4.2 Open Loop Pressure Control

To compare the system performance totally in the automatic transmission, 1-2 up-shift was performed in the same condition. At first, pressure profiles of the semi-active system during the up-shift were measured under certain condition. Then, we tuned the parameters of the DASC system and tested it under the same condition. The command duty ratio and the pressure profiles are like figure (11).



**Fig (11) Comparison of Upshift**

Even though more complex profiles of command duty ratio is required, it is sure that the DASC system works very well. However, the time lag is quite big in the applying pressure so that the total shift time is slightly longer than the semiactive system. It may be caused by the small flow rate capacity of the PCSV. As a result, it is necessary to improve the flow capacity of the PCSV for better performance of the DASC system

## V. CONCLUSIONS

Followings are some conclusions of this study:-

- This paper reviewed the shift control schemes from the early hydro-mechanical system to modern full electronic control system. It was certain that the future system needs the simple structure and more degree of freedom.
- The new concept, DASC scheme of full electronic control system using PCSVs was proposed. It is competitive than any others in the functionality and the reliability with the equal or less cost.
- From the experimental results, we can conclude that the DASC system has a reasonable performance but the initial time delay caused by the electrical circuit and the small flow capacity of the PCSV should be improved to increase the overall response.

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# STUDY ON A FLAT PLATE SOLAR COLLECTOR: APPLICATION, PERFORMANCE & EFFICIENCY AT DIFFERENT FLOW RATES

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## ABSTRACT

Solar energy is become an alternative for the limited fossil fuel resources. One of the simplest and most direct applications of this energy is the conversion of solar radiation into heat, which can be used in water heating systems. A commonly used solar collector is the flat-plate. Flat Plate Collector (FPC) is widely used for domestic hot-water, space heating/drying and for applications requiring fluid temperature less than 100oC. Three main components associated with FPC namely, absorber plate, top covers and heating pipes. The absorber plate is selective coated to have high absorptive. It receive heat by solar radiation and by conduction. Low emissivity coatings can significantly reduce radioactive heat losses of glass panes for solar energy use. Their effectiveness is strongly dependent on their optical properties, which need to meet the requirements for the specific application. The paper analyses the performance of newly developed. Two flat plate solar collectors for solar heating plants from Arson Solver A/S are tested in a laboratory test facility for solar collectors at Technical University of Denmark (DTU). The collectors are designed in the same way. However, one collector is equipped with an ETFE foil between the absorber and the cover glass and the other is without ETFE foil. The efficiencies for the collectors are tested at different flow rates. On the basis of the measured efficiencies, the efficiencies for the collectors as functions of flow rate are obtained. The calculated efficiencies are in good agreement with the measured efficiencies

**Keywords:** *Flat Plate Collector, Efficiency of Collector, Solar Water Heating, Solar Energy.*

## I. INTRODUCTION

### 1.1 Solar Collectors

Solar collectors are the major component of active solar-heating system. They collect and store the sun's energy, transform its radiation into heat, and then transfer that heat to a fluid (usually water or air). The solar thermal energy can be used in solar water-heating systems, solar pool heaters.[1] Solar energy is the most essential and economical of all energy forms. Renewable sources of energy from sun are fairly non-polluting and considered clean. Solar energy as the green and environmental friendly energy has produced energy for billions of years. Solar energy that reaches the earth is around 4x10<sup>15</sup> MW and it is 200 times as large as the global utilization. [2] There are a large number of solar collector designs that have are functional.

These designs are classified in two general types of solar collectors:-

- 1) **Flat-plate collectors** – The absorbing surface is approximately as large as the overall collector area that intercepts the sun's rays.
- 2) **Concentrating collectors** – Large areas of mirrors or lenses focus the sunlight onto a smaller absorber.[3]

## 1.2 Heat Collectors

Solar collectors are either non-concentrating or concentrating. In the non-concentrating type, the collector area (i.e., the area that intercepts the solar radiation) is the same as the absorber area (i.e., the area absorbing the radiation). In these types the whole solar panel absorbs light. Concentrating collectors have a bigger interceptor than absorber. Flat-plate and evacuated-tube solar collectors are used to collect heat for space heating, domestic hot water or cooling with an absorption .[4]

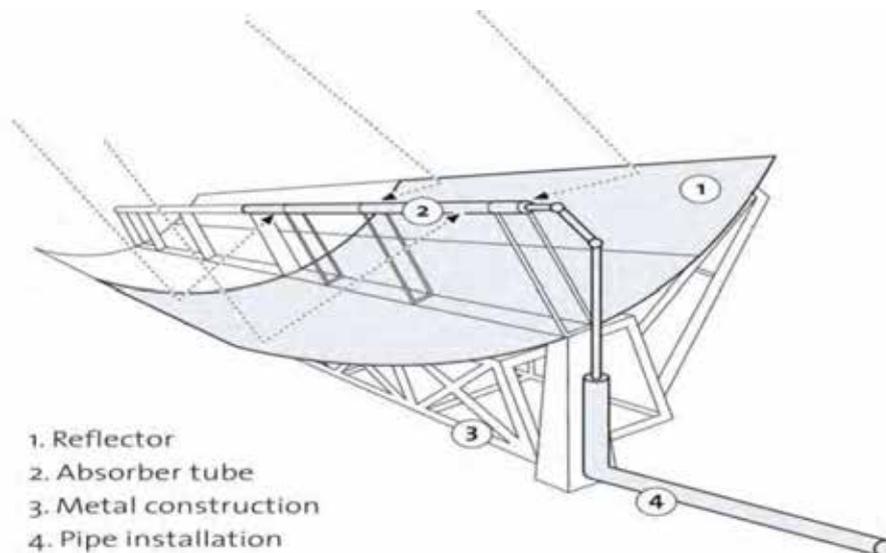


Figure 1.: Schematic of a Concentrating Solar Collector[5]

## II. FLAT PLATE COLLECTOR

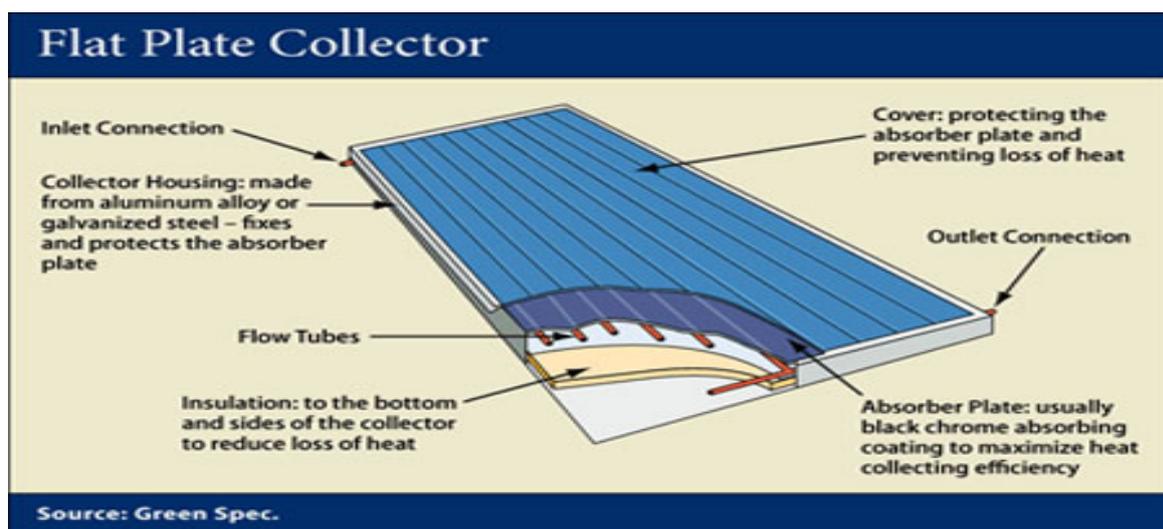


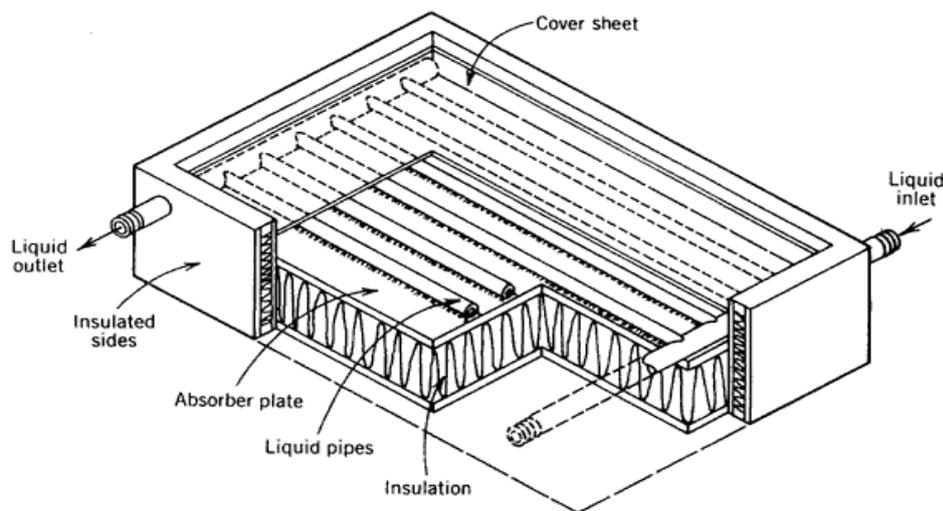
Fig2. Flat Plate Thermal System For Water Heating Deployed on a Flat Roof.

A typical flat-plate collector made up of an absorber which is in an insulated box together with transparent cover sheets (Glazing). The absorber is usually made up of a metal sheet of high thermal conductivity such as copper or aluminium, with integrated or attached tubes. Its surface is coated with a special selective material to maximize radiant energy absorption while minimizing radiant energy emission. The insulated box reduces heat losses from the back and sides of the collector. These collectors are used to heat a liquid or air to temperatures less than 680°C.[6] Flat plate collectors: in which absorbing surface is approximately as large as the overall collector are that intercepts the sun's rays. Concentrating collectors in which large areas of mirrors or lenses focus the Sun light onto a smaller absorber.[7]

Flat-plate collectors consist of

- (1) a dark flat-plate absorber,
- (2) a transparent cover that reduces heat losses,
- (3) a heat-transport fluid (air, antifreeze or water) to remove heat from the absorber, and
- (4) a heat insulating backing.[8]

Flat-plate collectors are in wide use for domestic household hot-water heating and for space heating, where the demand temperature is low. Many excellent models of flat-plate collectors are available commercially to the solar designer.[9] Solar flat plate collectors are used for water heating applications and the efficiency of these systems are around 70% which is very high as compared to solar direct energy conversion systems having efficiency around 17% [10].



**Figure 3: Cross-Section of a Typical Liquid Flat Plate Collector [11]**

### III. APPLICATION IN FLAT PLATE COLLECTOR

Based on the optical characteristics of the newly developed low-e glass its potential for the use in solar thermal flat plate collectors is investigated by means of calculation of the efficiency and the annual yield. The theoretical calculations are supported by experimental results for exemplary constructions. The basic data of the glass used for the comparative study are listed the selected values of solar transmittance and emissivity for the coated panes correspond to the optimum range, which is accessible by variation of the coating structure and the manufacturing parameters, according to the current state of development.

#### IV. PERFORMANCE

The performance of the solar thermal flat plate collector depends on the amount of solar insulations absorbed by the plate. The emissivity of the selective coated plate is Usually around 0.1 and that of glass cover lies between 0.85 - 0.88.[13] The major heat loss in the collector is from the top through the glass cover compared to bottom and side losses. The top loss coefficient from the collector is evaluated by considering both convection and radiation from the absorber plate to ambient. the collector efficiency under different conditions such as the absence of cover, with single and double glazing under different ambient conditions, tilt angles, wind speeds, emissivity of both glass cover and absorber plate.[14]

##### 4.1 Collector concept

The aim of our research project is to develop a new high efficiency flat plate collector up to a prototype status. The general concept of this collector, as shown in Figure 1, is the combination of a standard flat plate collector and a low-e1 double-glazing. As these two components are standard industrial products, the fabrication of this collector can be highly automated, which provides benefits for the expected production costs.[15]

##### 4.2 Design parameters and collector performance

We built a prototype collector with an indium tin oxide (ITO) low-e coating applied in the argon-filled glazing. The lower glass pane with a low iron content and coated on one side with the ITO coating system provides a solar transmittance ( $\lambda = 300 - 2500$  nm) of 86.5 %. If an additional antireflective coating on the opposite side of the glass pane is applied, the solar transmittance is increased to 89 %. The low-e coating reduces the thermal emissivity from 83 % (uncoated glass) to 30 %. The gap sizes between the absorber and the glass panes are dimensioned to minimize convective heat losses depending on the used gas filling according to previous theoretical and experimental investigations [15].

##### 4.3 Reliability of the collector

The significantly reduced heat losses through the insulated transparent cover lead to increased stagnation temperatures compared to a basic flat plate collector. Temperatures up to 264 °C were measured on the absorber plate at standard conditions ( $G = 1000$  W/m<sup>2</sup>,  $T_{amb} = 30$  °C). Standard single glazed collectors with antireflective coated glass can reach a maximum temperature of only 210 °C. The collector components have to withstand the increased temperature loads. Investigations with different solar absorbers, varying the materials (copper, aluminum) and the piping geometry (harp, serpentine), were performed, with focus on the thermo-mechanical loads and esulting deformation at high temperatures. For details on these investigations, we refer to Ref. [16]

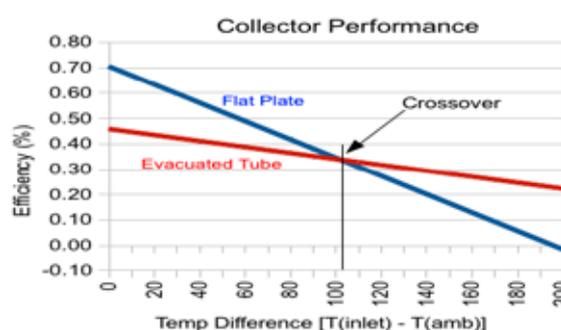


Fig.4:- Graph Between Efficiency & Temp Diff Of Collector Performance

## V. EFFICIENCY

### 1. Theoretical Efficiencies of Flat Plate Solar Collectors

Based on the measured data of total solar irradiance, diffuse solar irradiance, volume flow rate of collector fluid, ambient temperature, mean temperature of collector fluid, wind speed as well as the geometric and physical parameters of the flat plate solar collectors, the efficiencies are calculated with SOLEFF. The measured and calculated efficiency points for the collector without ETFE foil and for the collector with ETFE foil under the same conditions

### 2. Efficiency of a Flat Plate Solar Collector as a Function of Flow Rates

As seen above there is a good agreement between measurements and calculations. Therefore the efficiencies both for the collector without ETFE foil and the collector with ETFE foil as a function of the volume flow rate and the reduced temperature difference  $T^*_m$  can be developed with SOLEFF. Assuming a 40% concentration of propylene glycol/water mixture, 1000 W/m<sup>2</sup> of total solar irradiance, ambient temperature of 20 °C, wind speed of 2 m/s and a diffuse irradiance of 110 W/m<sup>2</sup>, mean temperature of collector fluid lower than 100 °C and a volume flow rate between 5 l/min and 25 l/min,

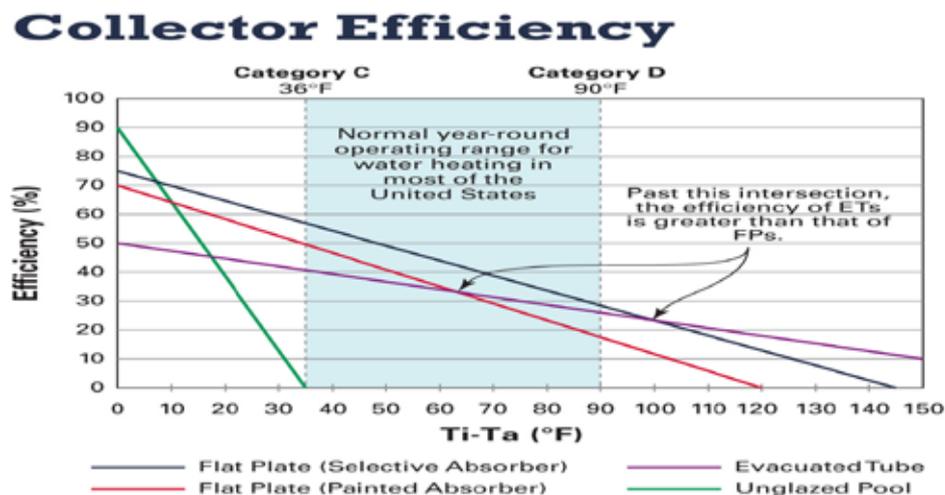


Fig.5:- Graphical Representation of Collector Efficiency

## VI. CONCLUSION

Theoretical and experimental analysis is performed on a flat plate collector with a single glass cover. It can be concluded that the emissivity of the absorber plate has a significant impact on the top loss coefficient and consequently on the efficiency of the Flat plate collector. The efficiency of FPC is found to increase with increasing ambient temperature. Using the solar fuel with in solar collector application have enormous potential in the future and is under global focus to attain clean and green energy. A detailed mathematical derivation for the flat-plate solar collector cross sections (cover, air gap, absorber, working fluid, and insulation) was presented. A way to describe the thermal performance of a Flat Plate Solar collector has been shown. The most important measure is the collector efficiency. A more precise and detailed analysis should include the fact, that the overall heat loss coefficient

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# STUDY ON SOLAR WATER HEATER AND ITS SYSTEM PERFORMANCE

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## ABSTRACT

*Solar energy is one of the renewable energy which it is the simplest and is easy to use. Solar water heater use the solar energy from the sun to generate heat (not electricity) which can then be used to heat water for showering, space heating, industrial processes or even solar cooking. Solar energy is the primary energy source for our planet as it is responsible for providing energy for planet growth (photosynthesis) and providing the warmth that makes our planet habitable. Solar water heater device has been around for even 100 years. A solar water heater is one of the most effective ways of cutting a household's carbon footprint by reducing reliance on dirty fossil fuel usage. Solar power system has been applied to heat water for night time activity in rural areas. The system will provide hot water availability out the day. The solar water heater used for supplying hot water during the day. Solar water heater is a solar collector box, insulation material, and absorber plate.*

**Keywords:** Solar Water Heater, History, Performance of Solar Water Heater

## I. INTRODUCTION

Solar water heating device that mimic those used in residences to capture energy in the form of solar radiation and convert it to thermal energy. This thermal energy is next transfer to water (to be used as domestic hot water) in the form of heat. In doing this student gain a better understanding of the three different types of heat transfer. The advantage of the radiation provided by our sun. Converting it to thermal energy to generate electricity, heat water and cook food [1]. Solar water heating is the conversion of sunlight into renewable energy for water heating using a solar thermal collector. Solar water heating system comprise various technologies that are used worldwide increasingly solar water heater system are designed to hot water for most of the year [2]. Power storage is a very common problem in our country and most of our work gets interrupted due to sudden power cut and voltage fluctuation. Solar power is one of the alternatives to the electricity.[3] Solar power is clean green electricity that is created from sun light, or heat from the sun. Solar energy is sustained and totally inexhaustible, unless fossil fuel that are finite. It is also non-polluting source of energy and it does not emit any greenhouse gases when producing electricity. The one of the popular device that harnesses the solar energy is solar hot water system. Water heating typically represents a high percentage of energy consumption in homes and business; in some cases 30% dramatically reduce energy bills without any environmental impact. [4]

## II. HISTORY

There are records of solar collectors in the United States dating back to before 1900 comprising a black-painted tank mounted on a roof. In 1896 Clarence Kemp of Baltimore, USA enclosed a tank in a wooden box, thus creating the first 'batch water heater' as they are known today. Although flat-plate collectors for solar water heating were used in Florida and Southern California in the 1920s there was a surge of interest in solar heating in North America after 1960[5] The earliest solar hot water collectors, dating back to the nineteenth century, were tanks filled with water and painted black. The downside was that even on clear, hot days it usually took from morning to early afternoon for the water to get hot. And as soon as the sun went down, the tanks rapidly lost their heat because they had no protection from the night air in 1909, William J. Bailey patented a solar water heater that revolutionized the business. He separated the solar water heater into two parts: a heating element exposed to the sun and an insulated storage unit tucked away in the house so families could have sun heated water day and night. The heating element consisted of pipes attached to a black-painted metal sheet placed in a glass-covered box. Because the water to be heated passed through narrow pipes rather than sat in a large tank, Bailey reduced the volume of water exposed to the sun at any single moment and therefore, the water heated up faster. Providing hotter water for longer periods put Bailey's solar hot water heater, called the Day and Night, at a great advantage over the competition [6]

## III. NEED FOR STUDY

solar water heater system is an effective water heating system without electricity. This study is especially designed to know that factor influence the customer to the purchase of solar water heater and their level of satisfaction. This study helps to know the problem faced by the customer while using solar The water heater. The study helps to understand how far the customers are satisfied with solar water heater.[7]

## IV. SYSTEM PERFORMANCE

Solar water heaters through the combination of two part a storage tank and a collector. The storage tank is a well insulated container that stores the circulating water. Solar collector which is usually located on a rooftop. The collector consist of either a long coiled copper pipe through which water flows or a series of parallel pipe across which water flows (perpendicularly). Radiation energy from the sum is absorbed with the collector, travels through the pipe via conduction. After the water has passed through the collector and absorbed heat. It returns to the storage tank an increase the temperature of the remaining water via convection. This process repeat until the water in the tank is sufficient hot so that it may be used as domestic hot water (for showers and baths) [3] System uses a commercial collector and a storage tank in a drain-down configuration. The collector is single-glazed with a selective surface copper absorber. The system contributed 40% of a hot water load. The net solar efficiency was 27% and the collector efficiency was about 28%. The high collector efficiency was partly due to the large hot water demand (the family includes five young children). The average preheat temperature was only 86°F (300C), which kept the collector temperature low and improved the efficiency. The average hot water output temperature was relatively low at 120 op (49°C), partly because the gas-fired water heater could not always keep up with the water use. Had the output temperature been 140°F (60°C), as in the other systems, the solar fraction would have been only 30%. This system performed remarkably well despite a serious control flaw. Due to an improperly placed sensor or a faulty controller, the collector pump cycled on and off an average of 49

times per day, draining the collector each time. [8] The solar collector performance model is mainly analogous to the one embodied in program sun, except that it represents only one physical component. Therefore, the program COLTEST, in which it is embodied, carries a single computational module. That computational module contains the same interfaces with environment and other components as the solar collector. In collector performance is determined by the intensity and angular performance of solar radiation, by ambient temperature and by the tempera-true of fluid entering it from storage or a conversion by the device. Energy output from the collector is described by the rate of heat extraction from it and the temperature at which that heat is removed [9] Solar water heater can also provide financial saving by reducing energy costs. After your water heater is properly installed and maintained. Try some additional energy-saving strategies to help lower your water heating bills especially if you require a back-up system. Some energy saving device and system are more cost effective to install with the water [10]

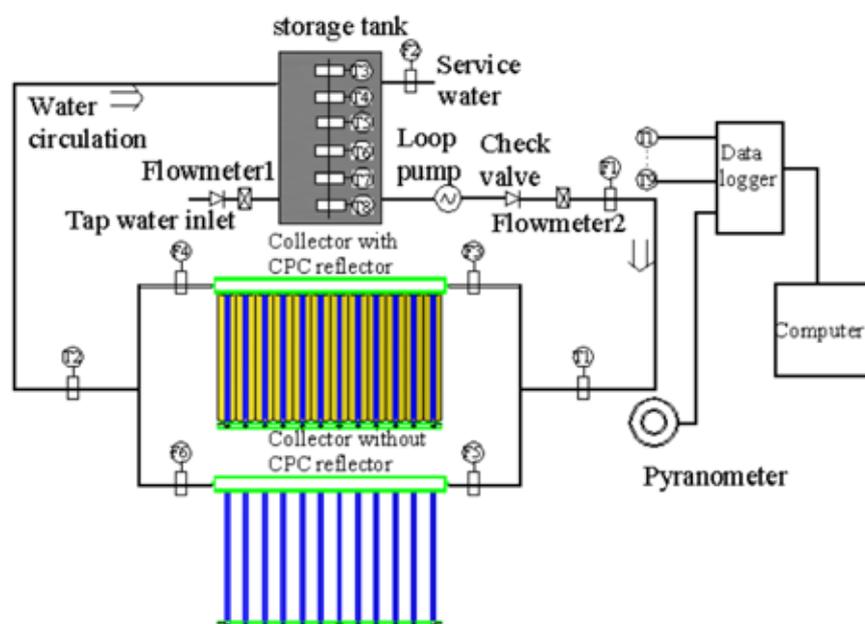


Fig 1:-Solar Water Heater System [11]

## V. SYSTEM SPECIFICATION AND INSTALLATION

- Except in rare instances it will be insufficient to install a SWH system with no electrical or gas or other fuel .Many SWH systems have a back-up electric heating element in the integrated tank, the operation of which may be necessary on cloudy days to ensure a reliable supply of hot water.
- The temperature stability of a system is dependent on the ratio of the volume of warm water used per day as a fraction of the size of the water reservoir/tank that stores the hot water.
- The installation of a SWH system needs to be complemented with efficient insulation of all the water pipes connecting the collector and the water storage tank, as well as the storage tank (or "geyser") and the most important warm water outlets. The installation of efficient lagging significantly reduces the heat loss from the hot water system.
- To eliminate the risk of hot water in the storage tank from being cooled that way this is very important. Solar controller may be required.

- The modularity of an evacuated tube collector array allows the adjustment of the collector size by removing some tubes or their heat pipes. Budgeting for a larger than required array of tubes therefore allows for the customization of collector size to the needs of a particular application, especially in warmer climates.
- Particularly in locations further towards the poles than 45 degrees from the equator, roof mounted sun facing collectors tend to outperform wall mounted collectors in terms of total energy output. However, it is total **useful** energy output which usually matters most to consumers. So arrays of sunny wall mounted steep collectors can sometimes produce more useful energy because there can be a small increase in winter gain at the expense of a large unused summer surplus[12]

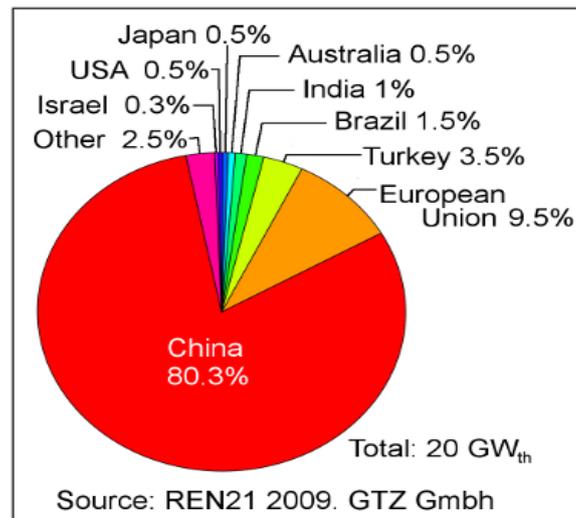


Fig.2 : Solar Water Heater Installation During 2007 worldwide [13]

## VI. CONCLUSION

In modern marketing customer is the king. Customer satisfaction is incredibly important for growing a sustainable business. Now it is a customer world the manufacturing give their product which suits the wants and needs of the customer. The present research was concentrated on the customer satisfaction about solar water heaters from this study it can be concluded that solar water heaters stands best because of its no electricity changes and environmental safety. Further there is some kind of promotional activities required to hold the present customer and make new customer. In India offer 100% deprecation claim in the first year itself on installation of commercial solar water heating.

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# STUDY ON ENERGY PERFORMANCE OF SOLAR GREENHOUSE

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## ABSTRACT

Solar energy is radiant energy that is produced by the sun. every day the sun radiates, or sends out, an enormous amount of energy. The sun radiates more energy in one second than people have used since time. Solar radiation is one of the most important energy resources of our planet. Solar greenhouses are the enclosures where crops, vegetables or flowers are provided proper environment under adverse climatic conditions for plant growth and production. Solar energy is in the first rank of renewable energies. In cold countries winter greenhouse is used where solar isolation is low is use. In tropical countries ambient temperature is quite high so summer greenhouses can be designed for reducing the inside temperature and the plants receive sufficient of sunlight required for photosynthesis, solar power plant is the best way to find the optimum of its performances. The most important factor affecting plant growth is solar radiation, and the most crucial solar radiation-requiring process governing plant growth is photosynthesis. Therefore, the characteristics of the greenhouse cladding materials, which can affect the level and quality of the transmitted radiation, are of primary concern for greenhouse cultivation. Solar radiation is an energy resource that will remain available until the end of time. In this paper described that the greenhouse systems have a great potential to improve quality of living and energy performance of the buildings. However, it is now important to adopt a valid evaluation method to assess the project efficiency.

**Keyword: Greenhouse, History of Greenhouse, Types of Greenhouse, Greenhouse Gases, Principal and Design of Greenhouse.**

## I. INTRODUCTION

Green house provide crop cultivation under controlled environment. A green house is a structure covered with transparent material that utilizes solar radiation to grow plants a may have heating, cooling and ventilation equipments for temperature control. [1] Greenhouse is also able to store heat during the winter season reducing the energy demand of the building. [2] They may be covered with glass and glass substitute when covered with plastic films, they are called plastic greenhouses, when covered with glass fibre reinforced plastic panels, they are called fibre glass greenhouse. [1] the most important factor affecting plant growth is solar radiation and the most crucial solar radiation-requiring process governing plant growth in greenhouse cultivations is photosynthesis. Therefore, the characteristics of the greenhouse cladding materials, which can affect the level and quality of the transmitted radiation, are of primary concern for greenhouse cultivation. [3] Solar radiation is a green energy source and inexhaustible. Capture solar energy also provides an energy source that is environmentally friendly. Solar power costs nothing to produce: it replaces the energy they buy, since it reduces energy costs. [4] It is possible to take advantage of solar energy through the improvement and promotion of photovoltaic systems by optimizing performance and efficient operation in all vital sectors such as public, mainly in agriculture and in enhancing the

energy independence of greenhouses as strategic self sufficiency in housing and in all areas to wider public use. [5] The composting greenhouse is an integral part of our market gardening effort, suiting commercial use better than the other (solely solar-heated) greenhouses at New Alchemy, with better soil heating, light, CO<sub>2</sub> levels and air circulation. Many of the solar-heated greenhouses that have been built in the last ten or fifteen years function quite well at keeping the air warm, but their typically high capital cost and low light levels limit their commercial potential. [6]

## II.HISTORY OF GREEN HOUSE

The idea of growing plants in environmentally controlled areas has existed since Roman times. The Roman emperor Tiberius ate a cucumber-like.[7] vegetable daily. The Roman gardeners used artificial methods (similar to the greenhouse system) of growing to have it available for his table every day of the year. Cucumbers were planted in wheeled carts which were put in the sun daily, and then taken inside to keep them warm at night. The cucumbers were stored under frames or in cucumber houses glazed with either oiled cloth known as specularia or with sheets of selenite (a.k.a. lapis specularis), according to the description by Pliny the Elder. [8] The concept of greenhouses also appeared in Netherlands and then England in the 17th century, along with the plants. Some of these early attempts required enormous amounts of work to close up at night or to winterize. There were serious problems with providing adequate and balanced heat in these early greenhouses. Today, the Netherlands has many of the largest greenhouses in the world, some of them so vast that they are able to produce millions of vegetables every year.[9] Active' greenhouses, in which it is possible for the temperature to be increased or decreased manually, appeared much later, Sanga yorok written in the year 1450 AD in Korea, contained descriptions of a greenhouse, which was designed to regulate the temperature and humidity requirements of plants and crops. One of the earliest records of the Annals of the Joseon Dynasty in 1438 confirms growing mandarin trees in a Korean traditional greenhouse during the winter and installing a heating system of Ondol. [10]

## III.TYPES OF GREEN HOUSE

Some broad classifications of greenhouses includes following:

- **Attached greenhouses**, which may be joined onto almost any suitable building structure.
- **Porch type greenhouse**, which may be designed as the entrance to a house, factory or office.
- **Free standing greenhouse**, which may be suited on any convenient porch or piece of waste water.
- **Pit type greenhouse**, which are usually employed on differing level or sloping land scrapes, and for the purpose of heat retention.
- **Cold frame type of greenhouse**, which are simply hot beds or plant facing frame equipped with a sloping roof. [1]

## IV.GREENHOUSE GASES

The three most powerful long lived greenhouse gases in the atmosphere are carbon dioxide, methane, and nitrous oxide. In addition we will consider the class of compounds known as halogenated organic compounds (of which CFCs are a subset), SF<sub>6</sub>, and ozone in the lower and upper atmosphere. [11]

#### 4.1. Carbon Dioxide (CO<sub>2</sub>)

Discussion of the human impact on the levels of carbon dioxide (CO<sub>2</sub>) in the atmosphere is complicated by two factors. First, emissions of CO<sub>2</sub> associated with human activities, while large on a human scale, are small when compared to natural fluxes of CO<sub>2</sub> associated with photosynthesis, respiration, uptake into ocean water, and release from ocean water. Second, there are several large reservoirs of CO<sub>2</sub> (e.g. atmosphere, upper ocean, deep ocean, biosphere) which are continually exchanging CO<sub>2</sub>. [12]

#### 4.2 Methane (CH<sub>4</sub>)

Methane (CH<sub>4</sub>) is the most abundant well mixed greenhouse gas after carbon dioxide. In contrast to carbon dioxide, methane is removed from the atmosphere via chemical reaction with hydroxyl (OH) radicals. Methane plays an important role in atmospheric chemistry and it can influence the levels of other important trace species via its reaction with OH. [13].

#### 4.3 Nitrous Oxide (N<sub>2</sub>O)

Nitrous oxide (N<sub>2</sub>O) is the third most abundant well mixed greenhouse gas after carbon dioxide and methane. Natural sources of N<sub>2</sub>O associated with emission from soils and the oceans are estimated to deliver the atmosphere. Anthropogenic emissions of N<sub>2</sub>O are associated with biomass burning, fossil fuel combustion, industrial production of acidic and nitric acids, and the use of nitrogen fertilizer. Photo dissociation in the stratosphere is the major (90%) loss mechanism for N<sub>2</sub>O in the atmosphere. [14]

#### 4.4 Halogenated Organic Compounds

Halogenated organic compounds are organic compounds containing one or more halogen atoms. Halogenated organic compounds can be fully substituted where all of the hydrogen in the molecule has been replaced by halogen atoms, or partially substituted where some hydrogen's remain. Chlorofluorocarbons (CFCs) and per fluorocarbons (PFCs) are two subsets of halogenated organic compounds in which all hydrogen atoms have been substituted by fluorine and chlorine atoms, or solely by fluorine atoms. [15]

#### 4.5 Sulfur Hexafluoride (SF<sub>6</sub>)

On a per molecule basis, sulfur hexafluoride (SF<sub>6</sub>) is one of the most potent greenhouse gases known. Its potency stems from its intense absorption at 10.3 μm (969 cm<sup>-1</sup>) in the atmosphere and its extremely long atmospheric lifetime of 3200 years. SF<sub>6</sub> is present in small amounts in fluorites and degassing from these minerals provides a small natural source. SF<sub>6</sub> is a useful industrial chemical used as an insulating gas in electrical switching equipment. As a result of anthropogenic emissions the current level of SF<sub>6</sub> in the atmosphere is approximately 400 times that of the natural background. Very recently a new SF<sub>6</sub>-like greenhouse gas was detected in the atmosphere: SF<sub>5</sub>CF<sub>3</sub>. The concentration of SF<sub>5</sub>CF<sub>3</sub> is very low and this compound does not play any significant role in global warming it is of interest because on a per molecule basis it is the most potent greenhouse gas yet identified in the atmosphere. [16]

#### 4.6 Ozone (O<sub>3</sub>)

Prior to discussing the relationship between ozone and global climate change it is useful to provide a brief background on the atmospheric chemistry of ozone. In contrast to all other greenhouse gases, ozone is not emitted into the atmosphere. Ozone is generated *in-situ* in the atmosphere from two processes: (i) photolysis of molecular oxygen (O<sub>2</sub>) which gives oxygen atoms (O) which then add to molecular oxygen to give ozone (O<sub>3</sub>) and (ii) oxidation of organic compounds (from natural and man-made sources) in the presence of nitrogen oxides (NO<sub>x</sub>). [17]

### V. BASIC PRINCIPLES OF SOLAR GREENHOUSE DESIGN

Solar greenhouses differ from conventional greenhouses in the following four ways:-

- Have glazing oriented to receive maximum solar heat during the winter.
- Use heat storing materials to retain solar heat.
- Have large amounts of insulation where there is little or no direct sunlight.
- Use glazing material and glazing installation methods that minimize heat loss.
- Rely primarily on natural ventilation for summer cooling.

Understanding these basic principles of solar greenhouse design will assist you in designing, constructing, and maintaining an energy-efficient structure. You can also use these concepts to help you search for additional information, either on the "Web," within journals, or in books at bookstores and libraries. . [18]

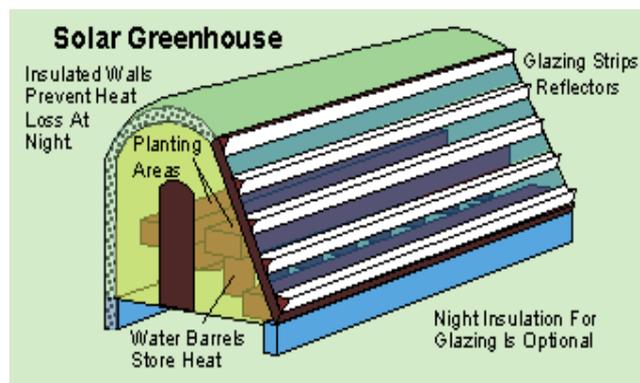


**Figure 1. Experimental greenhouse for testing cladding materials**

#### 5.1 Solar Greenhouse Designs

Attached solar greenhouses are lean-to structures that form a room jutting out from a house or barn. These structures provide space for transplants, herbs, or limited quantities of food plants. These structures typically have a passive solar design. Freestanding solar greenhouses are large enough for the commercial production of ornamentals, vegetables, or herbs. There are two primary designs for freestanding solar greenhouses: the shed type and the hoop house. A shed-type solar greenhouse is oriented to have its long axis running from east to west. The south-facing wall is glazed to collect the optimum amount of solar energy, while the north-facing wall is well-insulated to prevent heat loss. This orientation is in contrast to that of a conventional greenhouse, which has its roof running north-south to allow for uniform light distribution on all sides of the plants. To reduce the effects of poor light distribution in an east-west oriented greenhouse, the north wall is covered or painted with reflective material. Unlike the shed-type solar greenhouses, these do not have an insulated north side. Polarization of these structures involves practices that enhance the absorption and distribution of the solar heat

entering them. This typically involves the collection of solar heat in the soil beneath the floor, in a process called earth thermal storage (ETS), as well as in other storage materials such as water or rocks. [19]



**Figure 2. Solar Greenhouse**

## V. CONCLUSIONS

Throughout history, mankind has benefited from and worked to harness the sun's energy in order to create a more enjoyable living space and save energy. Solar energy has been used for centuries and has only improved with time, as researchers and scientists have developed processes and materials to improve the quality and effectiveness of solar energy. Solar greenhouses are designed not only to collect solar energy during sunny days but also to store heat for use at night or during periods when it is cloudy. They can either stand alone or be attached to houses or barns. A solar greenhouse may be an underground pit, a shed-type structure, or a hoop house. Large-scale producers use free-standing solar greenhouses, while attached structures are primarily used by home-scale growers. In our country, greenhouses are common in the Mediterranean region and where there is geothermal energy. The total greenhouse area in our country is more than 40,000 hectares. The most important factor affecting plant growth is solar radiation, and the most crucial solar radiation-requiring process governing plant growth in greenhouse cultivations is photosynthesis. Solar greenhouses commonly rely on large volumes of water or rock mass for passive storage of daytime solar gains to provide thermal stability. On the contrary, passive solar systems use materials that absorb heat, and therefore the floor is warmer and more comfortable.

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# SECURE TRUSTWORTHY SERVICE EVALUATION IN SOCIAL NETWORKS

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## ABSTRACT

*Large scale systems face security threads from faulty or hostile remote computing elements. Portable devices and call it MobID. The extent to which MobID reduces the number of interactions with sybil attackers. One approach preventing Sybil attacks without logical central authority. Sybil Guard identifies sybils that which every person exchanges keys with a limited number of well-known trusted friends. To develop trustworthy mechanism to detect Sybil nodes. Proposed trust authority that means discover intermediate nodes between sender and receiver that detects sybils using mobile -social networks.*

**Keywords:** *Mobile social networks, Trust authority, Sybil attack, Distributed system.*

## I INTRODUCTION

In service-oriented computing (SOC) [Singh and Huhns 2005] [1]environments, computing resources are modeled as services, which can be used directly or composed into other services We argue that it is practically impossible in a distributed computing environment, with no logical central authority to vouch for one-to-one correspondence between entity and identity. Many systems [2] replicate computational or storage task among several sites.

### 1.1 Literature Survey

One promising way to defend against sybil attacks in social networks is to leverage the social network topologies. Sybil Gurad suffers from high false negatives, as each attack edge may introduce  $O(\sqrt{n \log n})$  sybil nodes without being detected. SybilInfer [9], a centralized sybil defense algorithm, leverages a Bayesian inference approach that assigns a Sybil probability, indicating the degree of certainty, to each node in the network. sybil community detection algorithm can effectively detect the sybil community around a sybil node with short running time. Milanovic and Malek [2004] [10]compare various modern web service composition approaches. For example, suppose service A invokes service B, which may invoke E and F with probabilities denote PE and PFabout remote entities .it call identities. Local entity select subset of identities to perform remote operation. We term the forging of multiple identities a Sybil attack on system. Researchers have recently proposed general infrastructures with which portable devices in proximity of each other opportunistically trade various services within a scalable and decentralized way [3], [4], [5].The problem is that collaborative applications are easily disrupted by uncooperative and malicious individuals. creating very large number of bogus identities. In literature, those individuals are called sybil attackers or simply sybils [6].

This problem by making three main contributions:

- The key idea is that each device manages two small nodes in which it enlists the devices it meets: honest nodes and Sybil nodes
- MobID guarantees the honest nodes that reject bogus identities and accept honest identities. It provides

trust aware service selection approach. Trust is a key basis interaction between services.

## II PROPOSED SYSTEM

### 2.1 Trust Authority

Review submission may need co operations from other users when the vendor is not in the transmission range of the user, or when direct submission fails due to communication failure. The location client message passing among nodes that identify where is source and destination. The vendor spontaneously initializes a number of tokens and issues them to one per user. . A user cannot submit a review unless it currently holds one of the tokens. A token may be lost due to malicious users. each token is linked to a pseudonym[20] that belongs to a user who most recently submitted a review using the token. Trust authority node between sender and receiver. That prevent the packet loss. Sender send the all the information to trust authority node then trust authority node passing the information to destination.

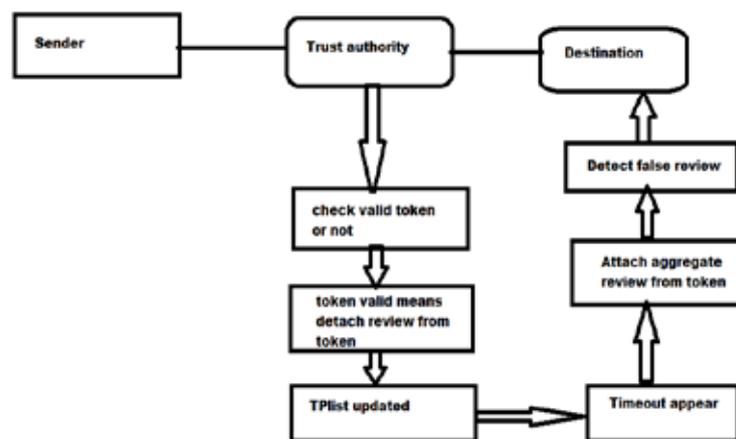


Fig.1 Overview of trust authority

## III. IMPLEMENTATION MODELS AND ALGORITHMS

### 3.1 Bayesian Approach

A Bayesian network [16] denote atomic and composite services with lowercase and uppercase, respectively. An edge from service a to B means B is composed of a. we use the Bayesian network terminology in this paper. A conditional probability associated with each node represents trust (a probability) of the node variable given an estimate of its parent's trustworthiness. use trust aware service selection model represent trust based on the beta probability distribution [Evans et al. 2000][17],which can be integrated with Wang and Singh's model. we can estimate the trustworthiness of service xi by applying maximum likelihood estimation (MLE) to maximize the likelihood of the observations [Buntine 1994][18].In this Bayesian network terminology a is B's parent then A's, B's child. This terminology opposite composite hierarchy. In this case we can use expectation maximization(EM) Algorithm.The maximizing likelihood function using the distribution parameters  $\pi$  and  $\theta$ . Estimation using EM Algorithm.

$$P(D)=\sum \pi_j p_j(D|\theta_j)$$

Where  $D=\{j_1, j_2, \dots, j_N\}$  are the observations.  $P_j$  is the  $j$ th component distribution with parameter  $\pi_j$  and  $p_j$ .

### 3.2 The Design of Ta

In my project TA means trust authority that is intermediate node concept between sender and destination. The review consists of two parts. One is content of review and another one is proving signature authenticity. There are two Sybil attacks can appear that produce inaccurate information. Propose intermediate node of trust authority to generate one review in predefined timeslot. In the review submission process that link ability reviews can be linked to real identities.

### 3.3 Finite Mixture Model

Finite mixture model can be formulated as. where  $D = \{x_1, \dots, x_N\}$  are the observations,  $p_k$  is the  $k$ th component distribution. MobID ensures that sybil attackers are detected with high probability.

### 3.4 System Model

We use graph  $G$  that means consider edges and vertices. There are two sets "sybil set" and "honest set". The simplest way is using the  $k$  means clustering algorithm[19]. This algorithm generates  $k$  clusters and determines which circles belong to which cluster circles belong to which cluster depending on the structure of the data. The circles are denoted by centroid. Top of the centroid is consider as honest set. Bottom of the centroid is denoted as Sybil set.

### 3.5 Security Model

The S-MSN is vulnerable to various security threats due to lack of centralized control. That is central trusted authorities in the network. The user can manipulate the malicious nodes. The aggregation technique [20] is used to reduce the signature size of different user from different social groups. By this technique token size can be reduced. In this method communication cost can be reduced.

### 3.6 Generation of Keys

A user  $u_i$  if the registering to a group Authority  $\chi_i$ . Each and every time bunch of pseudonym secret keys[21] can be received to the corresponding ids. It produce the secret keys which that token is valid or not. TP list can accept valid tokens. Each review is a value ranged in  $[0, 1]$ . A review is negative if its value is lower than 0.5. To produce the trust authority mechanism prevent packet or information loss.

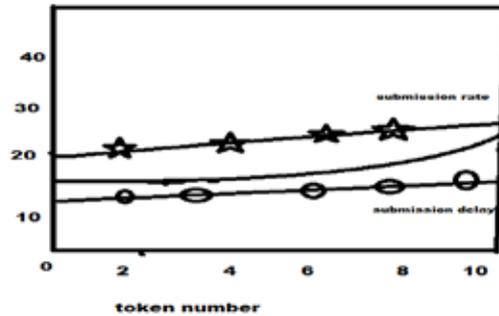
## IV. DETECTION OF SYBIL ATTACK

There are two sybil attacks appear in our project, Sybil attack1 and Sybil attack2. This aggregate signature technique is in srTSE. Using intermediate node concept that preventing sybil attack. A user having a review to submit transmits a token request message that particular time then receiving request. Tokens can be exchanged between sender and destination. The requesting user accepts the first arrived valid token and replies with an ACK message. The vendor maintains a token-pseudonym list. In this list, each token is linked to a pseudonym that belongs to a user who most recently submitted a review using the token.

## V. RESULTS AND DISCUSSION

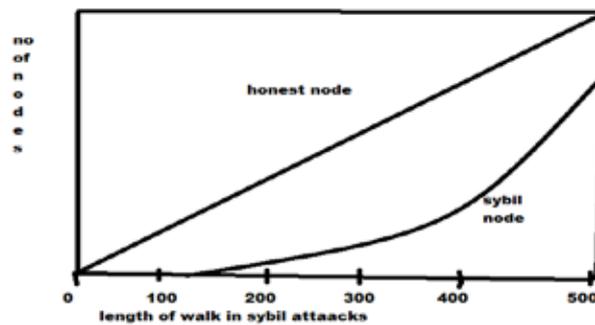
In the social network graph consists of vertices  $V$  and Edges  $E$ . There are two region one is Sybil region and another one is honest region. Sybil region consists of Sybil nodes, honest region consists of honest nodes. The user can generate false reviews. The aggregate signature technique that reduce the token size and cost. It will receive a bunch of pseudonym secret keys that produce corresponding ids. The token pseudonym list that check corresponding id that produce secret keys that produce corresponding ids. The token pseudonym list that check

corresponding id that produce secret keys. The token recording the history and the vendor will detect review missing. The trusted node declares the Sybil node and non Sybil nodes in the network. Pseudonyms that produce corresponding ids. The token pseudonym list that check corresponding id that produce secret keys. The token recording the history and the vendor will detect review missing. The trusted node declares the Sybil node and non Sybil nodes in the network.

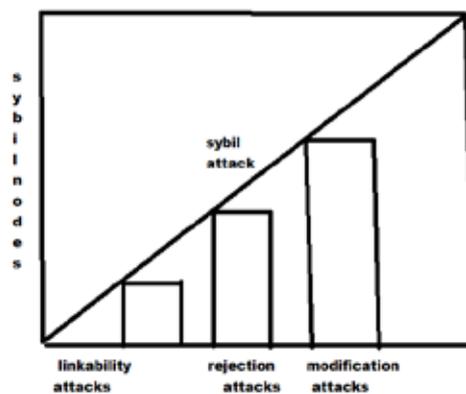


**Fig.2 performance evaluation of TA**

Rate of relationship named to the face book application. In my project using activity network. Activity network this network contains nodes and edges but it have limit no of attack edges. In the ER model build topologies that interaction between the nodes and edges. The Sybil region connect to the real world of social network. Fig.2 each and every token have the token Number that display that submission rate and Submission delay. Fig.3 display the Sybil node and honest node Fig.4 display the attacks



**Fig.3 Performance of attacks**



**Fig.4 Evaluation of attacks**

## VI. CONCLUSION

In this project we explored Trust Authority of intermediate node between source and destination in mobile social networks. Main focus of this project is implementing intermediate node concept. For this we use trust authority and evaluated using in different scenarios. This project also explains how to achieve the trustworthiness of service .To prevent the loss of information

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# ENERGY EFFICIENT ROUTING TECHNIQUE IN WIRELESS SENSOR NETWORK

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## ABSTRACT

*Energy conservation in Wireless Sensor Network(WSN) has always been the most crucial issue, for the sensor nodes are all powered by limited capacity battery sources which are difficult, if not impossible, to replace or recharge due to the inherent nature and types of applications WSN is used for. Therefore, energy efficient design of WSN has drawn considerable attention from many researchers resulting in quite a good number of approaches for saving the precious and limited energy of the sensor nodes. In this paper, a comprehensive list of these EER protocols have been studied having classified them into proper categories. The relative advantages and disadvantages of the protocols are also discussed while the protocols are evaluated based on certain performance metrics at the end of the paper.*

**Keywords:** *Wireless Sensor Network, Energy Conservation Routing, EER*

## I. INTRODUCTION

A Wireless Sensor Network (WSN) consists of a collection of some sensing stuffs usually called sensors which observes an event or gathers some physical data from its area of interest, processes the observed or gathered data by a tiny processor embedded in it and sends processed data via a short range radio transmitter to a central data collector usually called sink either directly or through intermediate sensor nodes. All these activities in a sensor node are carried out by limited energy battery sources which drain out in course of time as these activities are carried out. Therefore, energy conservation has always been a vital factor and a major challenge in the design of WSN. Although WSN is a class of ad hoc network, routing techniques for WSN widely differ from that of the traditional ad hoc networks mainly for its energy constrained nature. WSN routing approaches are compelled to find out routes that ultimately result in prolonged network life time, rather than focusing on routes with shortest distance, minimum delay or maximum bandwidth. Therefore, considerable research has been conducted on routing data in WSN where the main focus has been on reducing energy consumption giving rise to a new class of routing called Energy Efficient Routing (EER). And hence the dominant EER protocols for WSN are explored with proper classification. And a comparative study of the EER protocols is also carried out.

## II. RELATED WORK

S. Kaur, D. Prashar[7] and R.Rani, "Improvement in energy efficiency of Wireless Sensor Network", have proposed Improvement in energy efficiency of Wireless Sensor Network. In this scheme WSN the energy efficiency is the greatest topic for the research purpose. Clustering in the wireless sensor network is very important to increase the lifetime of the network. There are several numbers of protocol which is based on it but here the LEACH protocol is described.

A Hybrid Relative Distance[8] H. Gao, H. Li and Y. Cheng proposed “A Hybrid Relative Distance Based Cluster Scheme for Energy Efficiency in Wireless Sensor Networks e Based Cluster Scheme for Energy Efficiency in Wireless Sensor Networks. In this scheme energy efficiency is of great importance for wireless sensor network. A popular way for saving the energy of the node is construct the cluster of the networks for data collecting and transmitting. This paper studies the distributed cluster algorithm to improve the energy efficiency

Doohan, N.V [9] Mishra, D.K. Sanjiv Tokekar, “Shortest Path Routing Protocol (SPRP) for Highly Data Centric Wireless Sensor Networks”. studied on Data Centric protocols .where In data-centric routing , base station (BS) sends queries to certain area and waits for the data values from sensors located in that selected area.

[10] C. Intanagonwiwat, R. Govindan, and D. Estrin, "Directed diusion a scalable and robust communication paradigm for sensor networks," C. Intanagonwiwat et. al. proposed a popular data aggregation paradigm for WSNs, called directed diffusion. Directed diffusion is a data-centric (DC) and application-aware paradigm in the sense that all data generated by sensor nodes is named by attribute-value pairs. The main idea of the DC paradigm is to combine the data coming from diffusion sources (in-network aggregation) by eliminating redundancy, minimizing the number of transmissions; thus saving network energy and prolonging its lifetime

### III. ENERGY EFFICIENT ROUTING TECHNIQUE IN WSN

The main goal of any Energy Efficient Routing (EER) protocol for WSN is to maximize network lifetime by minimizing energy consumption in end-to-end transmission. The EER protocols for WSN are categorized in this paper as follows:

- Data Relaying Protocols
- Data Centric Protocols
- Hierarchical or Clustering-based Protocols
- Location-based or Geographical Protocols

#### 3.1 Data Relaying Protocols

Data relaying protocols are very simple in nature and easy to implement as they don't require any routing table nor do they require maintaining topology information about the network. Gossiping ,Flossiping, and LGossiping are some popular protocols of this family.

##### 3.1.1 Gossiping

A Gossiping [3] was proposed as an improvement over the straight forward flooding mechanism with a view to overcoming the implosion problem with flooding. Implosion is a phenomenon where a node broadcasts a packet to all of its neighbors which in turn continue with broadcasting the packet creating multiple copies of the same packet in the network. On the other hand, Gossiping doesn't broadcast a packet to all the neighbors, rather only to a single one chosen randomly which in turn forward the packet randomly to one of its neighbors including the one from which it received the packet. This process continues until the ultimate destination is reached. Gossiping reduces energy consumption over flooding to a great extent, but it heavily suffers from long propagation delay.

##### 3.1.2 Flossiping

Y. Zhang and L. Cheng proposed Flossiping [4] which is a balance between flooding and Gossiping. When a node has a packet to send, it decides a threshold value and then forwards the packet in Gossiping mode by saving the threshold in the packet header. Receiving the packet, a neighbor node generates a random number and chooses flooding if the random number is smaller than the threshold, otherwise; Gossiping is used.

### 3.1.3 LGossiping

LGossiping [5] proposed by S. Kheiri et. al. requires the nodes to have their location information available through GPS. Actually, it improves over Gossiping by choosing a known neighbor that is closer to the source based on GPS location information. Thus, it reduces the long latency problem of Gossiping, but introduces some extra cost for GPS device per node.

### 3.2 Data Centric Protocols

In data centric routing [9], all nodes have equal and same functions. Global identification to each sensor node is very difficult to assign in wireless sensor networks because the deployment of sensor network is very dynamic and dense. In data-centric routing base station (BS) sends queries to certain area and waits for the data values from sensors located in that selected area. To specify the properties of data, an attribute-based naming scheme is used to provide facilities in data-centric characteristics of sensor queries.

#### 3.2.1 Spin

Sensor Protocols for Information via Negotiation) Adaptive Protocols for Information Dissemination in Wireless Sensor Networks (SPIN) overcame the limitations of Implosion, Overlapping, and Resource Blindness of the traditional data flooding protocols by negotiating meta-data among the nodes before transmitting real data. Whenever a node has some new data to share, it sends an ADV message to its neighbors who then place a request to get the new data if they haven't already availed it via a REQ message in response to the ADV message. Eventually, the originator of the ADV message sends the real data to all REQ message issuers via DATA message to complete the whole process. Figure 1, shows the phases of SPIN. While SPIN achieves a reduction in energy consumption by a factor of 3.5 less than that of flooding, it can't guarantee the delivery of data in case the potential neighbors are far away from the ADV message generator (i.e. source node) and the nodes in between the source and destination are not interested in the new data.

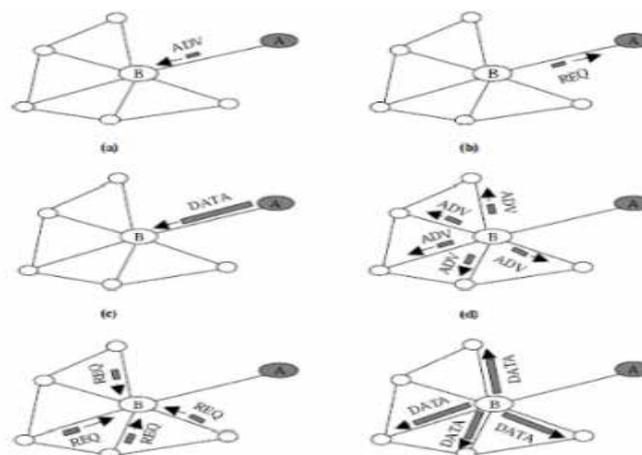


Figure 1. SPIN protocol. (a) Node A starts by advertising its data to node B. (b) Node B responds by sending a request to node A. (c) After receiving the requested data. (d) node B then sends out advertisements to its neighbours, (ef) who in turn send requests back to B.

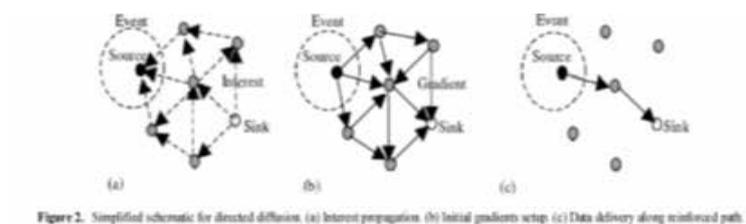
#### 3.2.2 Modified Spin (Mspin)

MSPIN transmits information only to sink node instead of the whole network thereby making the response to the sink faster than SPIN. Here, total number of packet transmissions is less than SPIN. Therefore a significant amount of total energy can be saved. But, MSPIN is not free from the typical drawbacks of SPIN.

### 3.2.3 Directed Diffusion

In [10], C. Intanagonwiwat et. al. proposed a popular data aggregation paradigm for WSNs, called directed diffusion. Directed diffusion is a data-centric (DC) and application-aware paradigm in the sense that all data generated by sensor nodes is named by attribute-value pairs. The main idea of the DC paradigm is to combine the data coming from different sources (in-network aggregation) by eliminating redundancy, minimizing the number of transmissions; thus saving network energy and prolonging its lifetime. Unlike traditional end-to-end routing, DC routing nodes routes from multiple sources to a single destination that allows in-network consolidation of redundant data. In directed diffusion, sensors measure events and create gradients of information in their respective neighborhoods. The base station requests data by broadcasting interests. Interest describes a task required to be done by the network. Interest diffuses through the network hop-by-hop, and is broad-cast by each node to its neighbors. As the interest is propagated throughout the network, gradients are setup to draw data satisfying the query towards the requesting node, i.e., a BS may query for data by disseminating interests and intermediate nodes propagate these interests. Each sensor that receives the interest setup a gradient toward the sensor nodes from which it receives the interest.

This process continues until gradients are setup from the sources back to the BS. More generally, a gradient specifies an attribute value and a direction. The strength of the gradient may be different towards different neighbors resulting in different amounts of information. At this stage, loops are not checked, but are removed at a later stage. Figure 2 shows an example of the working of directed diffusion ((a) sending interests, (b) building gradients, and (c) data dissemination). When interests  $\rightarrow$  gradients, paths of information are formed from multiple paths and then the best paths are reinforced so as to prevent further according to a local rule. In order to reduce communication costs, data is aggregated on the way. The goal is to  $\rightarrow$  and a good aggregation tree which gets the data from source nodes to the BS. The BS periodically refreshes and re-sends the interest when it starts to receive data from the source(s). This is necessary because interests are not reliably transmitted throughout the network.



Directed diffusion differs from SPIN in two aspects. First, directed diffusion issues on demand data queries as the BS send queries to the sensor nodes by some tasks. In SPIN, however, sensors advertise the availability of data allowing interested nodes to query that data. Second, all communication in directed diffusion is neighbor-to-neighbor with each node having the capability of performing data aggregation and caching. Unlike SPIN, there is no need to maintain global network topology in directed diffusion. However, directed diffusion may not be applied to applications (e.g., environmental monitoring) that require continuous data delivery to the BS. This is because the query-driven on demand data model may not help in this regard. Moreover, matching data to queries might require some extra overhead at the sensor nodes.

### 3.3 Hierarchical or Clustering-based Protocols

S.Kaur et al [7] have proposed Improvement in energy efficiency of Wireless Sensor Network. In this scheme WSN the energy efficiency is the greatest topic for the research purpose. Clustering in the wireless sensor network is very important to increase the lifetime of the network .There are several numbers of protocol which

is based on it but here the LEACH protocol is used for clustering. In LEACH each node has to equal probability of select as the cluster head. In each round the cluster head is change because every node has equal probability for selecting as a cluster head. In this paper the focus is on the approach how could the number of cluster head are limited in the network if there are limited number of cluster head in the network than the lifetime of the network is increased and decrease the energy dissipation per node. H.Gao et al [8] have proposed A Hybrid Relative Distance Based Cluster Scheme for Energy Efficiency in Wireless Sensor Networks. In this scheme energy efficiency is of great importance for wireless sensor network.

A popular way for saving the energy of the node is construct the cluster of the networks for data collecting and transmitting. This paper studies the distributed cluster algorithm to improve the energy efficiency. We observe that the cluster head has to lie within the range of transmission of the base station and the distance between the cluster head and sink node for energy consumption. Author have proposed the HRDCS scheme which is based on the distance between CH and BS and the energy consumption at the time of cluster head selection. Guo et al have proposed the Analysis and Optimization of Energy Efficient Cluster Forming for Wireless Sensor Networks. In this scheme Wireless Sensor Network should operate without protection for the long time before the replacement of battery; therefore characteristics such as self-organization and energy efficiency are of at most importance to the WSN. In the WSN we have meet with all these requirement by dividing the WSN network into clusters, where each the cluster managed by a cluster head. In this paper we provide the analysis of energy consumption in a clustered network and gain of energy with different number of nodes in the network. This analysis is generally proposed for minimize the energy consumption at the time of cluster head selection by the less cluster head selection. This provides the lifetime of the network is prolonged and easy to maintain the network.

### **3.4 Location-based or Geographical Protocols**

Location based or geographical protocols rely on the location information of the sensor nodes to find out the most energy efficient path between a source node and the sink or the cluster head. Location information is usually made available to the nodes by the use of GPS devices as it gives very accurate location information but imposes an extra cost per node. Sometimes, some localization algorithms are also used to find out the position of a node which is very cost effective. But this approach suffers from inaccuracy or approximation in estimating the position of a node. Some of the popular and representative geographical routing protocols for WSN include GAF, GEAR and which are discussed below.

#### **3.4.1 Gaf ( Geographic Adaptive Fidelity)**

Geographic Adaptive Fidelity (GAF) proposed by Y. Xu et. al. forms a virtual grid where each node is associated with a point on the virtual grid by exploiting its GPS-indicated position information. GAF tries to reduce energy consumption by switching some nodes to their sleeping states provided that some equivalent nodes are kept active.

#### **3.4.2 Gear (Geographical and Energy Aware Routing)**

(GEAR) complements the Directed Diffusion (DD) protocol by restricting the dissemination of interest messages to only a certain region rather than to the whole network as is the case with DD. This is possible in GEAR since it enables each node to possess the location information and remaining energy level of itself and its neighbors.

#### IV. CONCLUSION AND FUTURE WORK

WSN, by nature, is extremely energy constrained there by forcing the routing protocol designers to go for energy efficient design. Here a comprehensive list of the EER protocols for WSN has been studied. Through this, it is obvious that still there are plenty of issues the EER protocols are left with to address such as QoS, bandwidth utilization, exact but cost effective localization etc. Therefore, it is expected that researchers will of course go for these open areas of research to put things into shape so that the yet-to-be standardized EER protocols could be standardized.

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# AN OVERVIEW: MOBILITY BASED ANCHOR POINT NODE (APN) HYBRID NETWORK

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## ABSTRACT

*Mobile Ad-hoc Networks (MANET) are transient networks of mobile nodes, connected through wireless network different strategic methodologies have been introduced to connect the entire world. To transfer the data or information from one network to another network within a less period time. The TCP network layer play a vital role in information-oriented. In rural territories there is fixed infrastructure of network connection. To provide communication between urban and rural environment we use APN. There are many TCP Variants which will provide a fast and rapid communication and transformation. We use DSR routing protocol for MANET infrastructure. This paper will mainly focus on mobility scenarios to evaluate the throughput, good put and end-to-end delay.*

**Key Words:** *MANET, APN, DSR, TCP Variants*

## I. INTRODUCTION

There has been marvelous growth in the Communication but failed to provide the optimistic solution for remote territories. Wireless networks have controlled this issue with some extend and are greatly deployed in homes; hotspots and offices with 54 Mbps channel capacity but still failed to produce promising result. Wireless LAN is mostly suited for urban territory but having no proper coverage within rural territory [1]. They propose APN hybrid network, which provide solution for disaster areas, Scattered Educational Institution, network of hospitals and Battle situation. APN scheme is smart choice for communication for those rural territories where is no existence of infrastructure based network to communicate within both territories [2]. An extensive investigational study of TCP variants over IP and Multi-protocol Label Switching (MPLS) networks by focusing Tahoe, Reno, New Reno, Sack and Vegas under Constant Bit Rate (CBR) traffic. For analytical results, TCP Reno, New Reno, Sack, Tahoe and Vegas were simulated on single, two, four and eight flows over a limited number of nodes. To analyze their performance based on throughput, average delay, packets sent, received, and lost for CBR traffic [3]. MANET's are formed using mobile node to communicate without any fixed infrastructure (i.e., wireless). These can also be used in the areas where the establishment of fixed infrastructure is very difficult. MANETs can also be used to deploy and coordinate the drones in the battlefield. MANET is having limited bandwidth, battery and computation power. MANET nodes will act as host as well as router because of lack of infrastructure. It is a self-developing and highly dynamic in some special cases like ad-hoc routing protocols [5]. In ad hoc routing protocols there should not be centralized authority. To avoid the wastage of bandwidth and battery power of the nodes the routing protocols should be route loop free. The routing protocols must reactive when they are in need, because to avoid unnecessary wastage of power and bandwidth. Real time traffic flow of data packets form MANET-to-MANET or NETWORK-to-NETWORK must and should have low jitter. While sending the information the security is the main part where information should not

be accessed by unauthenticated or intruder or attackers like Wormhole attack. There are some types of attacks like impersonation or Spoofing, Black-hole Attack, Sink-hole Attack, Sleep Deprivation, Rushing Attack, Location Disclosure, Denial Of Service (DoS) Attack and Flooding [4]. In TCP Variants there is a mobility hybrid network topology by combining the features of wired network with wireless and MANET in order to make reasonable communication even in remote areas. APN Hybrid network and find the strength of different flavors in APN Hybrid network. TCP is most elegant protocol in communicating world and designed for infrastructure network. TCP performs well in our APN Hybrid network.

## II. RELATED WORK

Wafa Elmannai, et al. [6] Proposed simulation based study of TCP variants in Hybrid network, mobility is a major effect on TCP performance. MANET and all TCP Variants support Zone Routing Protocol (ZRP) with integration of random way point mobility model in MANET area. And Round Trip Time (RTT) to analyze the delivery of packets. TCP Vegas has better throughput and minimum end-to-end delay and better in order to delivery of data and improved RTT. In future work of TCP Variants TCP Vegas and westwood are combined that new variant could be better from mobility point of view in MANET and mixed environment.

Norrozila Sulaiman et al. [7] Proposed DSR Routing Protocol which is dependent on the cache memory for every node to store the routing path from source to destination. The New Route of cache structure –the cache of DSR protocol will be divided for two sub-caches: first part called (MASTER ROUTE cache) which saves information about the source node the numbers of hops the status of the route and destination node. The proposed algorithm provides minimum delay and minimum time route discovery for both the master and the index route cache.

Abadul Samad Isma'il et al. [8] Proposed collaborative virtual environment and congestion control algorithm. Study the performance of TCP Vegas versus different TCP variants in homogeneous and heterogeneous wired networks are performed via simulation experiment using network simulator 2 (ns-2). The performance of TCP Vegas outperforms other TCP variants in the homogeneous wired network. However, it achieves unfair throughput in heterogeneous wired network.

Ramarathinam et al. [9] Proposed evaluated the performance of TCP Reno, New Reno, SACK and Tahoe with respect to good put under three routing protocols over static multi-hop network and assumed Reno is to be better but conditions are not clearly mentioned in which, TCP Reno is better. We introduce only single DSR routing protocol with APN hybrid network with inclusion of TCP Vegas and West Wood. Our work covers both urban and rural environments and suited for realistic scenarios and simulated with NS2. In our work, Vegas is good and Tahoe is worse performer.

Stylianios et al. [10] Proposed examined the qualities of TCP Vegas and TCP New Reno with respect to TCP Reno over AODV routing protocol by using different topologies over square and strip simulation areas. Their work indicates that TCP Vegas is better than other variants and they also assume with their results that TCP Reno is worse in all the conditions.

Milan Todorovic et al. [11] Proposed presented test bed simulation and compared the newly proposed protocols, including TCP Probing, TCP Westwood/Westwood+, TCP Freeze, TCP Jersey, TCP Reno and JTCP with already existed protocols namely, TCP Vegas, TCP SACK and TCP New Reno on the bases of three benchmark metrics, which are average congestion window, throughput and completed time.

A.O. Oluwatope et al. [12] Proposed there are many application which are related to internetwork to browse like “WWW-World Wide Web”, ”FTP-File Transfer Protocol” and email to deliver the data or information over the network. TCP is a connection oriented network and it is reliable to service level application layer. The Quality-of-Service in the wired network is less than one percent of packet loss due to error in connections of links. Thus increase in wireless network communication day by day there is an extension of service level futures are getting updated in TCP layer for the efficient usage of wireless infrastructure.

Michelle Berger Servio Lima Alexandros Manoussakis et al. [13] Proposed Collaborative Virtual Environment (CVE) combining the two or more networks to work together with the distributed users. The comparison is made between different TCP Variants to known the throughput n escape time between the data packets sent from one network to other when there is an increase in the number of users and congestion control can be done through the TCP layer.

Abdulsalam Ya`u Gital et al. [16] Proposed One of the strengths of TCP is its high responsiveness toward network congestion. TCP is also a defensive protocol as it detects incident congestion as its result to try and lessen the impacts of the congestion. Thereby prevent collapse of communication. The TCP focuses on reliability, stability, and correctness of data transfer which fits well with requirements of loss sensitive applications such as web browsing and file transfer.

## 2.1 Routing Protocol

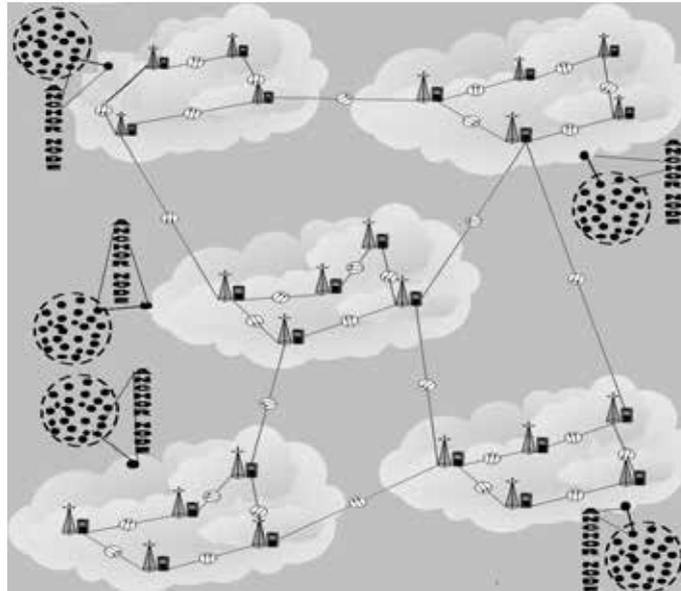
DSR is simple and efficient on-demand routing protocol designed for multiple wireless-ad-hoc networks based on source routing. Our main objective goals are to analyze the TCP Variants in hybrid network by increasing the ratio of mobility in Manet environment. Dynamic Source Routing Protocol (DSR) supports the Manet (Rural environment) to find out the route to destination when a node initiates a packet. Various on demand routing protocols (reactive) are introduced such as AODV, DSR, LAR, ZRP, TORA, PAR, ABR, SSR and FORP [17, 20].

Optimizing Routing Technique based on fuzzy logic concepts. The paths generated by conventional dynamical source routing protocol deviate far from the optimal paths because of the lack of knowledge about the global topology and the mobility of nodes. Routing optimality affects the network performance, especially when the load is high. Longer route consumes more bandwidth, power and is more prone to disconnections. We use TCP Variants with DSR routing protocol in APN hybrid network to analyze the qualitative and quantitative performance in the form of throughput, packet delivery ratio and end-to-end delay for each TCP variants.

## III.METHDOLOGY ARCHITECTURE FOR HYBRID NETWORK

We propose hybrid network by combining the fixed network with Wireless and MANET in order to make possible communication even in remote rural territories. The architecture of hybrid network is based on Anchor point nodes (APN). The nodes, which are not within the range of wired areas, can communicate with wired nodes through APN. APNs can play a role as coordinator node in hybrid network. Each node in MANET that is nearest to wired network but cannot get signal from Foreign Agents/Home Agents would be APN. The APN of MANET has information about the nodes, which are within MANET network. Similarly, the node that is located at the end of each wired network is APN. Both APNs would play a role as coordinators and make possible communication for rest of nodes in fixed and MANET network. The APN of MANET has information about the nodes, which are within MANET network. Similarly, the node that is located at the end of each wired network is

APN. Both APNs would play a role as coordinators and make possible communication for rest of nodes in fixed and MANET network [15].



**Figure 1: Proposed Architecture of Hybrid Network.**

In Figure 1, five networks are jointly connected and each of networks with network cloud represents urban territory. Rest of area, which is out of network clouds, represents the rural tertiary. The nodes, which are in circle, make the MANET network. Each node in circle plays a role as APN and coordinating with node that is at end of cloud from every edge of the network. The node that coordinates with MANET-APN; said to be Infrastructure bases Anchor point node (IBAPN). APN hybrid network is simulated with NS-2 by changing number of mobile nodes and using different mobility Scenarios. The proposed architecture is well suited for urban and rural territories and producing encouraging performance.

### 3.1 Initial Connection Setup and Handoff Process

This section gives overview of initial connection setup and handoff process for MANET Mobile Node (MMN). Figure 2 shows a timing diagram of the signaling involved in initial connection setup and hand off event. An initial connection setup and MMN hand off process can be defined in the following steps.

**Step1:** Nodes, which are available in MANET, intend to communicate with corresponding node (CN) but they do not have initial connection setup. Therefore, MMN sends message to Current MANET Anchor Point Node (CMAPN) as message “Request for connection setup with CN”.

**Step2:** When CMAPN receives the Request for connection setup from MMN, it coordinates with Infrastructure Based Anchor Point Node (IBAPN) and forwards the message “coordination request for connection setup”. Then in response CMAPN sends message back “Reply for connection setup with CN” to (MMN). When MMN gets the message from CMAPN then it will keep on waiting till initial connection is setup.

**Step3:** IBAPN forwards the message “forwarding coordination request for connection setup” to its HA/FA within wired area. When message is delivered at HA/FA then IBAPN sends back message with “Accept coordination request” to CMAPN.

**Step4:** HA/FA forwards message with “forwarding initial connection setup” to (CN) for initial connection setup. When message is forwarded to CN then HA/FA sends response back to IBAPN “Accept forwarding coordination request”. CN establishes connection “accept initial connection setup” with (MMN).

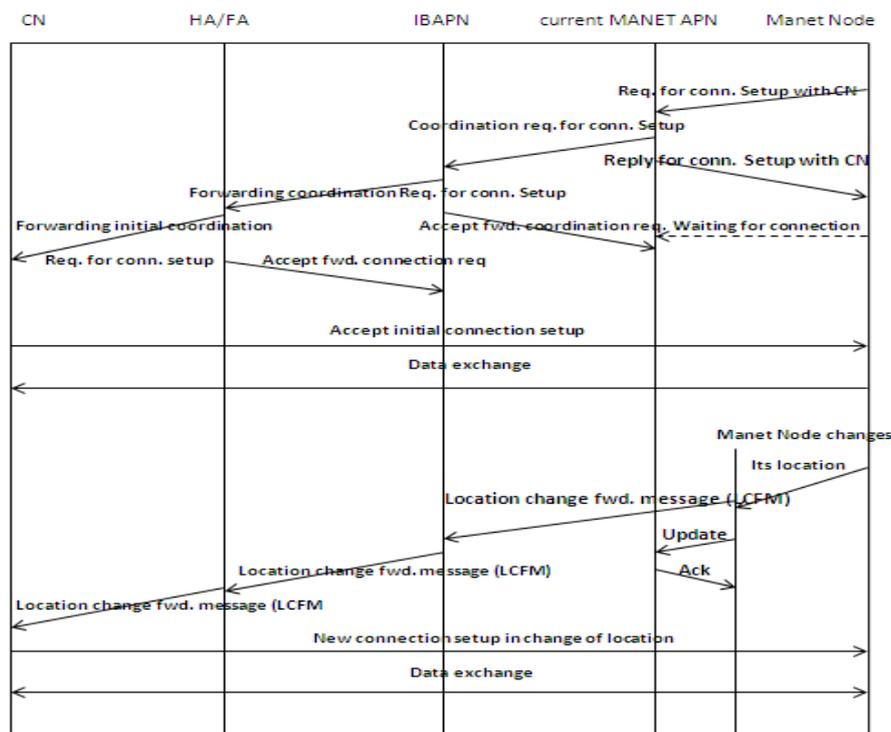
**Step5:** Whenever MMN changes its location and moves to another MANET then it sends the request for handoff to new MANET Anchor point node (NMAPN) with message “request for joining”.

**Step6:** NMAPN sends the message “location change forwarding message” (LCFM) to IBAPN for intimating the handoff process and same message is forwarded from IBAPN to HA/FA and finally message is reached to CN for location update.

**Step7:** When LCFM is forwarded by NMAPN then it sends the message “update” to CMAPN. In response, CMAPN sends acknowledgement (ACK) to NMAPN for location update.

**Step8:** When CN gets the message LCFM then it establishes the connection again with MMN and message is forwarded with “new connection setup in change of location”.

**Step9:** With the establishment of new connection setup between CN and MMN then data exchange process is started.



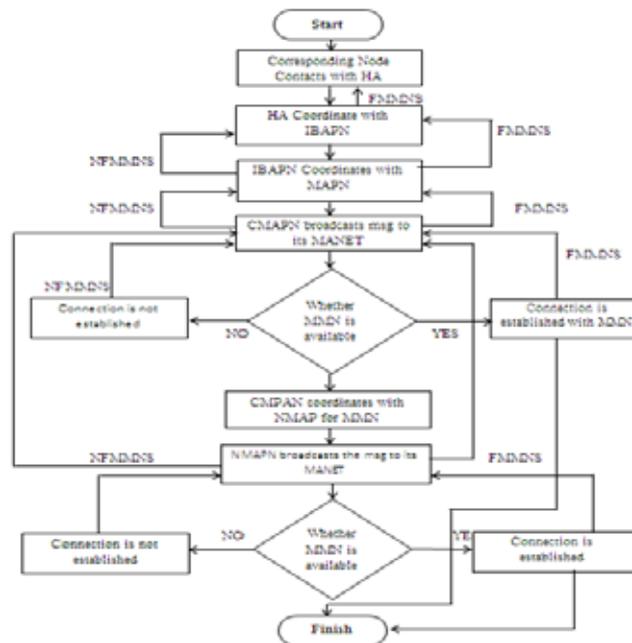
**Figure 2: Initial connection setup and handoff process.**

### 3.2 Manet-To-Manet Search For Manet Mobile Node (Mmn)

This scheme is introduced to search MMN. Whenever any corresponding node (CN) searches the MANET Mobile Node (MNN), it may require the following steps to find the required MMN in any MANET as described in the flow chart in Figure 3. Firstly CN contacts with (HA). Whenever request from CN is received to HA consequently HA coordinates with (IBAPN). The node (IBAPN) has capability of coordinating with (CMAPN). IBAPN is regarded as static node, which is fixed on that region where HA signaling powers becomes weak. IBAPN coordinates with CMAPN in order to search the required MMN in MANET [18]. CMAPN is the node, which has the functionality of broadcasting the message within same MANET and coordinating with other (NMAPN). CMAPN broadcasts the message (msg) to its MANET and taking decision whether MMN is available or not in its MANET.

If required MMN is available in its MANET then search process is finished. In response CMAPN sends availability of node with message “Found MANET Mobile Node Search” (FMMNS) to IBAPN. Furthermore IBAPN informs the HA regarding the availability of MMN with message (FMMNS). By this process, the

connection is established between CN & MMN and communication is started through same process. In case of MMN is not available in same MANET [16].



**Figure 3: MANET-to-MANET search Architecture**

CMAPN sends back the message “Not Found MANET Mobile Node Search” (NFMMNS) to IBPAN; as same message is forwarded to HA through IBAPAN and intimated the CN regarding the non-availability of MMN. If MMN is not found in the same MANET then CMAPN coordinates with New Manet Anchor Point Node (NMAPN) for the search of MMN. NMAPN is the Anchor Point Node of other MANET. NMAPN broadcasts the message to its MANET. If MMN is available to its MANET then NMAPN informs the availability of MMN to CMAPN with message “FMMNS”. After receiving the message of availability of MMN in Manet, CMAPN forwards the same message FMMNS to IBAPAN. IBAPAN forwards the availability message “FMMNS” to HA consequently connection is established between CN and MMN.

During the establishment of connection, the involvement of CMAPN for communication follows two conditions. If NMAPN is within the range of IBAPN then connection is directly established through NMAPN, otherwise connection is established through CMAPN to NMAPN. In case of nonavailability of MMN in Manet, NMAPN forwards the message to CMAPN. The same message “NFMMNS” of non-availability of MMN is forwarded to IBAPAN through CMAPN. Once again IBAPAN gets HA informed with message “NFMMNS”. When NFMMNS message is delivered to HA then other search approach is used for MMN and this search is said to be network-to-network search (NNS).

#### IV. PERFORMANCE COMPARISON OF TCP VARIANTS

For each TCP Variants the throughput performance Vegas produces encouraging throughput with different mobility patterns. The TCP Variants except TCP Vegas up to 40 percent but increase in mobility more than 40 percent, the performance of TCP SACK becomes little bit less than TCP New Reno. TCP New Reno is considered reliable protocol in increase of mobility ratios. TCP SACK is also good variant, but increase in the mobility ratio. An average elapsed time for delivery of individual data packets average End-to-End delays each TCP Variants on specific interval under different mobility. Vegas deliver data packets efficiently and produce uniform performance with minimal congestion and Tahoe is worse Performer [17].

## **4.1 The Performance-Affecting Factors For TCP**

TCP suffers due to timeouts and duplicate acknowledgments. TCP does not differentiate losses due to congestion or a link error, and in resulting the performance of TCP is affected.

### **4.1.1 Round Trip Time (RTT)**

RTT is set against congestion window to compute the Retransmission timeout (RTO) for each packet. The Variation of RTT reduces the performance of TCP. The RTT has much greater inconsistency in wireless networks than the wired networks.

### **4.1.2 Packet Error Rate**

The packet losses indicate the congestion. The ratio of packet error rates in wireless links is greater than wired links. In Hybrid network, occurrence of Packet reordering is related with handoff (mobility).

### **4.1.3 Bandwidth Utilization**

TCP tries to find out existing bandwidth in the slow start phase by doubling its congestion window against each RTT. TCP uses existing bandwidth by increasing it by 1MSS against each RTT. TCP identifies how much highest amount of data should be sent against each RTT [21]. There is different signal to Noise Ratio (SNR) available on wireless links, which reduces the bandwidth of channel. TCP does not also sense the fluctuation of SNR, and continuously sends the pace of the packet at the current rate, which causes the losses of packets. If ratio of SNR also falls in Hybrid network due to mobility, the performance of TCP suffers a lot that causes for degrading the performance.

## **V. CONCLUSION AND FUTURE WORK**

We have introduced Anchor point node approach in hybrid network. We simulate TCP Variants on our proposed scheme with different mobility scenarios. We mostly focus on Manet portion of network to analyze the condition of network with different mobility patterns. Wired-cum wireless mobile nodes are stationary in simulation and neither sends nor receives data. After completion of simulation time, we prove which Variant is best performer with our integrated scheme in hybrid network by using DSR routing protocol in Manet environment. TCP Vegas proves its strength with all of separate traffic flows [20]. Vegas provides constant end-to-end delay mobility with minimum packet loss in hybrid network, which makes Vegas smart choice for normal and large-scale real time traffic. Vegas produces encouraging throughput and good put as compare to other TCP variants. Our main scheme was to develop the connection between to territories which has not infrastructure. In future we would analyze and evaluate TCP Variants with our integrated proposed scheme in hybrid network with respect to different parameters by sending file of any specified size within fixed time for wireless environment and Manet environment with random mobility patterns.

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# STUDY ABOUT EFFICIENCY IMPROVEMENT OF THERMAL POWER PLANT & ADVANCE TECHNOLOGIES IN DIFFERENT TYPES OF PLANTS

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## ABSTRACT

*The purpose of the study outlined in this is to identify major energy loss areas in India's thermal power stations and develop a plan to reduce them using energy and exergy analysis as the tools. The energy supply to demand is narrowing down day by day around the world due to the growing demand and sometimes due to ageing of machinery. Most of the power plants are designed by the energetic performance criteria based not only on the first law of thermodynamics, but the real useful energy loss cannot be justified by the first law of thermodynamics, because it does not differentiate between the quality and quantity of energy. The present study deals with the comparison of energy and exergy analysis of thermal power plants stimulated by coal. Our national electricity requirement is about 2100MW against 1615MW supply; this is evident of about 21% deficit in terms of power requirements. Considering the high capital cost involved in new generation "clean technologies" developing countries like India having an abundance of cheap fossil fuel reserves have to give a major thrust to improvement in fossil-fired power technologies. Steam turbine based generating plants form the backbone of power generation in many countries in our country too, Base load is presently largely generated by fossil fuel based power plants. Most of these plants employ sub-critical coal fired boilers driving steam turbines to generate power. The adoption of "Supercritical cycles" for thermal plants on a wide scale has the ability to improve overall system efficiency, as well as provide benefits of lower emissions both on land & in air. Steam cycles for supercritical application operate at very high pressure & temperatures; these are thus characterized by features that take full advantage of the advanced parameters like higher expansion in turbines, more stages of feed heating & higher input levels to boilers, contributing to higher system efficiency.*

**KEY WORDS:** *Energy, Exergy, Effective, Efficiency, Improvement, Thermal Power Station, Different types of power plants.*

## I. INTRODUCTION

The expansion on the demand side resulted in over stretching of the current electricity generation capacity coupled with aging thermal plants which are still utilising old technology. The paper will focus on the energy efficiency improvement in thermal stations. Thermal Power Stations generate electricity through a thermal power plant; its installed capacity is designed with a common range of boilers feeding into common steam receivers from where any of the turbines take the steam. Currently only few boilers are in operation with an output of approximately 1615MW. The power plants use coal as the primary input for generating electricity.

The plant use 20-30% of energy value of primary fuels and the remaining 70-80% is lost during generation, transmission and distribution of which major loss is in the form of heat. The heat rate of a plant is the amount of fuel energy input needed (Btu, higher heating value basis) to produce 1 kWh of net electrical energy output. This study was done to identify various methods to reduce the heat rate of existing coal-fired power plant in India by identifying areas that cause the most heat losses and introducing the new technologies that cater for the losses. Energy and exergy analysis is used for the identification of these losses. Energy analysis evaluates the energy generally on its quantity only, whereas exergy analysis assesses the energy on quantity as well as the quality. The aim of the exergy analysis is to identify the magnitudes and the locations of real energy losses, in order to improve the existing systems, processes or components, This study identifies specific plant systems and equipment where efficiency improvements can be realized either through new installations or modifications, and provides estimates of the resulting net plant heat rate reductions and the order-of-magnitude costs for implementation.

Power generation technologies have also kept pace. Through old technologies like steam, hydro and Nuclear Turbine have progressed to dizzying levels, newer “clean technologies” like wind & solar have also gained a major share of the grid in many countries, like India. There is now an ongoing debate both in favor of and against these clean technologies like. These are characterized by higher capital investment & longer pay back periods. Also these are site specific & always cannot be set up near consumption centers. The paper dwells on these advanced Technologies so alternatives to the conventional one. Considering the high capital cost involved in new generation “clean Technologies”[1] developing countries like India having an abundance of cheap fossil fuel reserves have to give a major thrust to improvement in fossil-fired power technologies. [1]

### **1.1 Aim**

The main aim of the study is to identify areas where energy losses are occurring and develop them for efficient and effective improvement in a thermal power station.

### **1.2 Objectives**

The object to satisfy this are

- To conduct energy analysis of the overall plant and determine the efficiencies and energy losses of all the major components on the power plant.
- Select and develop the areas where energy losses are being experienced.
- Determine the costs and payback periods for the new technologies suggested for efficiency improvement.

### **1.3 Scope**

The study scope encompasses three major tasks, energy and exergy analysis and the identification of methods to reduce the energy losses of power plant and the determination of their associated costs involved with the installation of the possible measure to cater for the problem. Energy analysis is to be done on components from the combustor to the electrical generator.

## II. CURRENT SUPPLY DEMAND SITUATION

Table (1) shows the current demand supply in India[1]

Table (1) Demand situation

Maximum Demand	1615 MW
Available Maximum Capacity	1615MW
Maximum Demand	2100MW

Our national electricity requirements are about 2100MW against 1615MW supply; this is evident of about 21% deficit in terms of power requirements as shown in table 2, the future supply- demand forecast in India will require an additional of 1750MW by 2015 to further increase the power shortage.[1]

## III. FUTURE SUPPLY DEMAND SITUATION

India will require an additional 1750MW by 2015. In view of this situation, the project seeks to increase output from Thermal Power Station (TPS) in the process closing down on the power shortages now and in the future. Energy efficiency improvement measures provide a win-win situation by promoting cost-savings, lowering environmental impacts while at the same time promoting economic growth and social development. In addition to generating very large annual energy savings, present outlays on energy efficiency would avoid investment in energy infrastructure that would otherwise be needed to keep pace with accelerating demand. Efficiency improvement in all power plants can result in a sustainable gain in terms of electricity supply but this will need to be aided by other supply options such as imports and commissioning of new plants around the country.[2]

## IV. METHODOLOGY

The project is going to cover the following areas:

- A description of the facilities and their principal operation on the plant.
- A discussion of all major energy consuming systems.
- A description of all recommended Energy Conservation Measures (ECMs) with their specific energy impact.
- Energy and exergy analysis of the whole plant.
- A review on the implementation costs, benefits and payback period.
- Specific conclusions and recommendations.

## V. DESCRIPTION OF THE PLANT

A schematic diagram of a plant with its various significant components is shown in Figure (1). The continuous supply of de-mineralized water is ensured to the condenser hot well for the normal running of the plant at a constant load. The condensate extraction pump (EXP) feeds the feed water to the ejector from the hot well. After the ejector exit, the feed water passes through the gland steam cooler, and the low pressure heater (LP). From the outlet of the low pressure heater (LP) the condensate enters into the boiler feed pump (BFP) where the condensate is pumped from the high pressure heater one (HP1) to high pressure heater three (HP3). Then the condensate passes through the economizer, and then enters into the boiler drum. There is a continuous circulation of water between the drum and the water walls and a part of the feed water is converted into steam. The steam is separated in the boiler drum and supplied to the super heater section and the boiler condenser

section. The super heated steam produced in the super heater then enters into the turbine through the turbine stop valve and then rotates the electrical generator. After expansion in the turbine the exhaust steam is condensed in the condenser and is used for the closed cycle as shown in Figure (1).[3]

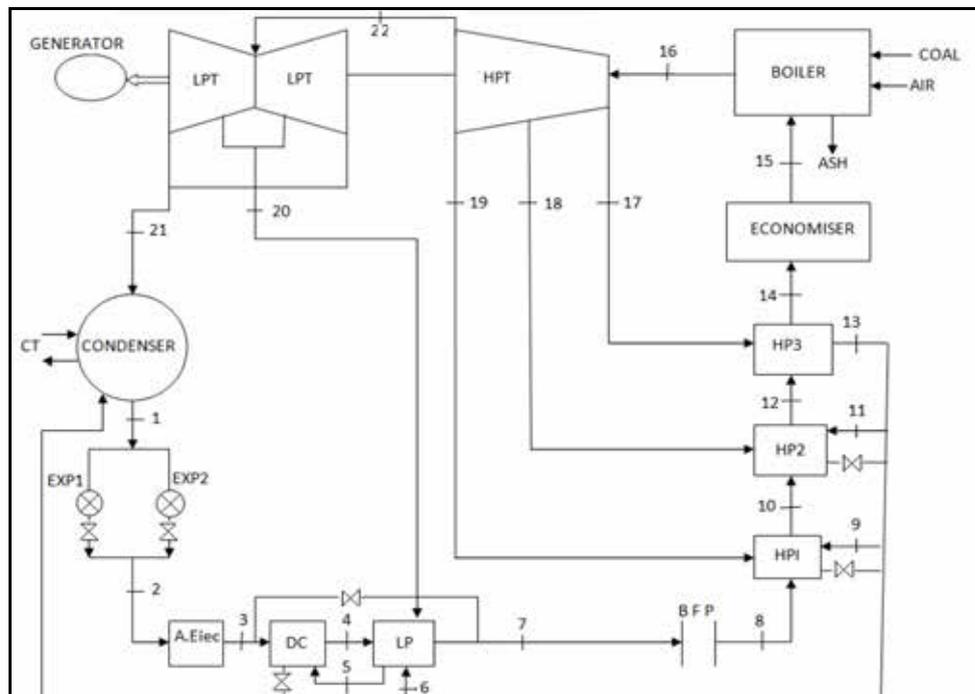


Fig (1) Schematic Diagram of Thermal Plant

## VI. RANKINE CYCLE

Rankine cycle is the idealized cycle for steam power plants; it is a heat engine with a vapour power cycle (Wiser, 2000). The common working fluid is water, and the cycle consists of four processes as shown in Figure (2)

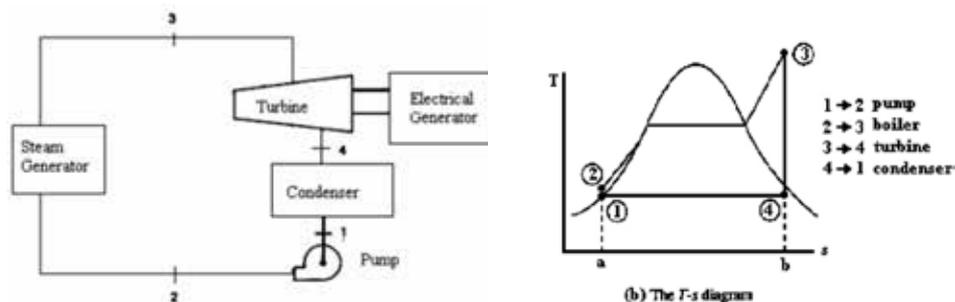


Fig (2) Rankine Cycle Representation of Power Plant

### 6.1 Power Plant Circuit

- Ø **Process 1-2:** Isentropic compression (Pump; during the isentropic compression process, external work is done on the working fluid by the pumping. Pumping takes place from low to high pressure.
- Ø **Process 2-3:** Isobaric heat supply (Steam Generator or Boiler; heat from the high temperature source is added to the working fluid to convert it into superheated steam. Pressurised liquid enters a boiler where it is heated at constant pressure to dry saturated vapour.
- Ø **Process 3-4:** Isentropic expansion (Steam turbine); an isentropic process, the entropy of working fluid remains constant. The dry saturated vapour expands through a turbine, generating power. The temperature decreases and pressure drops, and condensation can take place may occur.

Ø **Process 4-1:** Isobaric heat rejection (Condenser; An isobaric process, in which the pressure of working fluid remains constant. The wet vapour then enters a condenser where it is condensed at a constant temperature to become a saturated liquid.

## 6.2 Energy Analysis

In an open flow system there are three types of energy transfer across the control surface namely working transfer, heat transfer ( $Q_k$ ), and energy associated with mass transfer and/or flow. The temperature ( $T_k$ ) from the heat source and the network ( $W$ ) developed by the system are used for the analysis of open flow systems and to analyze plant performance whilst kinetic and potential energy changes are ignored. The energy or first law efficiency of a system is defined as the ratio of energy output to the energy input to system.[4]

## 6.3 Exergy Analysis

Exergy is a generic term for a group of concepts that define the maximum possible work potential of a system, a stream of matter or heat interaction; the state of the environment being used as the datum state. In an open flow system there are three types of energy transfer across the control surface namely working transfer, heat transfer, and energy associated with mass transfer or flow. The work transfer is equivalent to the maximum work, which can be obtained from that form of energy. Energy analysis is based on the first law of thermodynamics, which is related to the conservation of energy. Second law analysis is a method that uses the conservation of mass and degradation of the quality of energy along with the entropy generation in the analysis, design and improvement of energy systems. Exergy analysis is a useful method; to complement but not to replace energy analysis.[4]

## VII. DISCUSSION OF RESULTS

From the energy analysis, the overall plant energy loss is calculated as 81.72%. The comparison of energy losses between different components is given in Figure 4. It is observed that the maximum energy loss (47.79%) occurred in the condenser, this is due to the reason of heat energy expulsion from the condenser. Thus the energy analysis diverts our attention towards the condenser for the plant performance improvement. Approximately half of the total plant energy losses occur in the condenser only and these losses are practically useless for the generation of electric power. Thus the analysis of the plant based only on the First law principles may mislead to the point that the chances of improving the electric power output of the plant is greater in the condenser by means of reducing its huge energy losses, which is almost impracticable. [4]

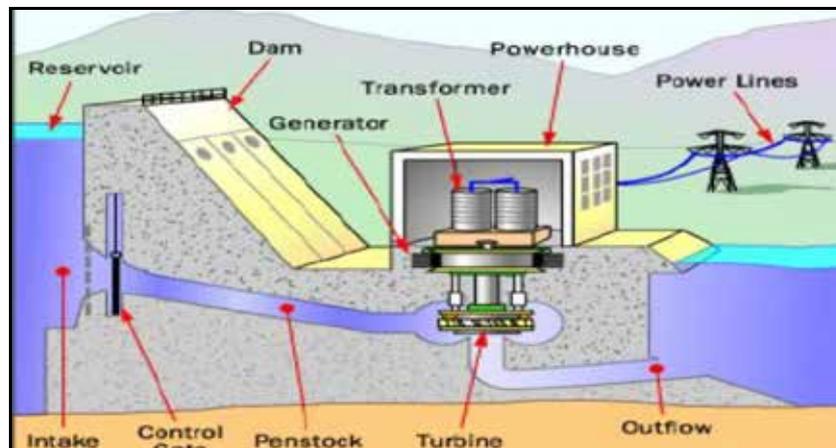
Hence the First law analysis (energy analysis) cannot be used to pinpoint prospective areas for improving the efficiency of the electric power generation. However, the Second law analysis serves to identify the true power generation inefficiencies occurring throughout the power station.

## VIII. DIFFERENT TECHNOLOGIES IN POWER PLANT

### 8.1 Hydro Electric Power Plant

Due to the abundant availability of coal, a large number of thermal sets were set up by the British for meeting power demand in India's emerging cities. Due to the limited manufacturing capabilities of equipment in India all these plants were set up using imported equipment. The power equipment industry was established in India with the setting up of the first plant of BHEL at Bhopal in November 1956, under Heavy Electrical India limited (HEIL). Heavy Electricl plant in Bhopal is the mother plant of BHEL. The largest engineering & Manufacturing enterprise in India in the Energy-related and infrastructure sector, It was dedicated to the nation on 6th of

November 1960 by first prime minister of India Pt. Jawaharlal Nehru. BHEL spread of Operations with 180 products groups caters to the core sectors of Indian economy, power, industry, transportation, Transmission, oil & GAS, Renewable energy etc. In service of the nation BHEL sets generates 73% of the total power in the country while accounting for 65% of India's total installed generating capacity 1, 23,668 MW. From the above we see that India was a pioneer in the introduction of clean Technologies like Hydropower.



**Fig (3) Hydro Electric Power Plant**

There have been subsequent in power plant Technologies the world over, mainly in the Thermal & Nuclear Segments. Due to the abundant availability of coal in India, the Technology base for manufacture of large size steam turbines utilizing these coal. The first steam station was set up in Calcutta in 1899. We have a share of around 59% in India's total installed generating capacity contributing 69% (approx.) to the total power generated from utility sets (excluding non-conventional capacity) as of March 31, 2012. Through these technologies suited India's interests, they are one being categorized as technologies that harm the environment. This coupled with the system of earning Carbon credits for reduction of green house Gas emissions has led to a resurgence for the use of clean Technologies. For the past few years the India has made great strides in these newer clean Technologies like Wind, Tidal & the latest being Solar.[8]

## **8.2 Wind Power Plant**

Wind power generation was not taken up on a wide scale owing to lack of suitable large size generation plants, lack of suitable micro Grid to connect these plants & proper support from the government & power buyers. However this has now seen a vast change with the government mapping the wind potential areas of the country mainly in coastal regions & in hill areas of Karnataka, Maharashtra, etc. The indigenous availability of large size WEG's up to 2MW, Govt. support for buying the higher priced Wind power coupled with ability to earn CER's of these plants have made Wind power an attractive investment source for many Govt. as well as private firms. In the process, the contribution of Wind power has grown to almost 15000MW as on date & is expected to rise further. Although a relative newcomer to the wind industry compared with Denmark or the US, a combination of domestic policy support for wind power and the rise of Suzlon (A leading global wind turbine manufacturer) have led India to become the country with the fifth largest installed wind power capacity in the world. Though Wind power seems attractive, it is beset by a major problem of continued availability & dependability. In spite of great developments in technologies, it is still expensive compared to conventional technologies, thus limiting its reach beyond a point.[5]

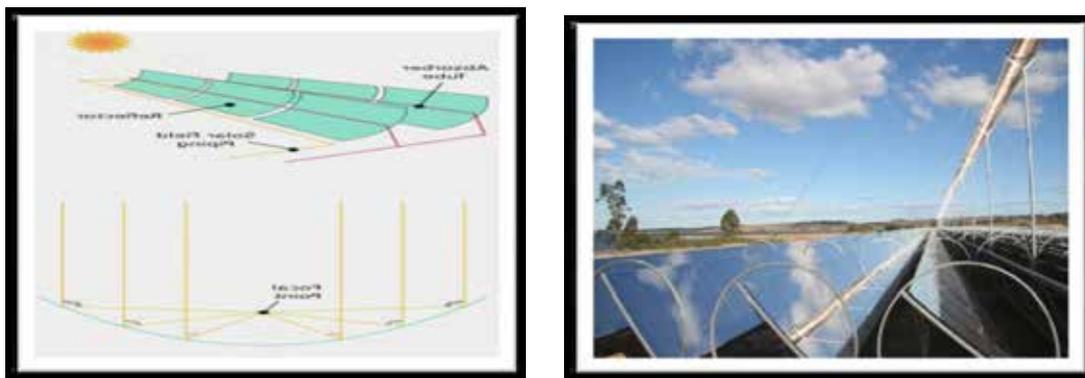


**Fig (4) Wind Power Plant**

### **8.3 Solar Power Plant**

Solar power is another one clean technologies emerging in a strong way across the world, notably in countries USA & Southern Europe like Spain, Italy &also Egypt. In the past use of solar energy was limited to direct use of solar heat for heating purposes or for power generation using photo-Voltaic method. In this method the efficiencies were quite low with high capital costs, thus limiting its use to far flung areas where no other technology could be built. However the newer technologies developed over the years have blunted the drawback to a great extent. In most parts of India, clear sunny weather is experienced 250 to 300 days a year. The annual global radiation varies from 1600 to 2200 kwh/m<sup>2</sup> which is comparable with radiation received in the tropical and sub-tropical regions. The equivalent energy potential is about 6,000 million Gwh of energy per year.[7]

Some of the Technologies are (I) Parabolic trough technology and (ii) Linear Fresnel reflector. Parabolic trough system is a type of solar Thermal energy collector. At the receiver can reach 4000C and produce steam for generating electricity. Power tower systems the reflected rays of the sun are always aimed at the receiver where temperatures well above 10000C can be reached. Solar tower technology: All of the illustrated technologies use different proven methods to capture the solar heat in large collectors & transfer this heat to fluids or water to generate steam, which is then used to power a conventional steam power plant.[8]



**Fig (5) Solar Power Plant**

### **8.4 Tidal Power Plant**

Tidal potential in our country is huge, as we are blessed with a large coastlines of almost 5000km. The identified economic tidal power potential in India is of the order of 8000-9000MW. The other clean technology is the field of Nuclear Technology. The 320MW Tarapur Atomic power station (TAPS) was the first nuclear power plant in India. A 500MW plant went operational in 1969. BHEL has further upgraded its facilities to supply steam

turbines for Nuclear Power stations up to 700 MW capacities being set up by Govt. of India. From the above we can conclude that there are many technologies in the world which can be collectively called ``Clean technologies''. These are characterized by low to Zero Emissions & pollutions & therefore environment friendly. Because of their clean nature these newer technologies like Wind, Tidal, and Solar & Nuclear have also gained major share of the grid in many countries However, there is now a ongoing debate both in favor of & against these Clean technologies. These technologies are characterized by higher capital investment & longer pay back periods. Also, these are site specific & always cannot be set up near consumption centers. Hence their use till date has been limited to those countries which have a good financial position or those wherein the demand for clean technologies has surpassed the negative aspects of these technologies. One clear common factor that emerges from the above technologies is the Steam Turbine, which is an important part of most of the above. Therefore the world focus has again shifted to further development of Steam turbines based power plants as these are not very capital expensive, are relatively efficient & have a long & reliable service life[6]



**Fig (5) Tidal Power Plant**

## **IX. CONCLUSION**

The paper set to show the weakness of depending on energy analysis only power plants as a performance measure that will help improve efficiency. Exergy analysis was undertaken at the thermal power plant which highlighted the areas that could be addressed to improve the efficiency. A recommendation of retrofitting and replacement was done for the system. On going work in development of intelligent power plant is expected to improve stability of steam headers, responsiveness to steam demand, increase power generation flexibility, minimize operations cost, improve overall plant efficiency, increase fuel cost savings and reduce CO<sub>2</sub> Emission. Though older technologies like steam, hydro & nuclear turbines have progressed to dizzying levels, newer clean technologies like wind, tidal & solar have also gained major share of the grid in many countries. Though there exists an ongoing debate both in favour of & against these clean technologies as these are characterized by higher capital investment and longer pay back periods. Presently, base load in our country is generated by fossil fuel based power plants. Considering the high capital cost involved in new generation ``Clean Technologies'', developing countries like India having an abundance of cheap fossil fuel reserves have to give a major thrust to improvement in fossil-fired power technologies. We have also seen how the Steam Turbine based power station is prevalent in both the new as well as old technologies, in both the polluting as well as ``Clean Technologies'', thus emerging the leader of choice for power generation. Lastly the paper highlights how the power plant technologies including supercritical steam turbines to meet & exceed emerging requirements of society.

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# IN A FOUR-STROKE ENGINE EFFECT OF KNOCKING IN SPARK IGNITION

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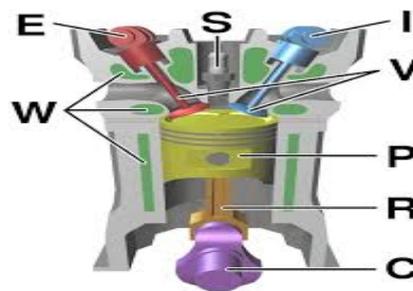
## ABSTRACT

*In present steady, A spark ignition and a compression ignition engine with inflow valve knocking of the cylinder and a transfer valve in the piston crown have been described. Under ideal conditions the common internal combustion engine burns the fuel/air mixture in the cylinder in an orderly and controlled fashion, the thermal extension of the range in proximity of the valve and other valve of the cylinder is different and so the distortion of the geometry of the cylinder liner surface force the designer to make the clearance between the piston and the cylinder liner bigger. This paper presents the review to the knocking using petrol on the combustion and emission characteristics of a single cylinder, four stroke, air cooled direct injection SI engine. It is well known that injection strategies including the injection timing and pressure play the most important role in determining engine performance, especially in knocking emissions. However, the injection timing and pressure quantitatively affect the performance of the SI engine. Knocking is due to auto ignition of end portion unburned charge in combustion chamber. Certain chemical changes must first occur for knock to happen; hence fuels with certain structures tend to knock easier than others. In spark ignition internal combustion engines, knocking occurs when combustion of the air fuel mixture in the cylinder start off correctly in response to ignition by the spark plug, but one or more pockets of air fuel mixture combust outside the involve of the internal combustion process.*

**Keywords: Knocking, Four Stroke Engine, Valve, Injection Timing**

## I. INTRODUCTION

In normal combustion, the flame initiated by the spark travels occurs the combustion chamber in a fairly uniform manner under certain operating condition the combustion deviates from its normal course leading to loss of performances and possible damage to the engine. Knocking is due to auto ignition of end portion of unbrunt charge in combustion chamber. As the normal flame proceed across the chamber, pressure and temperature of unburned charge increase due to compression by burned portion of charge. This unburned compressed charge may auto-ignite under certain temperature and release the energy at every rapid compared to normal combustion process in cylinder. This rapid released of energy during auto ignition causes a high pressure differential in combustions chamber and a high pressure wave is released from auto ignition region. The motion of high pressure compression waves inside the cylinder causes vibration of engine parts and pinging noise and it is known as knocking or detonation. [1]



**Fig.1. Piston and Some of Its Basic Components**

In a conventional SI engine, fuel and air are mixed together in the intake system, inducted through the intake valve into the cylinder where mixing with residual gas takes place, and then compressed during the compression stroke. Under normal operating conditions, combustion is initiated towards the end of compression stroke at the spark plug by an electric discharge. Spark ignition engines take a mixture of fuel and air, compress it, and ignite it using a spark plug. Figure-1 shows a piston and some of its basic components.

S- Spark plug

I-intake

E- Exhaust

V- Valve

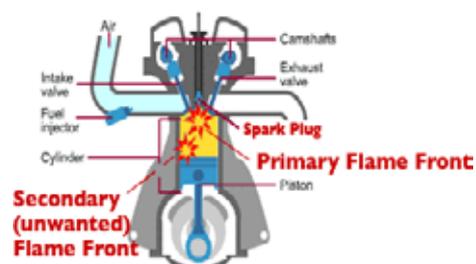
P- Piston

R- Connecting rod

C- Crank

W- water cooling .

The name 'reciprocating' is given because of the motion that the crank mechanism goes through. The piston-cylinder engine is basically a crank-slider mechanism, where the slider is the piston in this case. The piston is moved up and down by the rotary motion of the two arms or links. The crankshaft rotates which makes the two links rotate. The piston is encapsulated within a combustion chamber. The bore is the diameter of the chamber. The valves on top represent induction and exhaust valves necessary for the intake of an air-fuel mixture and exhaust of chamber residuals. In a spark ignition engine a spark plug is required to transfer an electrical discharge to ignite the mixture. In compression ignition engines the mixture ignites at high temperatures and pressures. The lowest point where the piston reaches is called bottom dead center. The highest point where the piston reaches is called top dead center. The ratio of bottom dead center to top dead center is called the compression ratio. The compression ratio is very important in many aspects of both compression and spark ignition engines, by defining the efficiency of engines. [2] Knocking in four stroke engine with primary flame front and secondary (unwanted) flame front as shows in figure-2. [3]



**Fig. 2. Knocking in Four Stroke Engine With Primary Flame Front and Secondary (Unwanted) Flame Front**

## II. THE PHENOMENON OF KNOCK IN SI ENGINE

### 2.1 Normal combustion

In normal combustion, the flame initiated by the spark travels across the combustion chamber in a fairly uniform manner. Under certain operating condition the combustion deviates from its normal course leading to loss of performance and possible damage to the engine. The phenomenon of knock may be explained by referring to fig.3 which shows the cross-section of the combustion chamber with flame advancing from the spark plug location. In the normal combustion the flame travels A-D and compressed the end charge BB'D and raises its temperature. Temperatures also increase due to heat transfer from the flame front. Now, if the final temperature is less than the auto-ignition temperature, normal combustion occurs and charge BB'D is consumed by the flame itself.

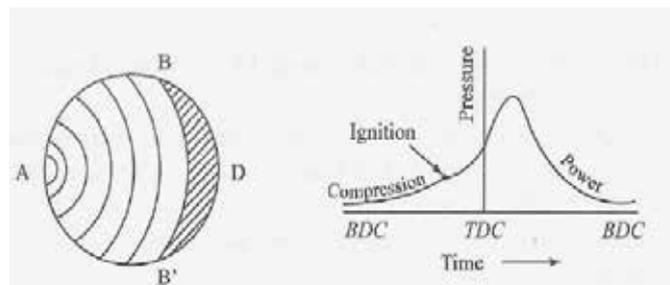


Fig. 3 Normal combustion

### 2.1 Abnormal Combustion

This type of combustion may be termed as an abnormal combustion or knocking combustion. The order of this abnormal process is the loss of power, recurring preignition and mechanical damage to the engine. Now, if the final temperature is greater than and equal to the auto-ignition temperature, the charge BB'D auto ignites (knocking). A second flame front develops and moves in opposite direction, where the collision occurs between the flames. This causes severe pressure pulsation and leads to engine failure/damage. [4]

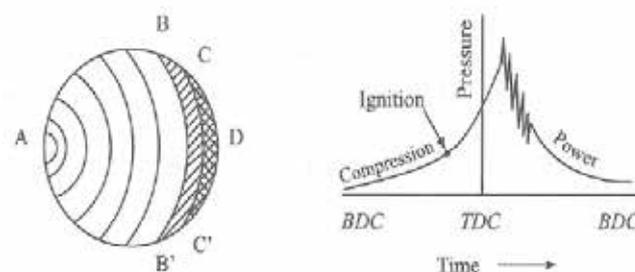


Fig. 4 Abnormal Combustion With Detonation

## III. EFFECT OF KNOCKING IN PISTON

In four stroke spark ignition engine may be knocking occurs due to the incorrect fuel injection timing and the temperature, pressure, density of the unbrout charge. The effect of knocking in piston and piston cylinder is crack and defect in piston head as shown in fig. 5. The piston is bourn due to high temperature of the unbrout charge in knocking. The air/fuel charge is meant to be ignited by the spark plug only, and at a specified time during the normal cycle of the piston. The peak of the combustion process no longer occurs at the optimum moment in which the air/fuel mixture was intended to ignite. The shock wave creates the characteristic metallic "pinging" sound, and cylinder pressure increases dramatically. Effects of engine knocking can be significant. However, it should not be confused with pre-ignition as the two are separate events. [5]



**Fig.5. Effect of Knocking In Piston**

#### **IV. PARAMETERS OF KNOCK LIMITED**

The aim of the designer to reduce the tendency of knocking in the engine, certain knock limited parameter are explained.

##### **4.1 Knock Limited Compressor Ratio**

The knock limited compressor ratio is obtained by increasing the compressor ratio on a variable compressor ratio engine until incipient knocking is observed. Any change in operating condition such as fuel air ratio or in the engine designed that increases the knock limited compression ratio is said to reduce the tendency towards knocking.

##### **4.2 Inlet Presser on Nock Limited**

The inlet presser is increase by opening the throttle are increasing supercharger delivery pressure until incipient knock is observed, knock limited inlet presser in increase the indicate a reduction in the knocking tendency.

##### **4.3 Knock Limited Inicated Mean Effective Presser**

The indicated mean effective presser measured at incipient knock is usually abbreviated as klimep. This parameter and the corresponding fuel consumption are obviously of great practical interest. [6]

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