AUTHENTICATION BASED REMOTE DATA POSSESSION IN MULTI-CLOUD STORAGE

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ABSTRACT

Remote Data possession (RDP) is a technique for ensuring the data integrity in storage outsourcing. In this paper, based on authentication cloud service providers request customers to store the information in the cloud. RDP scheme is used for cloud storage to support the scalability of service and data migration. Cloud security is applied to protect data, applications and infrastructure associated with in the cloud. Remote data integrity checking is of crucial importance in cloud storage. It can make the clients verify whether their outsourced data is kept intact without downloading the whole data. In some application scenarios, the clients have to store their data on multi-cloud servers. At the same time, the integrity checking protocol must be efficient in order to save the verifier's cost. From the two points, we propose a novel remote data integrity checking model: Authentication-based Remote data possession in multi-cloud storage.

Index Terms: Remote Data Possession, Cloud Security, Cloud service providers, Multi Cloud, Data Integrity

I. INTRODUCTION

In recent years, cloud computing has become a faster growth by providing a low-cost, scalable, independent platform for clients' data. Cloud computing environment is constructed based on open architectures , it has the capability to incorporate multiple internal and/or external cloud services together. Multi-cloud allows clients to easily access his/her resources remotely through interfaces such as web services.

Service Computing is used as interface between business services and IT services. Service computing refers to a flexible computing architecture for interoperable routines that can be used within multiple, separate systems. Service computing requires loose coupling of services with operating systems. The services communicate with each other by passing data, shared format, or by coordinating an activity between two or more services. Service computing include the concepts of Service Oriented Architecture, Mash-ups, Software as a Service, and Cloud Computing.

Service computing has become a strategic area of scientific study at IBM Research. IBM Research has a distinguished history in the science and technology of service-oriented business consulting, modeling, transformation, execution, monitoring and management. Foundational contributions includes Web services hub framework, federated Web services discovery, collaboration, business transformation solutions, component business model and SOA, multi-channel e-commerce architecture, access control and security, and industry solution frameworks.

II. LITERATURE REVIEW

Remote data possession is a technique for validating data integrity over remote servers [5]. In a typical model, the data owner generates some metadata/information for a data file to be used later for verification purposes through a challenge response protocol with the remote/cloud server [6]. The owner sends the file to be stored on a remote server which may not be trusted, and deletes the local copy of the file. As a proof that the server is still possessing the data file in its original form, it correctly computes a response to a challenge vector sent from a verifier who can be the original data owner or other trusted entity that shares some information with the owner. Researchers have proposed different variations of RDP schemes under different cryptographic assumptions. One of the core design principles of outsourcing data is to provide dynamic scalability of data for various applications. This means that the remotely stored data can be not only accessed by the authorized users, but also updated and scaled by the data owner. RDP schemes presented focus on static or warehoused data and do not consider the case of dynamic data that are usually more prevailing in practical applications. Dynamic provable data possession [7] (DPDP) constructions reported in the literature focus on the provable possession of a single copy of a dynamic data file. Although RDP schemes have been presented for multiple copies [8] of static data, RDP scheme exists for multiple copies of dynamic data.

In our system the each cloud admin consist of data blocks. The cloud user [9] uploads the data into multi cloud. Cloud computing environment is constructed based on open architectures and interfaces; it has the capability to incorporate multiple internal and/or external cloud services together to provide high interoperability. We call such a distributed cloud environment as a multi-Cloud .A multi-cloud allows clients to easily access his/her resources remotely through interfaces. Data Integrity is very important in database operations in particular and Data warehousing and Business intelligence in general. Because Data Integrity ensured that data is of high quality, correct, consistent and accessible. Trusted Third Party (TTP) [6] who is trusted to store verification parameters and offer public query services for these parameters. In our system the Trusted Third Party, view the user data blocks and uploaded to the distributed cloud. In distributed cloud environment each cloud has user data blocks. If any modification tried by cloud owner a alert is send to the Trusted Third Party.

III. STRUCTURE AND TECHNIQUES

In this section, we present our verification framework for multi-cloud storage and a formal definition of RDP. Although existing RDP schemes offer a publicly accessible remote interface for checking and managing the data, the majority of existing PDP schemes are incapable to satisfy the inherent requirements from multiple clouds. To address this problem, we consider a multi-cloud storage service as illustrated in Figure 1. In this architecture, a data storage service involves three different entities: Clients with private key have a large amount of data to be stored in multiple clouds and have the permissions to access and manipulate stored data; Combiner can collect and transmits the data to the multi-cloud. According to the type of data, the data is stored in the data type Veri fierwh oistrust edtostore verification parameterwill offer public query services

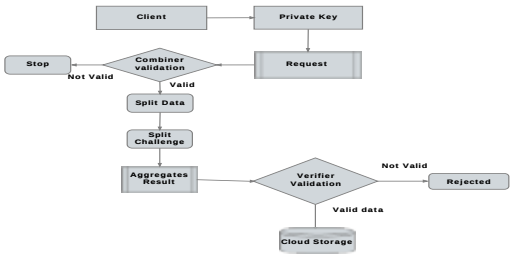

Fig1: System Architecture

In this architecture, we consider the existence of multiple clouds to store and maintain the clients' data.

Private Key Generation creates the private key for the client. The client creates the block-tag pair and uploads it to combiner. The combiner distributes the block-tag pairs to the different cloud servers according to the storage metadata. The verifier[11] sends the challenge to combiner and the combiner distributes the challenge query to the corresponding cloud servers according to the storage metadata. The cloud servers respond the challenge and the combiner aggregates these responses from the cloud servers. The combiner sends the aggregated response to the verifier. Finally, the verifier [4] checks whether the aggregated response is valid. The RDP construction mainly comes from the signature, provable data possession and distributed computing. The signature relates the client's identity with his private key. Distributed computing is used to store the client's data on multi-cloud servers. At the same time, distributed computing is also used to combine the multi-cloud servers' responses to respond the verifier's challenge [12][13][14][15][16][17]. Based on the provable data possession protocol, the RDP protocol is constructed by making use of the signature and distributed computing [18].

3.1 Modules Involved

Collection of client information and private key generation.

Request and response of the combiner.

Data transmission to multi cloud.

Generation of challenges to multi cloud.

Validation of challenges

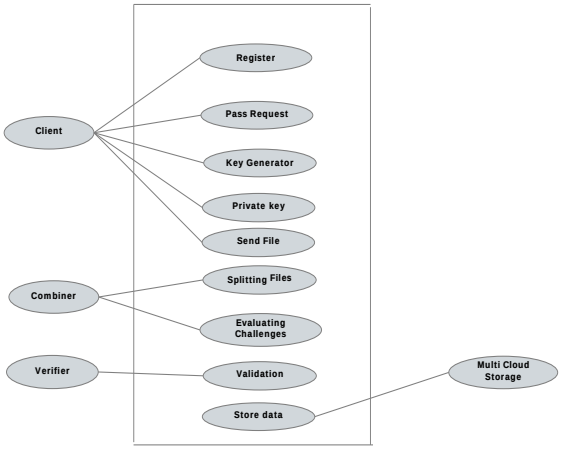

Fig 2:Use Case Digram Depicting Client Information Storing In The Cloud

IV. PROPOSED METHOD

In authentication-based public key cryptography, this paper focuses on remote data possession in multi-cloud storage. The protocol can be made efficient by eliminating the certificate management. We propose the new remote data integrity checking model: RDP. The system model and security model are formally proposed. Then, based on the bilinear pairings, the concrete RDP protocol is designed. In the random oracle model, our RDP protocol is provably secure. On the other hand, our protocol is more flexible besides the high efficiency. Based on the client's authorization, the proposed RDP protocol can realize private verification, delegated verification and public verification.

In PKI (public key infrastructure), provable data possession protocol needs public key certificate distribution and management. It will incur considerable overheads since the verifier will check the certificate when it checks

the remote data integrity. In addition to the heavy certificate verification, the system also suffers from the other complicated certificates management [23] such as certificates 1generation, delivery, revocation, renewals, etc. In cloud computing, most verifiers only have low computation capacity. Identity-based public key cryptography [24] can eliminate the complicated certificate management. In order to increase the efficiency, authentication based remote data possession is more attractive.

V. CONCLUSION

The construction of an efficient PDP scheme for distributed cloud storage is presented. Based on homomorphic verifiable response and hash Index hierarchy, a cooperative PDP scheme to support dynamic scalability on multiple storage servers is proposed. Our scheme provides all security properties required by zero knowledge interactive proof system, so that it can resist various attacks even if it is deployed as a public audit service in clouds.

Furthermore, the probabilistic query and periodic verification to improve the audit performance is optimized. Our experiment clearly demonstrates various approaches to introduce a small amount of computation and communication overheads. Therefore, our solution can be treated as a new candidate for data integrity verification in outsourcing data storage systems. As part of future work, we would extend our work to explore more effective CPDP constructions. Finally, it is still a challenging problem for the generation of tags with the length irrelevant to the size of data blocks.

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ANALYSIS OF REVERSIBLE WATERMARKING USING IMAGE COMPRESSION AND HISTOGRAM SHIFTING

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ABSTRACT

In this paper, we propose new reversible watermarking technique which is for data hiding. This data hiding enables embedding of messages in a host image without any loss of host content, which is proposed for image authentication that if the watermarked image is deemed authentic, we can revert it to the exact copy of the original image before the embedding occurred. Our first contribution is towards the modulation of the Histogram Shifting on image contents with compression of image. we present an improved histogram-based reversible data hiding technique based on pixel prediction and sorting. A rhombus pixel prediction is employed to explore the prediction for histogram-based embedding. Sorting the prediction has a good effect on increasing the embedding capacity. The second contribution is to hide data into textured area of the image. To achieve large hiding capacity we used characteristics of the pixel difference by keeping low distortion. The proposed scheme which derives a two-stage embedding strategy to solve the problem about communicating peak points. We also present a histogram shifting technique to prevent overflow and underflow. In this way, the watermark embedder and extractor synchronized for message extraction and image reconstruction.

Keywords: Reversible Data Hiding, Image Authentication, Reversible/Lossless Watermarking, Data Hiding

I. INTRODUCTION

Since from last twelve years many reversible watermarking schemes have been proposed for protecting images of sensitive content, like medical or military images, for which any modification may affect their interpretation . These techniques allow the user to restore exactly the original image from its watermarked image by removing the watermark. Thus it becomes possible to update the watermark content, as for example security attributes (e.g., one digital signature or some authenticity codes), at any time without adding new image distortions. However, if the reversibility property release constraints of invisibility, it may also introduce discontinuity in data protection. Also, there are some sensitive images where any embedding distortion made to the image is intolerable, such as military images, medical images or artwork preservation. For example, even slight changes are not accepted in medical images due to a potential risk of a physician giving a wrong explanation of the image.

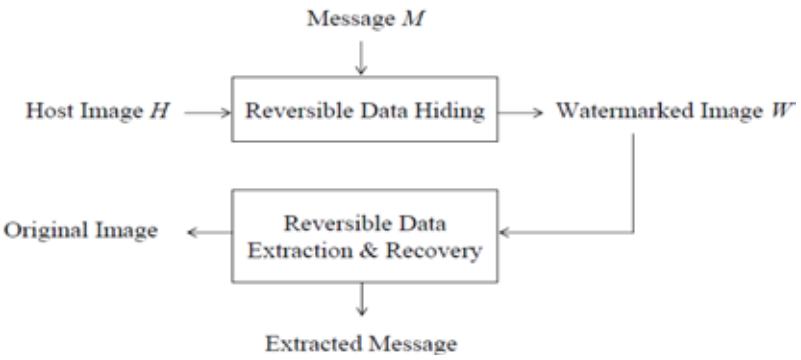


Fig. 1. Diagram For Reversible Data Hiding Procedure

This is the reason why, there is still a need for reversible techniques that introduce the lowest distortion possible with high embedding capacity.So, reversible data hiding techniques give a solution to the problem of how to embed a large message in digital images in a lossless manner so that the image can be completely restored to its original state before the embedding occurred. From the application point of view, reversible data hiding technique can be used as a fragile invertible authentication watermarking that embeds an authentication code in a digital image way.

II.EXISTING APPROACHES

Reversible data hiding techniques is proposed for various fields such as audio [2], MPEG-2 video [3], 3D-meshes [4], visible watermarking [5], SMVQ-based compressed domain [6]. For lossless compression, Fridrich *et al*. [1] devised an invertible watermarking method by using a lossless compression algorithm to make space in which to embed data.

In 2003, Tian [9] devised a high capacity reversible data hiding scheme that is called difference expansion (DE), where the message is embedded based on the 1-D Haar wavelet transform. The DE scheme is able to embedding as high as 0.15 to 1.97 bpp, which is significantly larger than other schemes proposed previously. Kamstra *et al*. [11] improved the DE scheme by using the low-pass image to find suitable expandable differences in the high-pass band. Thodi and Rodríguez [12] proposed an improved version of the DE scheme called prediction-error expansion, where the correlation inherent in the neighborhood of a pixel is better exploited than the DE scheme. Hu *et al*. [13] construct a payload dependent location map, where the compressibility of location map is further improved. Besides, several DE-based schemes [14][15][16] are also proposed recently in which they in principle differ in the employed prediction algorithm. Consequently, DE-based schemes can achieve high embedding capacity but low image quality.

Histogram-based reversible data hiding scheme was first proposed by Ni *et al*. [17] in 2006, where the message is embedded into the histogram bin. They used pairs of peak points and zero points to achieve low embedding distortion but low hiding capacity. Ni et al. [18][19] increased the hiding capacity by extending the histogram modification technique for integer wavelet transform. In 2009, Tsai *et al*. [20] used a residue image indicating a difference between a basic pixel and each pixel in a non-overlapping block to increase the embedding capacity. Tai *et al*. [21] designed a synchronization mechanism by selecting fixed peak bins in histogram of pixel differences. In 2011, Jung *et al*. [22] proposed an improved histogram modification based reversible data hiding technique with a consideration of the human visual system (HVS) characteristics. Yang and Tsai [23] used an interleaving prediction to improve histogram-based reversible data hiding.In 2013, Al-Qershi and Khoo [24] adopt a two-dimensional difference expansion technique (2D-DE) to increase the hiding capacity. Huang and

Chang [25] employed modification of difference values between pixels by using histogram-based scheme with extensions to pyramidal structure by utilizing inherent characteristics of original images. Besides, Lou *et al*. [26][27] presented an innovative active steganalysis algorithm for reversible data hiding schemes based on histogram shifting. Their proposed active steganalysis algorithm can effectively detect stego images at low bit rates and estimate the hidden messages locations. Note that histogram-based reversible data hiding schemes can achieve high embedding capacity and high image quality. However, those techniques all suffer from the unresolved issue represented by the need to communicate pairs of peak and zero points to recipients.

In this paper, we focus on improving our previous work done [21]. We present an improved histogram-based reversible data hiding scheme based on pixel prediction and sorting. A rhombus pixel prediction is employed to explore the prediction for histogram-based embedding. Sorting the prediction has a good influence on increasing the embedding capacity. Characteristics of the pixel difference are used to get the large hiding capacity by keeping low distortion. In addition, we derive a two-stage embedding strategy to solve the problem about communicating peak points. We also present a histogram shifting technique to prevent overflow and underflow.

III. PROPOSED SYSTEM

3.1 Embedding

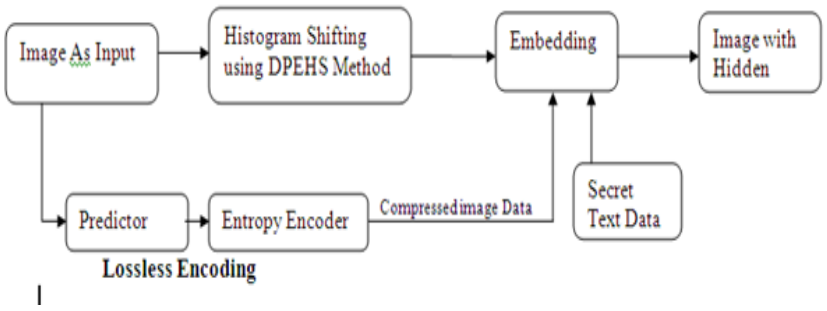


Fig. 2. Embedding Process

3.2 Embedding Algorithm

1)The image is divided into N_b non-overlapping blocks. Repeat (2)-(4) for each image blocks.

2) Let n be the number of (peak, zero). The more the number of pairs, the worse the image quality is Then, the following iterations are executed n times for i = 1:n.

3)For pair (p_i , z_i) the image block will be scanned. There are two kinds of conditions for different $peak_i$ and $zero_i$. The details are described as follows.

(a) $p_i > z_i$

For all intensity values of pixels located between $z_i + 1$ and p_i ,[$z_i + 1$, p_i] histogram shifts leftward by reducing intensity value to one.Therefore, a gap will be created at grey level p_i . If embedding bits are '1',p_{i-1} pixels value will increase by 1.

Otherwise, the p_{i-1} pixels value will not be modified.

(b) $p_i < z_i$

For all intensity values of pixels located between $p_i + 1$ and $z_i - 1$,

[$p_i + 1$, $z_i - 1$], histogram shifts rightward by increase intensity value by one. Thus, a gap at grey level p_{i+1}

will be created. embedding bits are '1', the p_i is increased by 1. Otherwise, the intensity will not be changed.

3.3 Extraction

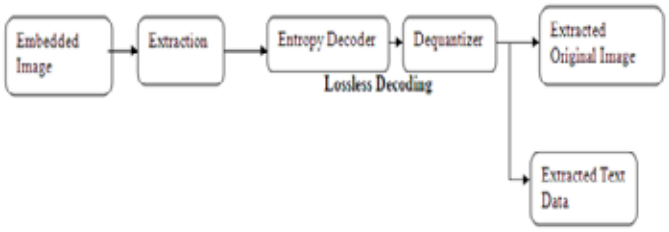


Fig. 3. Extraction Process

Data extraction process is a reverse process of data embedding.

3.4. Histogram Creation and Modification

For a host image, we first generate its histogram and find a peak point and a zero point. A peak point corresponds to the grayscale value which is the maximum number of pixels in a given image assumes. On the contrary, a zero point corresponds to the grayscale value which no pixel in a given image assumes. For example, the histogram of the grayscale Lena image (512×512×8) is illustrated in **Fig. 4**, in which the peak point is at 154 and the zero point is at 255. Let P be the value of peak point and Z be the value of zero point. The range of the histogram, [P+1, Z-1], is shifted to the right-hand side by 1 to leave the zero point at P+1. Once a pixel with value P is encountered, if the message bit is "1," increase the pixel value by 1. Otherwise, no modification is needed. We note that the number of message bits that can be embedded into an image equals to the number of pixels which are associated with the peak point.

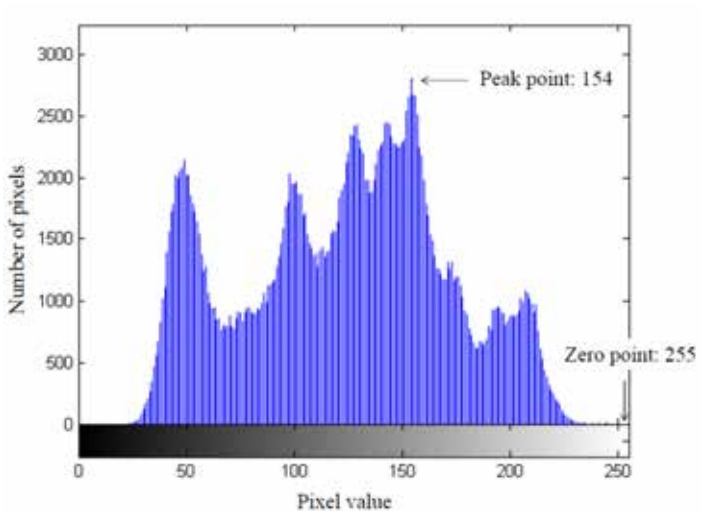


Fig. 4. Histogram of image 'Lena'

3.5 Rhombus Prediction and Sorting

To improve our previous work, we present the prediction sorting to generate the correlation of neighboring pixels. In order to predict the pixel value of position $u_{i,j}$ in **Fig. 5**, we use a rhombus prediction by considering four neighboring pixels $v_{i,j-1}$, $v_{i-1,j}$, $v_{i,j+1}$, $v_{i+1,j}$. All pixels of the image are divided into two sets: the "White" set

and "Gray" set. The pixel value u of the White set is predicted by using the four neighboring pixel values of the Gray set and to hide data. Note that the two sets are independent, which means changes in one set do not affect the other set, and vice versa. The center pixel $u_{i,j}$ can be predicted from the four neighboring pixels $v_{i,j-1}$, $v_{i-1,j}$, $v_{i,j+1}$, $v_{i+1,j}$. The predicted value $u'_{i,j}$ is computed as follows:

$$u'_{i,j} = \left\lfloor \frac{v_{i,j-1} + v_{i-1,j} + v_{i,j+1} + v_{i+1,j}}{4} \right\rfloor$$

In order to hide more data with less visual degradation the pixel difference needs to be changed. Thus, the cover pixels can be rearranged by sorting according to the prediction of neighboring pixels. To ensure the reversibility, we use a stable sorting algorithm to sort the prediction values. Sorting cover pixels according to the prediction values enables hiding data in pixel difference with high embedding capacity. As a result, this observation leads us toward designs in which the embedding is done in pixel differences according to the prediction sorting. Hiding data according to the sorting adapted to the rhombus prediction will be presented in more detail in Section

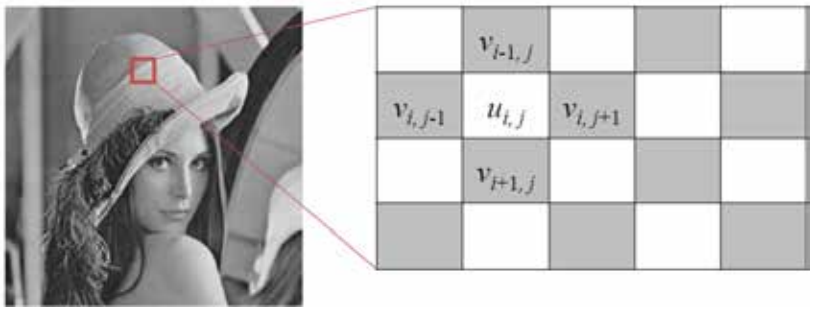


Fig. 5. Rhombus prediction

3.6 Histogram Modification on Pixel Differences

The reversible data hiding scheme for White set is designed as follows.

1) Predict the pixel value $u_{i,j}$ in White set using Eq. 1
2) Sort the host pixel $u_{i,j}$ according to the prediction value $u'_{i,j}$, and produce the sorted pixels $\{x_0, x_1, \ldots, x_i\}$ for $0 \le i \le N\text{-}1$ where N is the pixel number of White set.
3) Calculate the pixel difference d_i between pixels x_{i-1} and x_i by

$$d_i = \begin{cases} x_i, & \text{if } i = 0, \\ |x_{i-1} - x_i|, & \text{otherwise.} \end{cases} \quad \ldots.(2)$$

4) Determine the peak point P from the pixel differences.
5) If $d_i > P$, shift x_i by 1 unit:

$$y_i = \begin{cases} x_i, & \text{if } i = 0 \text{ or } d_i < P, \\ x_i + 1, & \text{if } d_i > P \text{ and } x_i \ge x_{i-1}, \\ x_i - 1, & \text{if } d_i > P \text{ and } x_i < x_{i-1}, \end{cases} \quad \ldots.(3)$$

6) If $d_i = P$, modify x_i according to the message bit:

$$y_i = \begin{cases} x_i + b, & \text{if } d_i = P \text{ and } x_i \ge x_{i-1}, \\ x_i - b, & \text{if } d_i = P \text{ and } x_i < x_{i-1}, \end{cases} \quad \ldots.(4)$$

7) Construct the watermarked White set according to the sorted pixels $\{y_0, y_1, \ldots, y_i\}$ for $0 \le i \le N\text{-}1$ where N is

the pixel number of White set.

The embedding scheme for White set computes predicted values using the Gray set and embeds data using the White set. Thus, the output of the embedding scheme for White set is the unchanged pixels from the Gray set and the watermarked pixels from the White set. Similarly, we can embed data in Gray set by considering the predicted values using the watermarked White set. The White and Gray embedding schemes are similar in nature. As a result, the consecutive usage of the White embedding scheme and the Gray embedding scheme results in nearly double the embedding capacity.At the receiving end, the recipient extracts message bits from the watermarked image by scanning the image in the same order as during the embedding. The recipient sorts the watermarked pixel $u_{i,j}$ in White set according to the prediction value $u'_{i,j}$, and produces the sorted pixels $\{y_0, y_1, \ldots, y_i\}$. The message bit b can be extracted by

$$b = \begin{cases} 0, & \text{if } |y_i - x_{i-1}| = P, \\ 1, & \text{if } |y_i - x_{i-1}| = P+1, \end{cases} \quad \ldots(5)$$

where x_{i-1} denotes the restored value of y_{i-1}.Then

the original pixel value of x_i can be restored by

$$x_i = \begin{cases} y_i + 1, & \text{if } |y_i - x_{i-1}| > P \text{ and } y_i < x_{i-1}, \\ y_i - 1, & \text{if } |y_i - x_{i-1}| > P \text{ and } y_i > x_{i-1}, \\ y_i, & \text{otherwise.} \end{cases} \quad \ldots(6)$$

Thus, the exact copy of the original host image is obtained.

Fig. 6 shows an embedding example for White set of a grayscale image with 4×4 pixels. We first predict the pixel value $u_{i,j}$ in White set using Eq. 1. Sort the host pixel $u_{i,j}$ according to the prediction value $u'_{i,j}$, and produce the sorted pixels $\{x_0, x_1, \ldots, x_i\}$. We then calculate the pixel difference d_i between pixels x_{i-1} and x_i. Thus, the peak point is 0 and the corresponding number is 5. Let us assume that the message bit-stream to be embedded is 01101. Since $|x_0\text{-}x_1|=|155\text{-}155|=0=P$, the first message bit 0 is embedded in x_1 by leaving x_1 unmodified. The difference between x_1 and x_2 is $|155\text{-}155|=0=P$, then the second message bit 1 is embedded in x_2 by setting $y_2 = x_2 + 1$ since $x_2 > x_1$. As $|x_2\text{-}x_3|=|155\text{-}156|=2 > P$ and $x_3 > x_2$, $y_3 = x_3 + 1=157$. The embedding process continues until all of message bits are embedded, and then theresulting watermarked pixels are obtained. Finally, we construct the watermarked White set according to the sorted pixels $\{y_0, y_1, \ldots, y_i\}$.Given P=0, we can completely restore the image to its original state before the embedding occurred. The recipient sorts the watermarked pixel $u_{i,j}$ in White set according to the prediction value $u'_{i,j}$, and produces the sorted pixels $\{y_0, y_1, \ldots, y_i\}$. Since $|y_1\text{-}x_0| = |155\text{-}155| = 0 = P$, a message bit 0 is extracted and $x_1 = y_1$. The difference between y_2 and x_1 is $|156\text{-}155|=1=P+1$, a message bit 1 is extracted and x_2 is restored by setting $x_2 = y_2 - 1=155$ since $y_2 > x_1$. Since $|y_3\text{-}x_2|=|157\text{-}155|=2 > P$ and $y_3 > x_2$, x_3 is restored by setting $x_3 = y_3 - 1=156$. The extraction process continues until all of message bits are extracted. Thus, the watermarked image is reverted to the exact copy of the original host image.

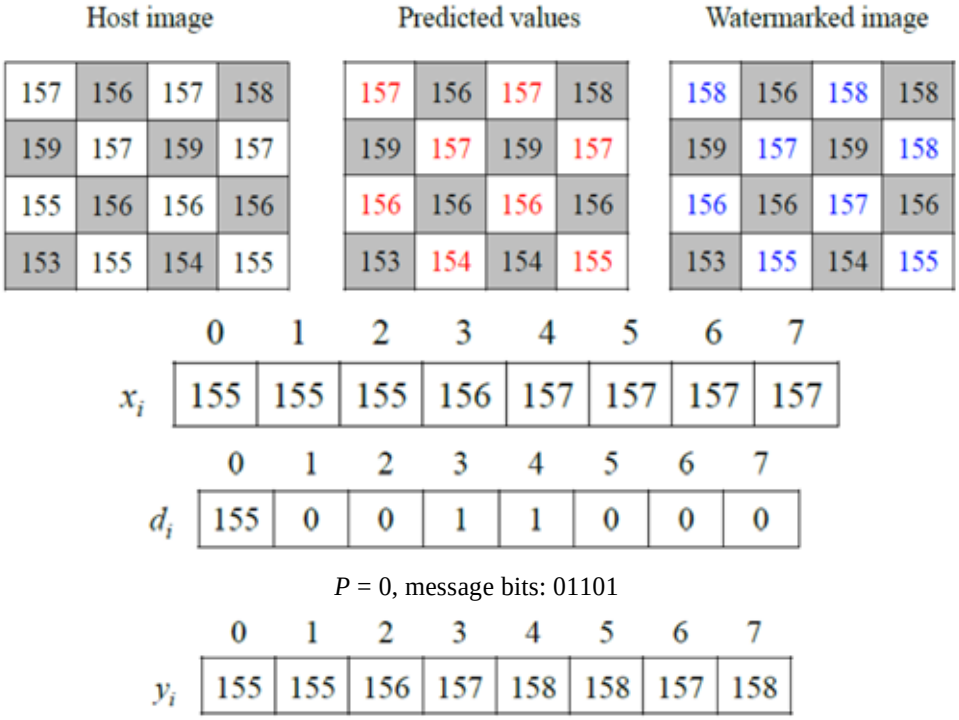


Fig. 6. An example of the reversible data

hiding scheme for White set

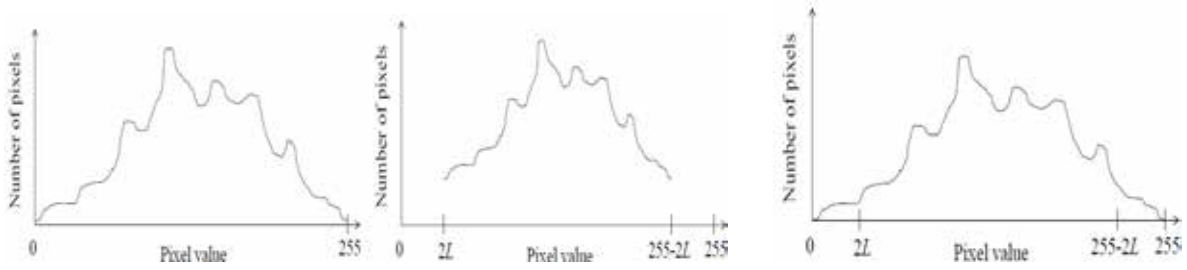
The above steps complete the data hiding process where only the White set is used to embed data. The White and Gray embedding schemes are similar in nature. Note that large embedding capacities can be obtained by repeated data hiding process in White set and Gray set.

3.7 Prevent Overflow and Underflow

Modification to a pixel may not be allowed if the pixel is saturated (0 or 255). Pixels causing overflow or underflow errors should be excluded. The condition

$$0 \le y_i \le 255$$

is used for finding such problematic pixels. To prevent overflow and underflow, we adopt a histogram shifting technique [21] that narrows the histogram from both sides as shown in **Fig.7**.Note that a single layer data hiding process consists of White and Gray data hiding. Let us assume that the number of peak points that we use to embed messages is L when we adopt the proposed L-layer data hiding scheme. Thus, we shift the histogram from both sides by L unit to prevent overflow and underflow since the pixel x_i that satisfies $d_i \ge L$ will be shifted by L unit after the embedding occurred



(a) (b) (c)

Fig. 7. Histogram shifting; (a) original histogram, (b)

After narrowing down the histogram to the range [*L*, 255-*L*], we need to record the histogram shifting information as overhead bookkeeping information. For this purpose, we create a one-bit map as the location map, whose size is equal to the size of host image. For a pixel whose grayscale value is in the range [*L*, 255-*L*], we assign a value 0 in the location map; otherwise, we assign a value 1. The location map is losslessly compressed by the run-length coding algorithm, which enables a large increase in compression ability since pixels out of the range [*L*, 255-*L*] are few and almost contiguous. We know that the maximum modification to a pixel is limited to *L* according to the proposed scheme. As a result, shifting the histogram from both sides by *L* units enables us to avoid occurring overflow and underflow. Note that peak points at every hiding pass and the location map need to be forwarded to the recipient in order to exactly extract the message. Thus, the overhead information needs to be embedded into the host image together with the embedded message. Next, we use two-stage embedding strategy to solve the problem about communicating peak points.

3.8 Lower Bound of PSNR

Obviously, the pixel x_i whose difference d_i is larger than peak point will be either increased or decreased by 1 in the data embedding process with one peak point. Therefore, in the worse case, all pixel values will be increased or decreased by 1 but the first pixel. That is, the resulted the mean squared error (MSE) is $(N\text{-}1)/N$, which is almost equal to 1 when N is large enough. Thus, the lower bound of PSNR for the watermarked image generated from the embedding process with one peak point is

$$\text{PSNR (dB)} = 10 \times \log_{10}\left(\frac{255^2}{\text{MSE}}\right) \geq 48.13 \text{ dB}.$$

As a result, the lower bound of PSNR for the watermarked image generated by our proposed algorithm with one peak point is theoretically proved larger than 48 dB, which is also supported by our numerous experiments.

IV CONCLUSION

In this paper, we present an efficient method histogram modification by considering the difference between adjacent pixels instead of simple pixel value. Further, we use prediction and sorting to enhance the correlation of neighbor pixels in order to improve the embedding capacity. In addition,To solve the problem of virtually histogram-based techniques is that they have to transmit pairs of peak and minimum points to recipients., we introduce the two-state strategy to embed the overhead information. We also use a histogram shifting technique to prevent overflow and underflow. As a result, the evaluation results show that the proposed scheme have significantly improved our previous work [21] and derived better performance.

This proposed system provides high capacities at small and invertible distortion. It can easily applied for compressed image formats, such as JPEG, MPEG, and JPEG2000, since the distribution of frequency coefficients is almost Laplacian distributed due to quantization and typical characteristics of images. Thus, the proposed system is able to be easily performed in the transform domain to improve the hiding ability.

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AN ASSESMENT OF PERCEPTION AND SATISFACTION OF STUDENT TOWARDS TRAINING

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ABSTRACT

The growth of professional education in India has been unprecedented since the privatization in the sector of higher education. Today the highly competitive market, in which education institutions, requires a skilful and competent student in order to remain a successful player in the competitive game of the industry. One of the main obstacles which occur in the environment of institutions is the lack of training and development. Soft Skill Training is the field concerned with organizational activity aimed at bettering the performance of individuals and groups in organizational settings. The overall aim of this paper is to study the perception and satisfaction of student about the training program.

Keywords: - Training, Student Development, Perception, Satisfaction.

I INTRODUCTION

The growth of technical education in India has been unprecedented since the privatization in the sector of higher education. Every technical college today attract students who meet the necessary eligibility criteria for enrolling in an management and engineering college, but unfortunately they are considerably lacking in soft skills and English language proficiency, which, as a result, makes these students unemployable, even after successfully completing their engineering and management degree course.

Students having a team spirit, positive attitude, effective time management skills, problem solving ability, effective communication skills, ability to handle criticism, self-confidence - combinely known as soft skills; are fittest one to survival in the tough corporate world and engineering, when compared with those students who are lacking in soft skills.

Today the highly competitive market, in which education institutions, requires a skilful and competent student in order to remain a successful player in the competitive game of the industry. One of the main obstacles which occur in the environment of institutions is the lack of training and development. Training on soft skill development is

becoming a significant aspect in the evolution of a student in education. Educational environment of professional student should be harmonized with corporate requisite. In education sector, there is constantly growing demand from aspirants for a course to groom them for required skills in corporate sector so that they achieve something. The educationists as a result are shifting their focus. They are more focusing on devising scientific ways by taking help of educational technology to fulfill their required need of students. So, personality development program has evolved to fulfill the need of industry. Therefore recently many educational institutions has introduced personality development programme in their curriculum. Most educational institutions have put stronger emphasis on the mode and module of personality development programme rather than the documented outcomes. The mode and module of training are keys because they adds value by helping students reflects on their experience and improve their ability to coherent and reveal resulting competencies during recruitment activities. Institutions have adopted various methods for personality development program like In house training and outsourcing. Training is an essential process which should be cautiously designed and implemented within all educational institutions.

II NEED OF THE STUDY

In response to the privatization of higher education, thousands of technical institutes have been established throughout India. In this scenario, the engineering and management colleges attract students from semi urban and rural areas who have received their school education in vernacular languages or Hindi. The global job market finds that these graduates are not employable, even after acquiring good technical skills while completing their degree course. Their soft skills, personality development standards and language proficiency are not at par with corporate requirements. A recent fall out of privatization and expansion of colleges is the requirement of soft skills training and English language proficiency classes for students of technical institutes. In response to the upcoming demand, today there are abundance of agencies offering personality development courses and soft skills training. The trend of free lancing agency trainers has trapped the mind of numerous private colleges, and they are spending lacks of rupees on these agencies that promise to bring a roundabout transformation in the rural youth into corporate honchos through various training methods that seem very impressive in the Board rooms, but fail miserably at the execution level, in the “hard realities” of the classroom atmosphere.

Soft Skill Training is the field concerned with organizational activity aimed at bettering the performance of individuals and groups in organizational settings. An educational institution which aspires to grow must be in tune with the changing needs of the corporate and society. Soft Skill Training becomes relevant in the context since it is only through training that the gap between performance of the educational institutions and the felt need of a changing corporate and society can be neutralized. Training reduces the gap by increasing students’ knowledge, skill, ability and attitude.

Every college needs the skilled students for placing them in the industry. The fast changing environment of corporate makes the knowledge of student obsolete. Soft skill training bridges the gap between corporate requirement and college. To achieve its purpose training needs to be effectively managed so that right training is given to the right

people in the right form at the right time and at the right cost. Training is different from college education. Training is purely vocational in contrast to education.

So soft skill training is mandatory to develop the student in college so that they can get success in their personal and professional life. Soft skill training strongly influence the productivity, efficiency, assertiveness, decision making, leadership and communication skill in student. Therefore, it is necessary to study on combination of tool, system and training practice to develop above skills in students. A holistic approach to the training is required for optimum results.

III SCOPE OF THE STUDY

Soft skill training is mandatory for students to meet the requisite of corporate and college. It will help the colleges also to increase their ranking. It will also increase their satisfaction level of student. Training can improve their perception in the mind of student which has greater impact on the admission of students. In this research, the emphasis is to identify the perceived effectiveness of training programme among the student in College. This extends to enable the educational institution to conduct better training programmes and to adopt new methods of training programme.

IV OBJECTIVE OF THE STUDY

- To assess the perception of the UG students towards the quality of training provided to them.
- To assess the perception of the PG students towards the quality of training provided to them.
- To compare the perception of UG and PG students towards the quality of training provided to them.
- To identify the dimensions of training quality in a private professional institution.
- To identify the relationship between the training dimensions and the overall satisfaction of the students.

V RESEARCH METHODOLOGY

5.1 Research Design

This study is based on descriptive research design and the empirical work has been done to understand the perception of UG and PG students of a private professional institution towards the quality of training being provided to them. The study is conducted in Ghaziabad city and satisfaction of the students is measured using a questionnaire. The sample size comprises 80 UG Students and 80 PG students & the Non-probability, convenience sampling method is used to collect the data.

5.2 Research Instrument

Both primary as well as secondary data was used to conduct the research. The sample unit comprises of UG and the PF students of a private professional institution in Ghaziabad. The students of different professional institutions

across Ghaziabad were contacted through e-mail/postal/personal contacts by means of questionnaire survey. A questionnaire is prepared containing 25 items and a respondent needs to answer in terms of Likert-type scale from 1 to 5 (1, strongly disagree and 5, strongly agree). The first part of the questionnaire asks about the demographic profile of the candidates i.e. name, age, gender, course and year of study.

The data used in this study is both primary as well as secondary. The primary data was collected through survey method. Survey is conducted by using a questionnaire. On the first part of the questionnaire, respondents were asked about their demographic profile, i.e. name, age, gender, and year of study. The second part of the questionnaire examines the perception of students regarding the overall quality of the training on a Likert's five point scale anchored by "strongly disagree" (1) to "strongly agree" (5). Since the questionnaires were distributed personally, we could avoid non-responses (Lagrosen *et al*., 2004)

5.3 Instrument Validation

It is done to verify that extent to which the content of the item is consistent with the construct definition, based solely on the researcher's judgement. After having a detailed discussion with the experts and suggestions received from them, necessary changes were incorporated in the questionnaire. The improved suggestion from experts improved the language of the questionnaire. Principal component analysis was used for establishment of validity of the instrument.

5.3.1 Content validity

To establish the content validity, the list of operational definitions of the construct and variables were given along with the questionnaire to the experts. After going through the definitions and questionnaire, the expert panel suggested that some of the questions could be dropped and some were reworded and rephrased.

5.3.2 Construct validity

It is the extent to which a set of measured variables actually represents the theoretical latent construct for that, variables are designed to measure. The objective is to validate the theory behind the test. Principal Component Analysis with varimax rotation was used to examine the structure of the questionnaire.

The identified six training constructs have been treated as independent variables and factor analysis has been used to structure these factors. Also, the Kaiser-Meyer Olkin (KMO) measure is used to assess the suitability of the sample for each unifactorial determination. The KMO coefficients for the six constructs ranging between 0.772 and 0.898 ensured sampling adequacy and supported the appropriateness of the data for each unifactorial determination. Barlett's test of sphericity test the items are uncorrelated in the population. Suitability of the data can be checked by chi-square value. Determinant value checks for the multicollinearity, the problem exists if the determinant value is less than .00001. The analysis is shown in the table below:

TABLE I: Construct Validity Through Principal Component Method

Constructs	KMO Measure of Sampling Adequacy	Barlett's Test of Sphericity	Determinant Value
STUDENT INFORMATION	.657	Sig. = .000<.001	.001>.00001
TRAINING QUALITY	.705	Sig. = .000<.001	.115>.00001
ASSESSMENT	.734	Sig. = .000<.001	.003>.00001
TRAINING CONDITIONS	.758	Sig. = .000<.001	.158>.00001
LEARNER ENGAGEMENT	.638	Sig. = .000<.001	.120>.00001
WORK READINESS	..663	Sig. = .000<.001	.163>.00001

5.3.3 Criterion related validity

The basic idea of criterion-related validity is to check the performance of the measure against some criterion. Traditionally, criterion-related validity is evaluated by examining the correlations of the different constructs with one or more measures of quality performance (Saraph et al., 1989). In the present study, the students' satisfaction of is the outcome of the six training constructs. The correlation analysis of these six quality training variables with the outcome, students' satisfaction is given in Table II. It should be noted that all the variables have significant positive correlations with students' satisfaction, thus establishing a criterion-related validity.

TABLE II: CRITERION RELATED VALIDITY

CONSTRUCTS	Correlation Coefficient with overall satisfaction
STUDENT INFORMATION	.781
TRAINING QUALITY	.635
ASSESSMENT	.732
TRAINING CONDITIONS	.663
LEARNER ENGAGEMENT	.875
WORK READINESS	.634

5.3.4 Instrument Reliability Assessment

After finding out the unidimensionality of scales, internal consistency has been estimated using a reliability coefficient such as Cronbach's a (Cronbach, 1951) on the given set of Training quality constructs using the "reliability analysis" procedure of SPSS. The "alpha" model for determining internal consistency is derived for all the six individual constructs. The Cronbach's a value for these six constructs ranges between 0.634 and 0.875. All the values are above the threshold value of 0.70 (Nunnally, 1978) and demonstrate that the scales are consistent and reliable. The details can be shown in Table III:

TABLE III: RELIABILITY ANALYSIS OF THE DIMENSIONS OF QUALITY ASSESSMENT

Constructs	α-value

STUDENT INFORMATION	0.876
TRAINING QUALITY	0.789
ASSESSMENT	0.870
TRAINING CONDITIONS	0.713
LEARNER ENGAGEMENT	0.725
WORK READINESS	0.639
OVERALL QUALITY OF THE INSTITUTION	0.951

VI RESEARCH HYPOTHESES

For the execution of this research following hypotheses were formulated and studied. An appropriate statistical test is used to test and validate the hypothesis.

H_1: There exists a significant difference between mean perception scores of undergraduate and postgraduate students of private professional Institution with respect to training variables such as:

H_{1a}: There exists a significant difference between mean perception scores of undergraduate and postgraduate students of private professional Institution with respect to Student Information

H_{1b}: There exists a significant difference between mean perception scores of undergraduate and postgraduate students of private professional Institution with respect to Training conditions

H_{1c}: There exists a significant difference between mean perception scores of undergraduate and postgraduate students of private professional Institution with respect to Training quality

H_{1d}: There exists a significant difference between mean perception scores of undergraduate and postgraduate students of private professional Institution with respect to Assessment

H_{1e}: There exists a significant difference between mean perception scores of undergraduate and postgraduate students of private professional Institution with respect to Learner Engagement

H_{1f}: There exists a significant difference between mean perception scores of undergraduate and postgraduate students of private professional Institution with respect to Work Readiness

TABLE IV: T-value for comparing the means

Constructs		N	Mean	Standard Deviation	Standard Error	t-value	Sig.
STUDENT INFORMATION	UG Students	80	3.458	.450	.116	2.51	**.015***
	PG Students	80	2.93	.755	.119		
TRAINING CONDITIONS	UG Students	80	3.44	.674	.174	1.42	**.160**
	PG Students	80	3.07	.900	.142		
TRAINING QUALITY	UG Students	80	3.40	.406	.104	3.55	**.001****
	PG Students	80	2.68	.738	.116		

ASSESSMENT	UG Students	80	3.45	.342	.089	2.35	**.022***
	PG Students	80	3.01	.691	.109		
LEARNER ENGAGEMENT	UG Students	80	3.57	.407	.105	2.64	**.011***
	PG Students	80	2.98	.817	.130		
WORK READINESS	UG Students	80	3.47	.398	.097	2.49	**0.16***
	PG Students	80	2.89	.755	.117		

**Correlation is significant at the 0.01 level

*Correlation is significant at the 0.05 level

H2: The 6 constructs of training: Student Information , Training quality , Assessment , Training conditions, Learner Engagement ,Work Readiness together predict the overall satisfaction of UG and PG students'.

TABLE V: Model Summary[b]

Model	**R**	**R Square**	**Adjusted R Square**
1.	.904[a]	.832	.804

a. Predictors: (Constant), Student Information , Training quality , Assessment , Training conditions, Learner Engagem Work Readiness

b. Dependent Variable: Satisfaction

TABLE VI: ANOVA

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	**Regression**	20.308	5	4.462	57.790	.000[a]
	Residual	2.673	49	.095		
	Total	22.982	54			

TABLE VII: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		

1	(Constant)	-.036	.227		-.165	.768
	Student Information	.362	.141	.378	2.420	.012
	Training quality	.199	.055	.232	2.782	.007
	Assessment	.111	.121	.109	.831	.416
	Training conditions	.137	.121	.127	1.362	.158
	Learner Engagement					
	Wok Readiness					

a. Dependent Variable: Satisfaction

H3: There is a positive correlation between the various variables of training.

TABLE VIII: Intercorrelation Matrix Among The Dimensions of training

DIMENSIONS	STUDENT INFORMATION	TRAINING QUALITY	ASSESSMENT	TRAINING CONDITIONS	LEARNER ENGAGEMENT	WORK READINESS
STUDENT INFORMATION	1	.727**	.871**	.811**	.690**	.515**
TRAINING QUALITY		1	.683**	.581**	.532**	.642**
ASSESSMENT			1	.792**	.713**	.734**
TRAINING CONDITIONS				1	.578**	.827**
LEARNER ENGAGEMENT					1	.886**
WORK READINESS						1

**Correlation is significant at the 0.01 level.

6.1 Interpretation

The various dimensions of training quality assessment were subjected to a correlation analysis. The dimensions were found to correlate with one another. The hypothesis failed to get rejected and it was proved that there is a positive correlation between the various dimensions of training quality assessment.

VII RESULTS AND DISCUSSION

T-tests have been conducted to determine the perception of UG and PG students on training quality (Table IV). It can be concluded from the table IV that there is a significant difference in the mean perception scores of the respondents with all the training dimensions except 'Training Conditions' hence, it shows that UG and PG students do not differ in their perception towards training conditions. Hence, the hypotheses **H_{1a}, H_{1c}, H_{1d}, H_{1e} and H_{1f}** are accepted and H_{1b} is rejected.

Form the table V, VI, VII, it can be seen that the dependent and the independent variables are highly correlated with each other also tolerance and VIF value denotes that problem of multicollinearity does not exists here.

The F statistic value is 57.790 with p-value (p=0.000), is less than alpha value (0.05). This means that all 6 independent variables affect the dependent variable simultaneously. Hence the model is assumed useful in predicting overall satisfaction. R square = 0.832 i.e. 83.2% of variance in overall satisfaction is explained by the 6 independent variables. The results shown proves that all the 6 variables are significant predictors of the overall satisfaction. Hence, the hypothesis H2 is supported.

From table VIII, it can be concluded that all the dimensions of training quality are correlated with each other and the hypothesis H_3 is accepted.

VIII CONCLUSION

Soft skill training to management and engineering students is necessary to develop their skill and help to get settle in the corporate world. In this research paper we have focused to analyze the different parameters of training and their perception and satisfaction in the mind of UG and PG students. For effective training student should have effective trainer and prior information about the training program. The training program should be according to the need of the student. The students highly focused upon the engagement of the learner and both the UG and the PG students have the same views towards it.

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ARCHITECTURAL AND MANAGEMENT CONCEPTS IN CLOUD COMPUTING

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ABSTRACTS

The general trend of computing is such that it can be the fifth basic assumption elements such as the water, Power, Gas and telephone. In such a case, the users based on their needs and regardless of whether and where a service is or how it is delivered, tries to access it. IT experts have provided a variety of computing systems to meet the needs of these users. The main idea of the cloud computing is to providing software services to the users and organizations at all levels over the internet. In order to achieve the highest level of performance in the cloud, deploying the cloud computing must be monitored and managed. Cloud management software provides, capability of fault management, configuration, accounting, performance and security. In this paper, we will try to evaluate the types of managerial implications available in the cloud computing and their use, architecture for cloud management, challenges in cloud management-relevant security issues, and cloud management standards and clouds future.

Keywords: Cloud Computing, Security, Cloud Management

I. INTRODUCTION

In fact, the mean of the term cloud in computing, is the internet, that is uses universally. In fact, the word clouds, includes another aspect that we have no any valuable information about this massive cloud from the aspects of the software resources. Suppose that you want to edit one of the photos that you have taken in the park. You will enter your photos in your computer. Except from ability to work with software for editing photos, you must have the software on your computer. Suppose that for this purpose you have selected Photoshop software. As you know, this application is under exclusive adobe.

So obviously this is not freeware and it is not true that the copied version and crack one uses. After the first stage you need to pay the cost of the software to purchasing it that it is not unclear that when you may have to use it.One of the aspects of cloud computing is file sharing topic and having the private cyberspace. This gives you the option to have the space of about one million gigabytes to whatever you want stored in it by any devices such as mobile and … and in anywhere you have it in your possession. In addition to detailed discussion of cloud computing it includes a little discussion about the operation systems under the web platforms.

II. BENEFITS OF CLOUDS

1-Reduce Cost: This technology greatly reduces costs.

2-Increase performance: efficiency of the systems increases without any cost.

3-Easy maintenance: Because of that there was no need to install any applications per user the maintenance of it is easier and has lower cost.

4-Scalability: Users can access dynamically on demand to the resources and there is no need prior preparing to times of maximum resource consumption.

5-Fast execution: The computers systems of the cloud can be faster boot and set up.

6- Green technology: The computers of the cloud computing systems because of usingthe virtual data center environment less causing global environment warming. That's why it's called green technology.

7- Mobility and portability: Users are not restricted to a particular computer system on the network or cloud.

8- Increase in storage capacity: One of the remarkable effects of this approach to increase the capacity of the computersand theusers has not to raise their own.

III. LIMITATIONS OF CLOUDS

1- Loss of data:

Because of we have no aware about the places of the data or how to processing may be it is overwrite or may be deleted.

2- Stealing the credit:

May be hackers by using your user/passabuse your data or alter or delete the information contained therein.

3- Control of the processes:

Because of have no information about the place of storing the data and processing of them, thus he doesn’t able to have control over the process.

4- Internal attacks:

The cloud employees that have access to user coding's like hackers can use the information, manipulate information in the cloud or clear them.

5-Legal aspects:

Because of freshness there is no any legal aspect for the prosecution and there is no any possibility of complaints.

6- Jurisdiction:

May be not meet the user's expectations correctly and understanding of the possibilities provided by the customer or not.

7- Transfer from one provider to another:

Since recently it was not possiblethat the user can transfer his information from one provider to another provider.

8- Reliability:

While using the clouds, must ofthe needs of the users to be fixed. However, factors such as lack of control over unauthorized users or processes and that the other factors are of lower reliability.

9- Inspection capability:

As mentioned being new to the legal aspects of prosecuting of it still did not applied and there is no possibility of complaints.

10- Quality of Service:

Companies may offer different services and cloud services provide broad, but there is a probability that the provided services are expected by user's aimed service quality is not be done.

IV. TYPES OF CLOUDS IN CLOUD COMPUTING

1- Private Clouds

A private cloud is a cloud computing infrastructure that was created internally by an organization for which the organization uses.

2- Public Clouds

Describes cloud computing's in the traditional mainstreams sense of it.

3- Hybrid clouds (mixed)

Provide a hybrid cloud that includes multiple internal and external, is a good choice for most businesses.

4-Group clouds

Cloud infrastructure is shared between multiple organizations and a group that supports collaborative and same tasks.

5- Management Challenges:

* Vulnerability againstEconomical Pressures

Computer service models, is very vulnerable to the economic downturn. During a recession, as companies are cautious, costs incurred for services they will do reduce the computers costs.

* The new forms of software

The software professionals, faced with several new challenges, in create software that millions of computer users instead of running it on their own pc's, and that they can use it as a service.

* Compliance

This approach is relatively is new approach and in many cases still it is not accepted.

* Control

The Service providers usually are not designed IT platforms to support specific business practices of the company's, in additions, the users will not be able to change the technology platforms when they needed. However, given that what technology providers to best meet the needs and when needed it can change, that this work is done without the consent of the customer.

* Bandwidth costs

Regarding to the high network bandwidth, even when the user is using the web as a universal computer,he feelshe is working on the local system.

* Trappingwith providers and Standards

There are needs to using the open standards for all modes of sweeping the web as a computer. With the increasing of the number of cloud providers the importance of mobility will be increases. If a company is dissatisfied with the services of the providers; or if the seller of this business withdraws, it cannot be necessarily an easy and low cost, be transferred to another provider, Or that the services will be restored back into the company.

*Access transparency

Ifthe companies couldn't show who has access to the customers dataand how to prevent unauthorized staffs to access to the information, they will not be able to successfully come out with the accounting of their capacity via future customers.

* Privacy protection

Privacy advocates are criticizing the cloud model, because cloud service providers can full monitor and control legal and illegal on the data and relationships between service users and their cloud hosts.Events such as the secret NSA program, United States of America (CIA), that has recorded more than ten million American citizen telephone conversations, creates distrust among privacy advocates have been.

* Security

The relative security of cloud computing is controversialthat may be cause delay in the adoption of cloud computing. Some believes that the security of data is higher when they are in the office,while the others believe that the service providers have strong motivations to maintain trusts, and hence uses a higher security level.

* The availability and effectiveness

In addition to security of host data, availability and performance of applications that are hosted on cloud are also has a high importance.

V. CONCLUSIONS AND THE FUTURE WORKS

In this research we examined the performance of cloud computing as well as administrative and security problems. One of the future workscan be reviewing of the security status of these services in Iran, comparison with the other countries.

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DISTANCE MEASUREMENT USING STEREO VISION

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ABSTRACT

In this paper, we propose a novel concept of relative distance measurement using Stereo Vision Technology and discuss its implementation on real-time image processor. We capture two images using two CCD cameras and compare them. Distance is calculated for the object using a mathematical calculation using matlab algorithm. This algorithm is based on the concept of the triangulation method for distance (Proved Later), we can thus get the relative distances of objects in front of the camera. The output is displayed on a Computer screen in the form of a distance image . This system works in real time on a full PAL frame rate (720 x 576 active pixels)

Keywords: Stereo Vision, Relative Distance Measurement.

I.INTRODUCTION

As the world progresses towards human comfort and automation, distance perception forms an integral part of automated navigation and motion. There are several techniques that are implemented for the purpose of obstacle detection and distance perception. Some popular methods include use of infrared sensors, ultrasonic sensors, common RADAR technology, a combination of digital camera and Laser, etc. Most of these methods involve recording of time between transmission and receiving of the signal. Other systems may use Laser stripping, optical flow, etc. However the sensors used in these methods are very strongly affected by environmental conditions like temperature, fog etc. Also, these methods provide information only about the distance of the object and not its geometry. The image sensor that we use, i.e. the camera is less affected by environmental parameters and provides information about the distance of the object too which can be further utilized for navigation and other such purposes.

We cannot perceive distance of an image from its two dimensional representation. Distance here represents the distance of objects in the image from the center of two cameras. To extract distance we use a pair of images called stereo images. These images are of the same scene captured bytwo cameras separated by a horizontal distance. The correlation between object positions in the two images gives us the distance information that we seek. This is the concept of stereo vision and triangulation.

II.SYSTEM BLOCK DIAGRAM

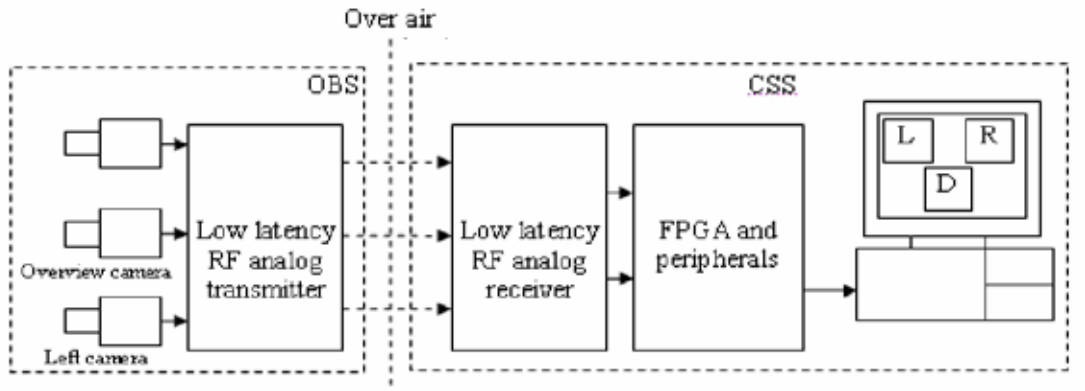


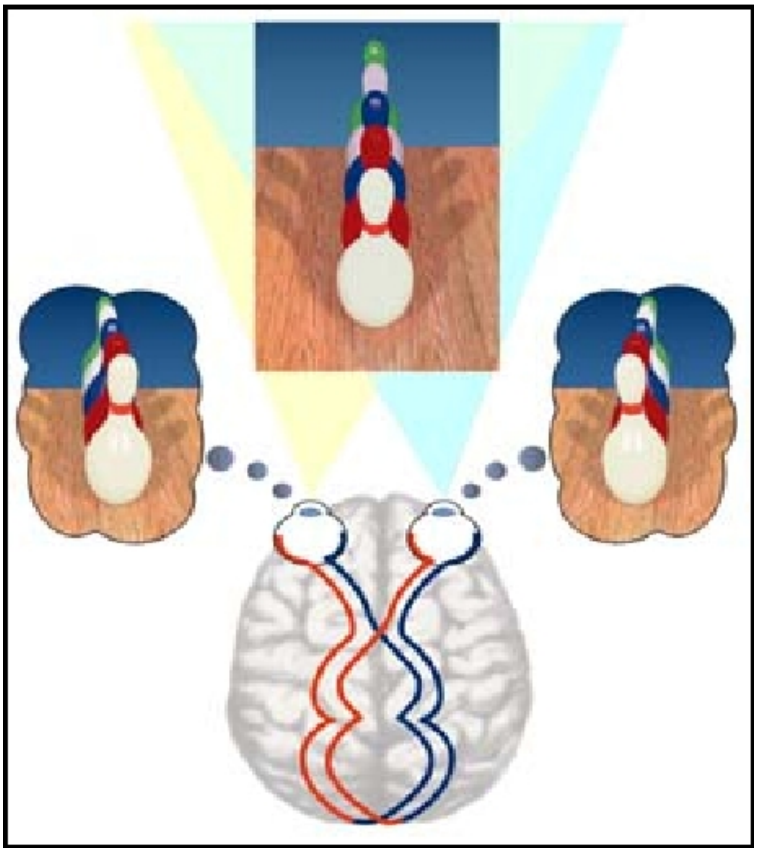
Fig. 1 Block Diagram of Overall System

2.1 Description

Inputs received from two cameras (left and right) placed in the field are transmitted through an analog transmitter-receiver pair. These images are received at the processing station. Images are processed to calculate the distance with the help of matlab algorithm and hence distance of the object is calculated. The output is displayed on computer screen in the form of centimeter. Also, the output in centimeter format is shown on a computer monitor in full frame size as well as full frame rate. An overview camera may also be provided to give the user a better perspective of the situation.

III.STEREO VISION TECHNOLOGY

Stereo means having 3 dimensions. It comes from the Greek word ‘Stereos’ which means firm or solid. Stereo vision technology is where 3-D images are used to judge the depth, contrast and distance of objects in our surroundings. 3-D image processing systems have reached the mainstream and are now embedded in a wide range of products including security and surveillance devices, industrial robotics, and autonomous vehicles. This concept of stereo vision is based on the human ‘Eyes and Visual System’. This is ‘Binocular Vision’. It is nothing but the ability to use two eyes to see an object as one. The human eye catches two images with the help of two eyes and integrates them into one. Thus we can achieve 3-D vision and depth perception.For instance, when you hold up an apple and look at it with just your right eye, the image will be different from the one you see with only your left. Not only that, you will notice that the position of the apple seems to have shifted, relative to the background. The apple will seem to be more to the left side when you look with your right eye, and conversely more to the right side when you look with your left. Yet, when the two images are sent from our eyes to the brain, it processes the two as one image. As the image of the apple from both eyes merged as one, it seems to us to be sharply-defined, detailed and depth-filled.



This concept is implemented in the electronic world with two cameras, which mimic the way the human eye captures two images. The two cameras are placed in an Epipolar fashion i.e. they are displaced horizontally. The cameras are then modeled whereby they will see slightly different projections of the world view and thus capture the left and right images. The correlation between these two images gives us the depth information that we seek. We can also obtain information about the geometry of the objects in the images.

IV.ALGORITHM DETAILS

Mathematical Representation:

P1 / P = D1 / D.

Where,

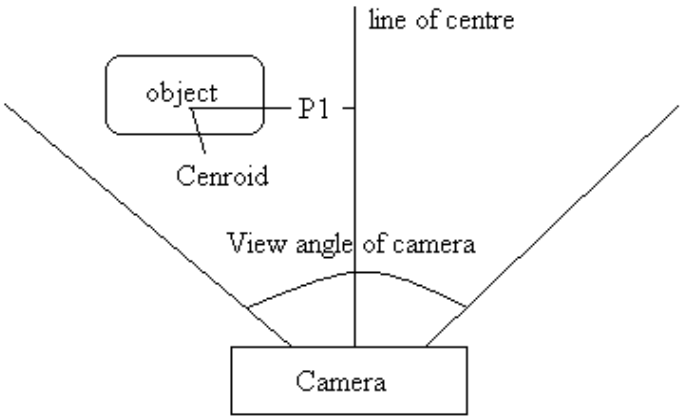
P1 represents pixel displacement from centre

P represents total pixel displacement of the camera

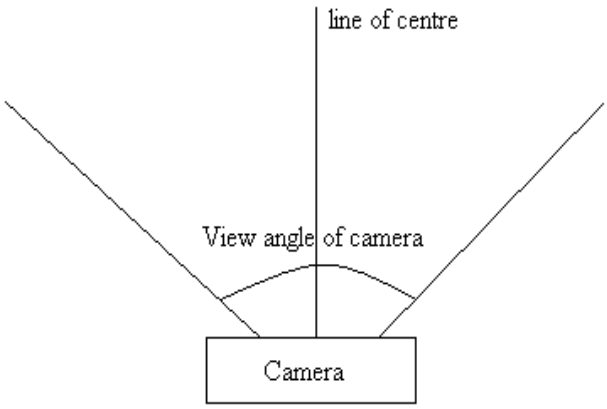
D1 stands for angle displacement from centre

D stands for total angle displacement of the camera

V. GRAPHICAL REPRESENTATION



Object recognized and observed to be at the left side of the camera from the line of centre.



The camera is rotated anti clock wise in steps of 18 degrees till the object centroid fall in the right quadrant of the camera, then the parameters are calculated which are needed to determine the angle displacement from the line of centre of the camera.

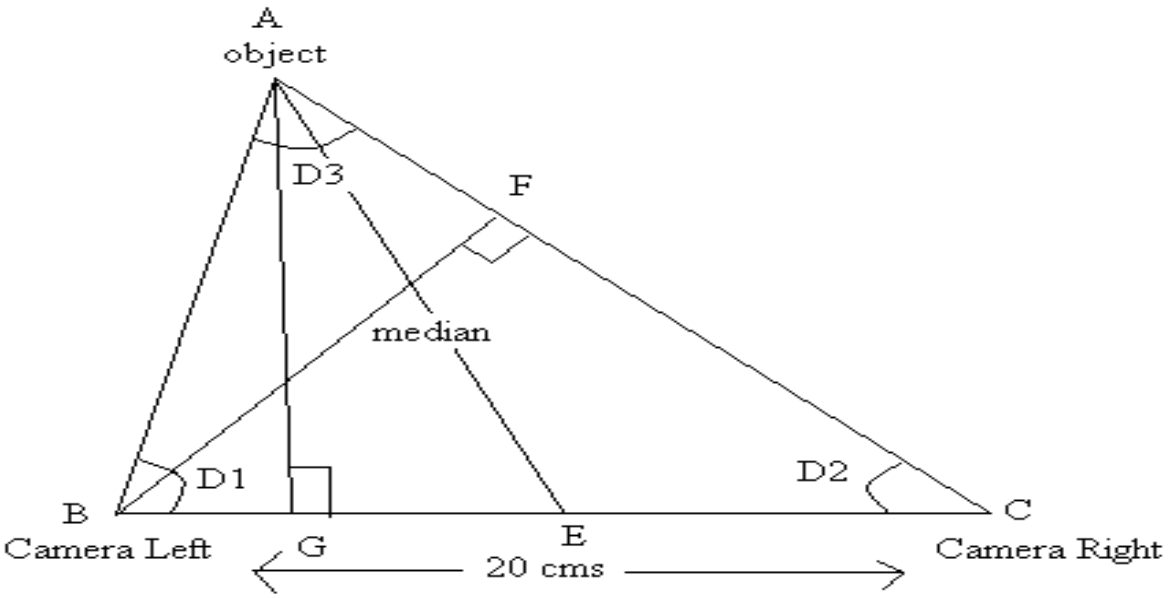
The camera is rotated anti clock wise in steps of 18 degrees till the object centroid fall in the right quadrant of the camera, then the parameters are calculated which are needed to determine the angle displacement from the line of centre of the camera.

Once the displacement angle is calculated, the object distance can be determined by using the following formulas:

Assuming that the object is on point A, left camera to be on point B and right camera to be on point C.

The parameters know are: D1, D2 and length of BC i.e. 20cms.

The parameter to be calculated is AE which is median to the triangle ABC, this median is the real distance of the object from the gadget**.**



Thus to calculate AE, following calculations must be executed:

In triangle BFC,

Sin (D2) = BF/BC à BF=BC * Sin (D2)

as D2 and BC (20cms) are known - Step 1

In triangle ABF,

Sin (D3) = BF/ AB à AB= BF/ Sin (D3)

as D3=180-(D1+D2) and BF is calculated from the above step -- step 2

In triangle ABG,

Sin (D1) = AG/AB à AG = AB* Sin (D1)

as AB is calculated from above step and D1 is known -- step3

Cos (D1) = GB/AB à GB=AB * Cos (D1) -- step 4

BE=BC/2 i.e. BE=10cms as median divides the base into two equal parts.

In triangle AGE,

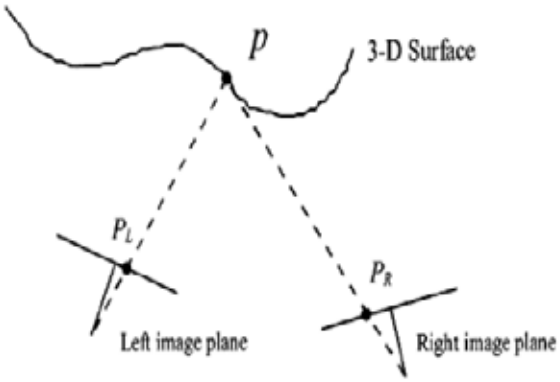
$AE = \sqrt{(AG^2 + GE^2)}$

as GE = BE-GB and AG is calculated from the step 3

Thus median AE is calculated, the distance of the object from the gadget.

VI. PROJECT SET-UP

As described, for implementation of stereovision two cameras will be employed, separated apart by a calculated distance, these cameras will be mounted on two individual stepper motors controlled by MATLAB program, these motors will be connected to the microcontroller which in turn will be connected to the computer via serial port, on recognizing the object with respect to its shape and color (matching with the database object), the MATLAB computation program will command the motors to make the object in the centre of image taken by both the cameras.



Web Camera mounted over stepper motor, analogous to human eyes. Once the object is aligned to the centre, the matlab software will count the deviation of the cameras from the centre thus calculating the angle formed from their straight line of sight. Therefore on calculating the angle formed and knowing the distance between the cameras, the distance from the object can be calculated.

VII. HARDWARE WORKING

This hardware works in conjunction with computer, it receives serial data from computer via serial port (DB-9) and acts in accordance to the commands. Two stepper motors (two phase with 0.9 degrees step angle) and a buzzer is connected to this circuit. Stepper motors acts as a base for left and right camera i.e. cameras are mounted on these stepper motor so as they can be rotated to clock wise or anti clock wise direction as required. Buzzer is used to give audible notification. All these devices are in control of microcontroller which serially accepts commands from computer and works in accordance to that.

Commands

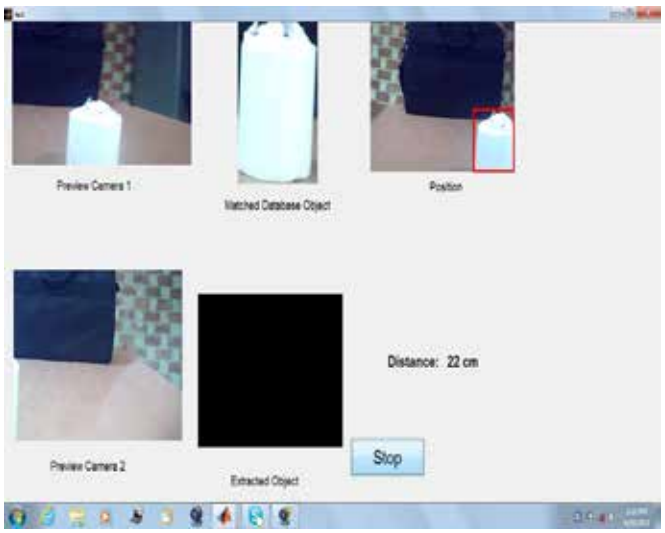
1. a<no. of steps> - rotates right stepper motor in clock wise direction, with specified no. steps.
2. b<no. of steps> - rotates right stepper motor in anti clock wise direction, with specified no. steps.
3. c<no. of steps> - rotates left stepper motor in clock wise direction, with specified no. steps.

4. d<no. of steps> - rotates left stepper motor in anti clock wise direction, with specified no. steps.
5. x – Buzzer on
6. y – Buzzer off

VIII. DISTANCE MESUREMENT OUTPUT FOR DIFFERENT DISTANCES

Here we are representing some experimental results for different distances. With the help of this distance measurement stereo vision system we can measure the distance which must be at least 20 cm far from the system. There are five windows for getting the result from this system. First window shows the output of left camera second window shows the output of right camera.

After taking the preview with the help of two cameras we store the object in database. Now when we start the distance measurement system then after taking the preview of the object, system will search the object in database and after matching the object result will display on the screen. There are another window for showing the position of object after matching the object in database and make a bounding box of the object. Now matched database object is shown in an another window matched database object shows the object which is matched with database object.



IX. CONCLUSION

In this paper we have proposed a novel concept of Implementation of stereo vision for distance measurement of the object by the triangulation method always gives improper results and failure. Thus a reliable method is proposed and results are shown in the theses. Practically in this project need a proper lightening and no moving

object in background when we run this project. In such practical conditions this technique is giving exact results. There are threshold values used in MATLAB program to recognize the objects and measure the distance of the object which is used in different fields. There are many aspects related to object recognition which are not considered like if object is in the same color of the back ground color.

X APPLICATIONS

1. Security and Surveillance Devices
2. Industrial Robotics
3. Autonomous Vehicles
4. Calculation of Contour Maps

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IMPLEMENTATION OF TOTAL PRODUCTIVE MAINTENANCE (TPM) IN INDIAN INDUSTRIES USING LEAST SQUARE MULTI ATTRIBUTE DECISION MODEL (LSMADM)

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ABSTRACT

Total Productive Maintenance (TPM) has gained wide spread acceptance for raising productivity, gaining profitability, improving the quality besides cutting down the break down costs immensely. The availability of a plant in general and machines in particular rises significantly if TPM strategies are implemented correctly and practiced companywide by one and all. A set of activities or practices that collectively decide the success or failure of TPM implementation are quantified using least square multi attribute decision model (LSMADM). The relative rankings of identifiedactivities which will be interchangeably called as attributes for the case situation are presented in this paper. The main attributes viz. productivity, quality, cost, safety, delivery, morale, work environment and competitive advantages are being considered as the major drivers to raise profitability of a firm. These attributes are determined on the basis of discussions held with industryexperts and literature survey. The prioritiesestablished using LSMADM will act as base line to implement the industrial activities in a more systematic and balanced way to gain far-reaching optimizedproductivity and quality standards.

Keyword: Attribute, Least Square Multicriteria Decision Model (LSMADM), Optimized Productivity, Total Productive Maintenance (TPM), World-class maintenance system [WCMS]

I INTRODUCTION

The unleash of liberalization and globalization have caused unprecedented business challenges making the maintenance function under the spotlight as never before. Industries all over the world are concerned to implement novel practices to reduce cost of operations to stay ahead and competitive (Monica R. 2014). Industries must gear up to set in place the priorities to guide their roles in a new era of competitiveness for sustainable, advanced and surging manufacturing systems (Prasanth et al 2015). The weightage of eachattributes must be known to establish the relative ranking among the attributes. The attributes which have high rank will contribute most towards raising the profitability, brand image etc. of the firm.

Every industry has to thrive to excel across all the business functions to gain the unparalleled productivity of all its resources. It is exhibited that the distinctive impact of TPM lies in raising the wide spectrum of productivity, quality and safety standards (RambabuKodali et al. 2001). An effective maintenance program is paramount towards making valuable contributions inenhancing production efficiency, plant availability, machinereliability and organizational productivity (Bamber, C.J., et al. 2003). World-class maintenance system [WCMS] has evolved through numerous tried and tested noble practices (Patterson et al 1995). These practices must be accorded priorities for satisfactory implementation and intervention within the scope of corporate work culture and work environment.

II DEFINITION OF TOTAL PRODUCTIVE MAINTENANCE

TPM differs from thetraditional practices in reinvigorating the compartment approach into a companywide culture of autonomous maintenance by everyone irrespective of department barriers. TPM aimsat improving the overall effectiveness, availability and restoration of plant performance to the maximum extent (Majumdar 1998). Traditional thinking has created an attitudinal barrier between production and maintenance departments. This creates the blame fixing and face saving environment across the various functions of industry. I operate you fix mentality has to be renounced.They indulged in passing the buck to each other. The production staff is providedmaintenance training to mend the machines themselves for minor ailments. Skilled maintenance craftsman ship is mostly a missing link in most traditional industries (Spratling, 1987). This often results in undue reliance on maintenance contracts with suppliers of original equipment and an erosion of in-house skills. Loss of in-house experience in maintenance, and of ownership of maintenance problems, has a devastating effect over time.

2.1 Description of Model

A methodical and comprehensive analysis of the problem is required along with the identification of the important attributes involved. A Delphi study is conducted to provide the initial relative importance of each attribute. There are variations in opinions. Only the most consistent data are averaged (Thakkar et al 2007). The effect of the variance is not considered. The relative importance provided here is solely based upon the data provided by expertsfrom industry and academia for the case situation given in table 1.

Table 1. Case Situation

Industry type	Process
Production volume	High
Company vision	World class company of national repute
Mission	Continuous improvement of products, processes and people

The attributes and the sub-attributes used in the LSMADAM model for the evaluation of relative weights are (RambabuKodali et al. 2001):

1) Productivity [PRO]

- Equipment [EQP]
- Energy [ENE]
- Material [MAT]
- Manpower [MAN]

2) Quality [QUL]

- Defects in process [DIP]
- Defective products [DEP]
- Claims from clients [CFC]
- Customer complaints [CCP]

3) Cost [CST]

- Reduction in manpower [RIM]
- Reduction in maintenance cost [RMC]
- Reduction in power consumption [RPC]
- Reduction in heat consumption [RHC]
- Reduction in operating cost [ROC]
- Reduction in breakdown [RIB]
- Reduction in rework [RIR]

4) Delivery [DEL]

- Stock reduced [STR]
- Dependable delivery [DPD]

5) Safety [SAF]

- Zero accidents [ZAC]
- Zero pollution [ZPO]

6) Morale [MOR]

- Increase in improvement ideas [IIM]
- Small group meetings [SGM]
- Group culture [GCL]
- Motivation [MOT]

7) Work environment [WEN]

- Free flow of information [FFI]
- Owner-ship of equipment [OEQ]
- Improved cooperation and coordination [ICC]
- Self-confidence [SEC]

8) Competitive advantages [CMA]

- Customized service and product support [CSP]
- Customer delightment [CDT]

- Value addition [VAD]

III DESCRIPTION OF ATTRIBUTES

A general description of each attribute is provided here in the following paragraphs.

3.1 Productivity [PRO]

The productivity improvement is instrumental to mend the performance of the manufacturing systems. The manufacturing systemconsistsof the resourcesof varied types like materials, labor, plant and equipment, tools, and others, used for production (Prabhuswamy, 2013). Each resource needs proper planning and execution of plans to reduce costs.

A well thought maintenance plan is responsive to improve the equipment availability and reliability. Overall equipment effectiveness (OEE) goes hand in hand to achieve the plant effectiveness (Sharma et al., 2012) and gain the control over the objective of high profitability. There are six preventable losses. The downtime loss is responsible to demean the plant availability.

Energy saving methods, wastages of energies, under capacity utilization of machines need to be analyzed and promising solutions are sought. The timely identification of deficiencies of worker's skills and providing prompt training to bridge the gap is all time event. Saving energy is companywide drive. All ways and means are explored to reduce hourly cost of operating plant.

3.2 Quality [QUL]

The Company must bring down to zero the production of defective products. Ifany activity involved from customer needs, product development, and product design is defective, the product cannot be good to use no matter how carefully it is manufactured and vice versa (Sivaram et al 2014). Quality of late is about producing future products in present time.TPM systems unfurlnew promising vistas that use the untapped potential off all the individuals to harness their strength to the fullest capacity and capability to achieve quality goals (Sila et al 2003).

3.3 Cost [CST]

A cost reduction should be applied to any activity if it reduces the cost in totality. The axioms ofindustrial premise are technology driven. The methods of yesterday are ineffective or obsolete to provide the cutting edge solutions. In any industrial activity some waste is bound to occur. Waste of time could be in the form of break down, rework etc. Spare parts and raw materials stocked in godowns are waiting to be used (Chandra, 1991).

3.4 Delivery [DEL]

It is all about to provide the rightproduct at the right time, in the right quantity at the right place. It may devise its method to enable collaborative planning, forecasting and replenishment to meet stated objectives (Korgaonkar 1992).The continuous replenishment program and vender managed inventory through advanced methods, as electronic data interchanged will provide the added advantage toestablish a balance between supply and demand and to substantiate the level of future demand for the firm. The third party logistic provider can aggregate inbound and

outbound transportation to gain production economies of scale. Its functions include forecasting, monitoring, shipment and allocation planning, and interfacing with other established systems in an organization (Martin, 1990).

3.5 Safety [SAF]

Working environment must be safe from accidents and safety points of view. Identification, assessment and control of environmental factors that are harmful to the health of employees will have an adverse effect on the health conditions of employees. These factors may be physical, chemical or biological agents or ionizing radiation. The scientificapproach must be adopted in applying industrial hygiene includes, identifying the extent of toxicity (Ahuja and J.S. Khamba., 2008).

3.6 Morale [MOR]

Employees well being, engagement to work, passion, enthusiasm, and commitment are different facets of Morale. Almost everything which happens to a human being at work such as delay in payment, the amount of information they receive, their organization in general or the lighting in their work area can affect his or her experience of "well-being" or "morale" , positively, or negatively (David Bowles, 2009). TPM enables the need for the employee involvement in the improvement efforts, collaborative practices, and delegation of decision making, and extending self directed roles

The factors stated, when taken care of, the employee morale is sustained high even in hard time (Rodrigues et al 2006). All time respect, recognition, and duly appreciation to employees, Empowering and engaging employees in decision making.

3.7 Working Environment [WEN]

All employees must take pride in the quality of their workmanship. Everyone observes and practices honesty, respect, and ethics into their daily business practices. The poor performing worker is not discouraged but deficiencies are identified and corrective measures taken to up bring it. All must assume the responsibility of their work. Team work culture is highly prevalent. The knowledge transfer is facilitated to see that the team outperforms and objectives are met (Attri, et al. 2012). All feel motivated if the find that their services are important.

3.8 Competitive advantages

TPM has been envisioned as a comprehensive manufacturing strategy to improve the competitive position of the company. The efforts of small groups and individuals in their capacity are all well synced to exploit the synergy of human resource (Brahy and Chongy, 2004). The quality of the process, the product issubjected to periodic scrutiny and continuous improvement to enhance reliability, maintainability and restore deterioration to gain competitive advantage. The benchmarking is key to know the competitor's position (Abhijeet, 2014). It gives space to know how the new levels of performances can be gained. The value addition to the product or services must be done conspicuously. The worth that a product or service bears in the mind of the consumer. The value of the product or service must be worth of money.

IV NEW LEAST SQUARES METHOD

In least square method, the error is $x_{ij} - w_i/w_j$. The parameter xijis the element of judgement matrix. It is the relative importance of attribute ivis a vis attribute j. The expression $x_{ij} - w_i/w_j$ is nonlinear which leads in the form a nonlinear programming problem. If the error is $x_{ij}w_j - w_i$, the expression is linear. Using sum of squares of error as objective function, the model is

$$\min \sum_{i=1}^{n}\sum_{j=1}^{n}(x_{ij}w_j - w_i)^2$$

Subject to the condition $\sum_{i=1}^{n} w_i = 1 w_i \geq 0, i = 1, 2, \ldots\ldots, n$

The Lagrange's function is given below

$$Z = \min \sum_{i=1}^{n}\sum_{j=1}^{n}(x_{ij}w_j - w_i)^2 + \lambda \sum_{i=1}^{n}(w_i - 1)$$

where,λ is known as Lagrange's multiplier.

The weights can be calculated by equating $\frac{\partial Z}{\partial w_i} = 0$ to minimize the error.

$$\frac{\partial Z}{\partial w_i} = -2(x_{ij}w_1 - w_i) - -2(x_{ij}w_1 - w_i) -$$

$$-2(x_{ij}w_n - w_i) + 2x_{1i}(x_{1i}w_i - w_1) + 2x_{2i}(x_{2i}w_i - w_2) + \cdots\ldots\ldots + 2x_{ni}(x_{ni}w_i - w_n) + \lambda =$$

$$-2(x_{i1} + x_{1i})w_1 - -2(x_{i2} + x_{2i})w_2 - \cdots\ldots\ldots\ldots [2(n-1) + \sum_{\substack{j=1 \\ j\neq i}}^{n} x_{ij}^2]w_i - \ldots\ldots - 2(x_{in} + x_{ni})w_n + \lambda$$

….

Let $\frac{\partial Z}{\partial w_i} = 0 (i = 1, 2, 3, \ldots\ldots, n)$, the result are

$-2(x_{i1} + x_{1i})w_{1 \text{ for } i\neq 1} - 2(x_{i2} + x_{2i})w_{2 \text{ for } i\neq 2} - \cdots\cdots\cdots + [2(n-1) +$
$2\sum_{\substack{j=1 \\ j\neq i}}^{n} x_{ji}^2]w_i - \cdots\cdots$ for above diagonal elements eg. for 3rd row $i = 3$, and $n > 3$, $-2(x_{in} +$
$x_{ni})w_n + \lambda$ =0

$(i = 1, 2, 3, \ldots\ldots, n)$,

Add $\sum_{i=1}^{n} w_i = 1$, We have alinear system about $n + 1$ equations . Solve the linear system, We obtain w1, w2, w3, ……wn and λ.

The a_{ij} values for Attribute Cost [CST] is given below:

Table 2: Relative importance of attributes of Costcriterion

$$A = \begin{bmatrix} 1 & 1/3 & 1 & 3 & 1/3 & 1/7 & 1/3 \\ 3 & 1 & 1 & 3 & 1/3 & 1/5 & 1/7 \\ 1 & 1 & 1 & 2 & 1/5 & 1/3 & 1/3 \\ 1/3 & 1/3 & 1/2 & 1 & 1/5 & 1/9 & 1/5 \\ 3 & 3 & 5 & 5 & 1 & 3 & 5 \\ 7 & 5 & 3 & 9 & 1/3 & 1 & 2 \\ 3 & 7 & 3 & 5 & 1/5 & 1/2 & 1 \end{bmatrix}$$

On applying the new least square method

$$\begin{bmatrix} -162.22 & 6.6667 & 4.0000 & 6.6667 & 6.6667 & 14.285 & 6.6667 & -1 \\ 6.6667 & -176.44 & 4.0000 & 6.6667 & 6.6667 & 10.400 & 14.285 & -1 \\ 4.0000 & 4.0000 & -98.500 & 5.0000 & 10.400 & 6.6667 & 6.6667 & -1 \\ 6.6667 & 6.6667 & 5.0000 & -314.00 & 10.400 & 18.222 & 10.400 & -1 \\ 6.6667 & 6.6667 & 10.400 & 10.400 & -8.9067 & 6.6667 & 10.400 & -1 \\ 14.2857 & 10.4000 & 6.6667 & 0.4444 & 6.6667 & -26.867 & 5.0000 & -1 \\ 6.6667 & 14.2857 & 6.6667 & 0.8000 & 10.400 & 5.0000 & -66.5652 & -1 \\ 1.0000 & 1.0000 & 1.0000 & 1.0000 & 1.0000 & 1.0000 & 1.0000 & 0.000 \end{bmatrix} \begin{bmatrix} w_1 \\ w_2 \\ w_3 \\ w_4 \\ w_5 \\ w_6 \\ w_7 \\ \lambda \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

The values of weights W_1, W_2, W_3, W_4, W_5, W_6, W_7 are 0.0473, 0.0441, 0.0776, 0.0346, 0.4815, 0.2022, and 0.1127 respectively.

Data Summary: The weights of attribute level 2, attribute level 3 and overall weights are given in the table

Table 3: Data Summary

Attribute	Weights Attribute Level 2	Sub-Attribute Level 3	Weights Sub-Attribute Level 3	Overall criteria weight
Productivity [PRO]	0.6053	Equipment [EQP]	0.6966	0.42
		Energy [[ENE]	0.1128	0.07
		Material [MAT]	0.0819	0.05
		Manpower[MAN]	0.1086	0.07
Quality [QUL]	0.1323	Defects in Process [DIP]	0.7182	0.10
		Defective Products [DEP]	0.1213	0.02
		Claims from clients [CFC]	0.0753	0.01
		Customer Complaints [CCP]	0.0852	0.01
Cost [CST]	0.0805	Reduction in Manpower [RIM]	0.047	0.00
		Reduction in maintenance cost [RMC]	0.044	0.00
		Reduction in Power consumption [RPC]	0.078	0.01
		Reduction in heat consumption[RHC]	0.035	0.00
		Reduction in operating cost [ROC]	0.482	0.04
		Reduction in break down [RIB]	0.202	0.02
		Reduction in rework[RIR]	0.113	0.01
Delivery [DEL]	0.0557	Stock reduced [STR]	0.7817	0.04
		Dependable delivery [DPD]	0.2183	0.01
Safety [SAF]	0.0419	Zero accident [ZAC]	0.8521	0.04
		Zero Pollution [ZPO]	0.1479	0.01
Moral [MOR]	0.0333	Increase in improvement ideas [IIM]	0.0704	0.00
		Small group activities [SGM]	0.0504	0.00
		Group Culture [GCL]	0.511	0.02
		Motivation [MOT]	0.3682	0.01
Work Environment [WEN]	0.0275	Free flow of information [FFI]	0.0668	0.00
		ownership of Equipment [OEQ]	0.2863	0.01
		Improve cooperation and coordination [ICC]	0.1321	0.00
		Self-confidence [SEC]	0.5149	0.01
Competitive Advantage [CMA]	0.0234	Customize service and product support [CSP]	0.1079	0.00
		Customer delightment [CDT]	0.1753	0.00
		Value addition [VAD]	0.7168	0.02

V RESULTS

The continuously improving and learningculture is essential to embark the implementation of TPM. There are a number of practices that are always discussed. All the organizations claim about knowledge ofthe same, but some are performing well compared to other. The implantation of these practices must be managed carefully. The priorities are given in figure 1.0 for main criteria. Now the industry must embrace what all needs to achieve the best performance in productivity, followed by quality, then safety and so on. The relative rank of all sub-attributes under main attributes is also given in the data summary table. The relative ranking of sub attributes of criterion cost is summarized below in figure 2.0. The quantitative ratings will help to know the priorities of the attributes. The deficiencies may sometime lead to disastrous situations if not safeguarded.

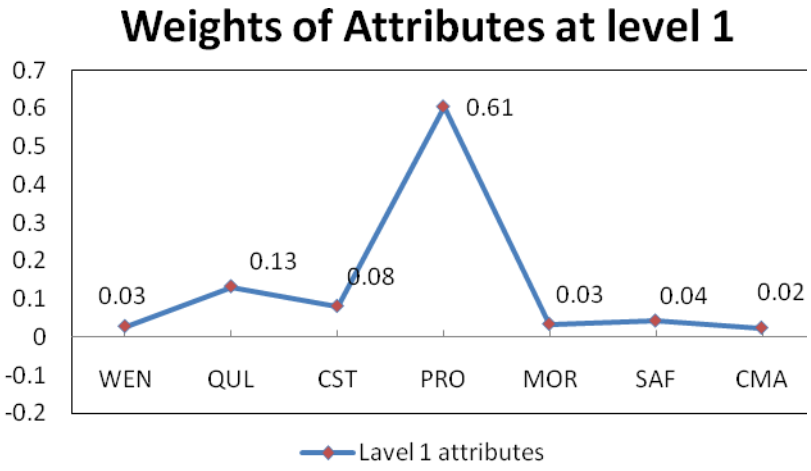

Figure 1.0: Relative weights of Main Attributes

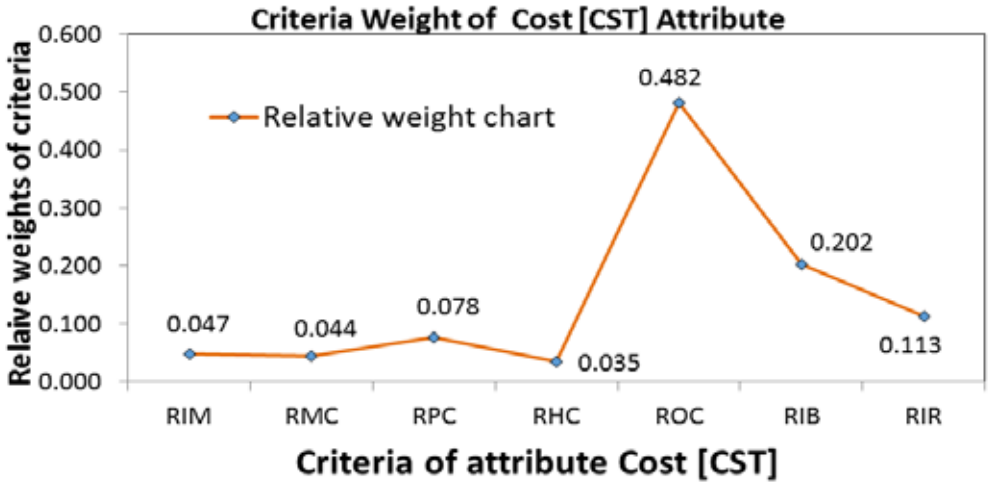

Figure 2.0: Relative weights of sub-attributes

The relative weights of all the sub attributes of all the main attributes are summarized below (refer figure 3.0). Equipment (EQP) is highest, followed by defects in process (DIP), then manpower (MAN), then energy (ENE) and so on. The priorities can be used for strategic decisions and operational planning.

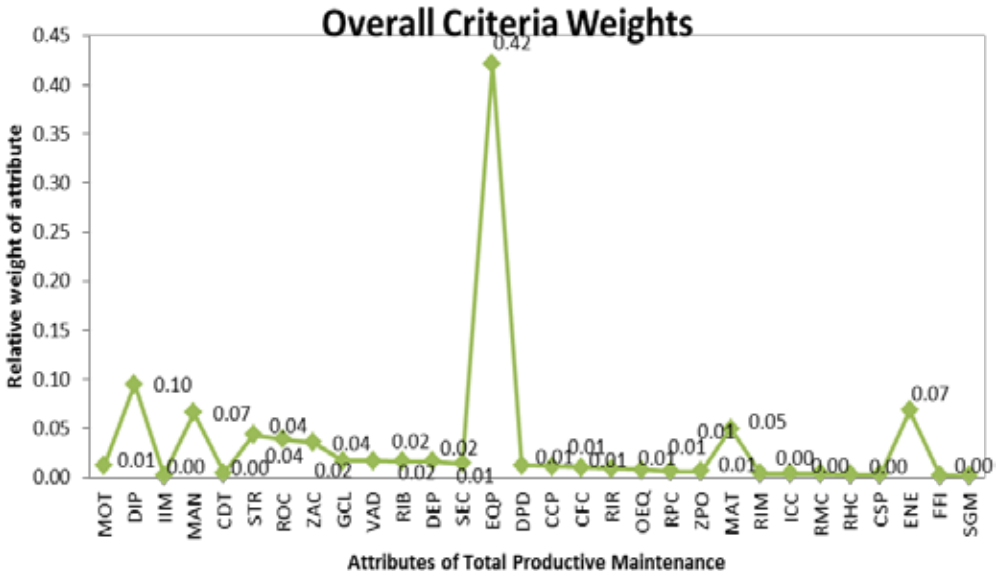

Figure 3.0: Relative weights of all the sub-attributes

VI CONCLUSIONS

The dynamically changing needs of manufacturing and formidable challenges coming from increasing global competition are making industries to re-examine the role of improved maintenance management towards enhancing organization's competitiveness. Unless the efforts are directed in required magnitude and ratio, it may be difficult to get optimal performance. The paper presents the hierarchy of rank so that efforts must align accordingly. Organization though committed their required resources and still confronted with the reality of poor performance, falls under great pressure to reinstate their competencies to create value to customers. Theimplementation has been failure in many organizations due to some or the other reason. Some makes management commitment responsible, some the training and skill levels, some blame corporate culture, some feels lack of understanding, the list goes on. This paper gives insight to implement under the scheme of the specific heads like productivity, quality, morale as the outcomes of performance. The present paper attempts to summarize the relative ranking of attributes of successful companies. The relative weights will help new organization to make their own frame work and embark upon the implementation of TPM. Equipment productivity form productivity is highly weighted, followed by defects in process of quality, then energy, man power, and material for productivity. So productivity is first to be emphasized. The quality is at second ranking thus a lot has to be done on quality.

Cost is coming next in the row, then safety and so on.

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