

# TECNO SAVIOR

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### **Vision**

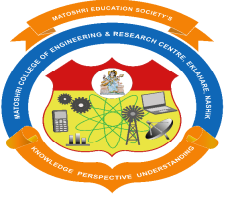
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- Setting up state-of-the-art infrastructure
- Instilling strong ethical practices and values
- Empowering through quality technical education
- Tuning the faculty to modern technology and establishing strong liaison with industry
- Developing the institute as a prominent center for Research and Development
- Establishing the institute to serve a Lighthouse for the society

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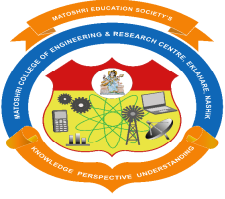
### *Optimal composition of plaster mortar reinforced with palm fibers*

*Mrs. S. T. Borole, Civil Engineering Department*

The Kyoto Protocol on global climate change has accelerated the transition to a sustainable and more environmentally friendly economy. This is primarily due to the gradual replacement of petrochemicals with renewable resources, such as the efficient use of local materials. Current materials research is concerned with the development of new composites of building materials, with the aim of improving the mechanical, physical and durability properties of these materials. The Algeria, especially the South, is rich in natural materials, which can then be used directly in the construction field he must study their properties in order to extend their use. Among these materials, which can be exploited, and that we will consider, plaster, sand dune, and the fibers of the Palm. The use of vegetable fibers in the reinforcement of building materials to improve certain properties, it is the most used technology currently, because these results and to expand the use of eco-materials. Algeria has unlimited sources of vegetable fibers (of Palm, Alfa Abaca, hemp, Cotton.), but their use in the construction of the almost non-existent field. The incorporation of the fibers of date palm in the mortar of plaster, is carried out in order to improve the tensile strength and decrease its fragility. The major assumption that the fibers allow the judgment of the cracking mechanism, delaying the start of the crack and the controlling once it appears. we will examine the effect of the addition of fibers of palm trees date palm to the physical and mechanical properties of the Mortar plaster. Where we are looking at the impact of the rate and length of the fibers of date palm on the characteristics of mortar plaster. To make our contribution to the enhancement of local materials, such as gypsum, dune sand and the fibers of the date palm. and integrate in a rational way in the field of construction. The study itself offers two essential objectives and which are: Study of composition of a pate of plaster pure and a mortar of plaster to basis of dune sand. The improvement of certain physical and mechanical properties of the Mortar plaster through its strengthening with the fibers of the date palm. and the study of the sustainability of this material.

Use of local materials (plaster, sand dunes and date palm fiber) for the region of southern Algeria. By expand areas of the use of these materials in the field of construction. Despite the large ament of gypsum, its use is limited to some secondary operations like coatings and decorative elements. The sand dunes and palm fiber, its use in the construction are very limited. In this study, the sand dunes and palm fiber was added to plaster, to find the mortar that has physical and mechanical properties that allow its use in construction. The results obtained showed that the addition of date palm fibers improves the physical properties (density, water absorption, etc) we have achieved an optimal composition for a mortar of plaster reinforced with fibers of date palm, which meet the different mechanical and physical characteristics and the requirements necessary for a building material, such as; the workability, to compression and flexural strengths, water absorption and density. The plaster mortar based on dune sand reinforced with date palm fibers seems to have a great future in certain areas, the technical and economic advantages of this material.

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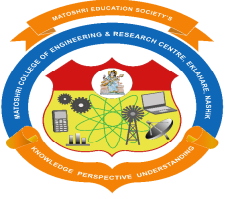
### *Modeling of compressive strength of concrete using pulse velocity values from a non-destructive testing of concrete*

*R. S. Mawal Civil Engg.*

In this article ultrasonic pulse velocity (UPV) and crushing strength tests were carried out. Major factors which affect the strength of concrete such as concrete mix, aggregate size, and water-cement ratio were considered such that the model obtained could be used for the determination of strength of concrete elements made under different conditions. Three proposed models were calibrated using some of the data generated in the laboratory. The models were verified and compared with two similar existing models using the remaining data. The following statistical parameters were adopted for the comparison; the square of the coefficient of correlation ( $R^2$ ), the root mean square error (RMSE), and the average relative error (AVE). The proposed and existing models produced significant values of coefficient of correlations ( $R^2$ ) of 0.9833, 0.9645, 0.9895, 0.9822 and 0.9645. The first proposed model generated the highest value of  $R^2$  (0.9895), and least values of root mean square error and average relative error (1.35 and 4.95%) respectively, while the remaining models yielded an appreciable range of errors. The performance of the first proposed model shows that the correlation between the compressive strength of concrete and pulse velocity values is a logarithmic function.

Casting of concrete during construction in some cases is carried out with certain uncertainties resulting from poor supervision and low-quality materials. It is imperative to carry out a non-destructive investigation after the setting of the concrete to check if the structure meets its predesigned characteristics. Non-destructive testing (NDT) is defined as the sequence of examining, testing or assessing materials, components or assemblies without destroying the serviceability of the part or system (Workman and More, 2012). The main aim of nondestructive testing is to evaluate the reliability of the component materials used without distorting or hampering the structure's ability to achieve the designed functions. Non-destructiveness is different from noninvasiveness. Testing methods which have no effect on the future usefulness of a part or the full structure can be considered as non-destructive even if there were invasive actions (Helal et al., 2015).

The most common tests on concrete structures can be categorized under non-destructive and partially nondestructive tests. The non-destructive testing creates no damage on the concrete such as ultrasonic pulse velocity and rebound hammer tests. Partially non-destructive testing creates little damage on the surface of the concrete such as core tests and pull-out and pull-off tests. The cost of carrying out non-destructive testing is by far less than that of partially non-destructive testing. It is important to carry out non-destructive testing of concrete elements of both old and new structures. To prevent some conceivable doubts especially when there are suspicions on the quality of supervision during construction, non-destructive testing when conducted should act as a quality assurance measure. For existing structures, non-destructive testing on the concrete is mainly to obtain the structural integrity and adequacy of the concrete which helps with the assurances on the safety of the structures. In words, if destructive testing is solely conducted by removing cores for the compression testing, the cost of coring and testing may only allow a relatively small number of tests to be carried out on a large structure which may be misrepresented. Nondestructive tests are widely applied to study mechanical properties and integrity of concrete structures (Helal et al., 2015; Ravindrarajah, 1997; Nazarian et al., 1997; Proverbio and Venturi, 2005). The non-destructive machines are adapted for multiple data gathering during the testing.

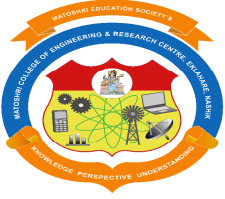


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Different methods of non-destructive tests are interrelated with each other for improved diagnosis of defects in a concrete element and to economize the number of tests (Breysse, 2012). Compressive strength is a commonly used parameter for the assessment of the quality of concrete. Although the results obtained using the destructive methods of determination of compressive strength can be closer to the actual values, they have their own limitations; some of which are; the cost of execution, a limited number of samples, partial or total destruction of the concrete element. Cube or cylindrical samples cast from fresh concrete may not be identical to in-situ concrete because of curing and placement differences. The partially nondestructive coring method consumes a lot of time and resources, and its effect can lead to damage of part or the entire concrete structure under study (Mehta, 1986). These aforementioned major limitations of destructive testing are the reasons why non-destructive tests are normally preferred. Schmidt rebound hammer test is one of the indirect measurement methods of the compressive strength of concrete.

The manipulation of rebound hammer is easy while the interpretation of results obtained during the testing is also very simple. However, rebound hammer test is greatly influenced by the properties of the surface of the specimen. Estimation of compressive strength  $N_{widi}$  13 using Schmidt rebound hammer can only be accurate if the density of the concrete is constant at every point within the element. Its major limitation is that it does not reflect on the internal properties of the concrete element. Vacuum cast concrete elements have greater surface hardness than normal concrete cast. The performance of Schmidt hammer tests could be worse for vacuum cast concrete (Mehta, 1986; Erdal and Simek, 2006). Ultrasound measurements provide a simple nondestructive and inexpensive method to evaluate the elastic modulus of concrete. In this method, the velocity of sound waves transmitted through the concrete specimen is measured. This velocity is dependent on the stiffness of the concrete specimen (Bungey, 1989; Malhotra and Carino, 2004). Pulse velocity measurements made on concrete structures may be used for quality control purposes with an advantage that they relate directly to concrete in the structure rather than to samples which may not be the true reflection of the concrete cast in-situ. Ideally, pulse velocity should be related to the results of tests on structural components and, if a correlation can be established with the strength or other required properties of these components, it should be desirable to make use of it. The relationship between ultrasonic pulse velocity and strength is affected by a number of factors including age, curing condition, moisture condition, mix proportion, type of aggregate and type of cement (BS 1881-203, 1986). The formulae proposed by different standards to estimate the dynamic modulus of elasticity from the resistance are very approximate (Baalbaki et al., 1992).

The dynamic modulus of elasticity is strongly influenced by the aggregates, and cannot be determined accurately based on the strength, which depends mainly on the cement paste and the particle size (Honza, et al., 2002). For temperatures between  $-10$  and  $+30^{\circ}\text{C}$ , there is an increase in the dynamic modulus of elasticity of the concrete with temperature (Gardner, 1990; Marzouk and Hussein, 1990). Meanwhile, a number of models have been propounded based on rebound numbers and ultrasonic pulse velocity. These are as shown in Table 1. Interpretation of Schmidt rebound hammer results can easily be done using the chart on the machine, while that of ultrasonic pulse velocity results has been a challenge



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in non-destructive testing of concrete. There is no information from the relevant standards on the direct interpretation of the results of ultrasonic pulse velocity tests in terms of compressive strength. Most of the results have been presented as a range of values. For example, Whitehurst (1951) published the following tentative classification for using pulse velocity as an indication of quality. Table 2 has been quoted in many subsequent publications; however, Whitehurst (1951) warned that these values were established on the basis of tests of normal concrete having a density of about 24 kg/m<sup>3</sup> and that the boundary between conditions could not be sharply drawn. It was also mentioned that rather than using these limits, a better approach would be to compare velocities with the velocity in a portion of the structure that are known to be of acceptable quality (Nicholas, 1997). In an effort to directly interpret ultrasonic pulse velocity tests, Ivan Ivachev interpreted results obtained through experimental procedures with EN 12504-4: 2004 and EN 2390-3:2009, and compare the results with theoretically calculated compressive strengths according to EN 1992 – 1- 1: 2004. The errors obtained ranged from 13.5 to 103.3% (Ivan, 2018). Another study was made on the improvement of compressive strength of concrete using the ultrasonic method. The parameters for interpretation are the dynamic modulus of elasticity of the concrete, bulk density of the concrete, and a factor k that depends on the quality of materials used. A recent study on nondestructive estimation of concrete elements using exactsize specimen (Watanabe et al., 2018) was good but very expensive, and forms one of the major limitations to this study.

This forms the basis of this research to look for the possibility of obtaining model(s) from the proposed models by using different mixes and different grades of coarse aggregate at different temperature ranges which to a certain level determines the compressive strength of concrete. The idea of using different materials and different grades is to obtain a universal model that can be applied no matter the nature and condition of materials used for the casting of concretes. These models will be compared with the existing ones to test their performance on independent data. **METHODOLOGY** Ultrasonic pulse velocity test Descriptive research was adopted while quantitative study was conducted using statistical analysis of linear regression and two error analyses. The equipment used was made up of an electrical pulse generator, an emitter transducer, a receiver transducer, an amplifier and an electronic timer for measuring the time taken by the ultrasound to move from the emitter transducer to the receiver transducer. The pulse velocity test was determined using cuboid specimens in accordance with the requirements of BS 1881- 203:1986.

The ultrasonic pulse velocity test meter is as shown in Figure 1 while the working principles are represented in Figure 2. Description of the method For this experiment, ultrasonic pulse velocity meter (V-C-400, VMeter Mark IV) from James instrument and compressive-testing machine were used. While the former is a non-destructive testing instrument, the latter is a destructive testing machine. Varieties of commonly prescribed concrete mixes (1:1.5:3, 1:2:4, 1:3:6), sizes of coarse aggregate (10 mm – 20 mm) and water-cement ratio ranging between 0.5 – 0.6 were adopted. To balance these conditions, the V-meter was tuned to the frequency of 150 kHz. The size of concrete cubes ranges between 150 mm × 150 mm to 200 mm × 200 mm and the age range between 21 days and 56 days were adopted. The reason for

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adopting this is because in most cases, concrete reaches appreciable strength in 21 days while its maximum strength is also reached between 28 days and 56 days. About eighty (80) sample cubes were used for both calibration and verification of proposed models. For each of the cubes, two tests were carried out as aforementioned. To obtain the pulse velocity, the path length was measured and recorded into the V-Meter; also, the couplant was applied to the traducer scan areas on the opposite sides of the cuboid. After this, the traducers were placed firmly on Nwidi 15



Figure 1. Ultrasonic pulse velocity.

The areas where couplant has been applied and the pulse velocity was read from the display window of the V-Meter. It was repeated four more times on the specimen after which an average of the five readings was obtained. The cuboid was later taken to the compressive-testing machine where the compressive strength of the concrete was obtained. The same experiment was repeated on all the concrete cubes. This experiment was done under a different range of temperature, the water-cement ratio as mentioned above, different aggregate sizes (between 10 mm – 20 mm) and different curing conditions.

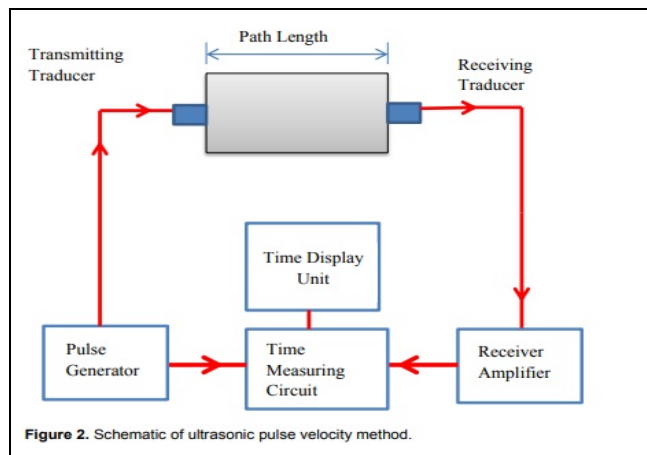
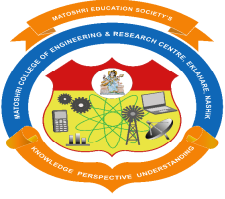


Figure 2. Schematic of ultrasonic pulse velocity method



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### ***Replacement of R.C.C Water tank by ferrocement water tank***

***Mr. H. M. Pawar, Civil Engineering Department***

Water is a basic need for everyone of this earth. Therefore storage of water is also important and various storage methods and techniques are used worldwide. In Rural areas ground water is a main source for drinking water. Therefore almost 85 % schemes in rural areas are based on ground water. Due to over exploitation of ground water and inadequate recharge, such storages are not feasible from long term & cost percentage. Government adopted various measures for drinking water supply in rural and urban areas. The main objective behind these various schemes is to recharge ground water. Hence, it would be appropriate if the rainwater could be used directly for drinking purposes in view of its purity.

Under these circumstances, it is planned by Government to take up the program and implement a comprehensive scheme for use of rainwater at individual or community levels by using the available technologies and through proper implementation. Considering all these aspects Government sanctioned the implementation of “**Shivkalin Pani Satvan Yojana**”(Shivkalin Water Harvesting Scheme) for conventional and non conventional measures for strengthen of rural area in drinking water under this rooftop rain water harvesting, construction of storage tanks in hilly areas of the villages is done. For this scheme funds were made available by UNICEF and State Government and one NGO (for proper monitoring and technical support). Here Jalvardhini Pratisthan, Mumbai facilitation a technical support team and monitoring agency. The fund criteria were 10 % of total expenditure should be from the beneficiary (in cash or in the form of voluntary labour) and out of remaining 60 % from UNICEF and 30% from State Government.

The main objective of this scheme is use of available water in proper planning and management of water resources by the village community by considering that the water available in the village as a community recourses as a whole and giving priority to drinking water, especially for those villages which consistently face drinking water scarcity and are tanker

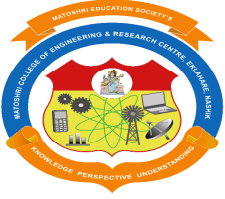
Various methods of water tank construction are mainly dependent upon material used and cost of construction. From these all methods ,one technique is ferrocement water tank construction, The stored water can be used for drinking or washing & cleaning.

In Year 2002 , In village Vadav, Tal: Pen (Maharashtra) 220 such type of ferrocement tank were constructed with Maharashtra State ,Jalvardhini Pratisthan (NGO) , farmers (End users) and UNICEF as stake holders under the scheme “ Shivkalin Panipuravata Yojana”. To store water for local people from villages and region were identified who were facing very much scarcity for drinking water and mainly dependent upon rain water. In this region drinking water was not available even water table was very shallow, people were travelling about 8 to 10 km for drinking water.

Again the local people and farmers were not able to construct separate water tank with their own investment. Structural condition and percentage uses after construction of these tanks are not yet studied in details. In India it is not a set practice to monitor the performance of structures after put in use.

After 17 years (Institute of Chemical Technology [ICT,Mumbai], Mumbai and Gharda Institute of Technology[ GIT], Lavel, Ratnagiri) decided to survey these 17 years old ferrocement water tanks. Our main aim behind this survey is to evaluate the condition & assess performance of ferrocement water tanks after 17 years. The points like maintenance, waterproofing capacity, crack development; base settlement and any other were studied. For this we surveyed 45 tanks in detail which are used for last 17 years.





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### ***Investigation of the properties of self-compacting concrete with palm kernel shell ash as mineral additive.***

***Priyanka Shelke S. E. Civil***

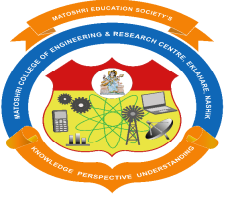
This study investigates workability and the compressive strength properties of self-compacting concrete with palm kernel shell ash (PKSA) as mineral additive for partial cement replacement. The iterative method mix design was used, where water and super plasticizer contents were fixed while solid constituents were adjusted for optimum performance. The mixes were to achieve EFNARC's 650 and 800 mm slump-flow limits. The results showed that up to 25% replacement of cement using PKSA produced self-compacting concrete with the workability criteria met and comparable compressive strength.

In the last few decades, a new innovation was added to the concrete family, high performance concrete, defined as a concrete with high durability due to low watercement ratio (Gagne et al., 1989). Self-compacting concrete (SCC) belongs to the group of concrete described as high performance concrete due to its ease of workability (Ouchi et al., 1996). This concrete has in addition to the four constituents of normal concrete: water, cement, fine aggregate and coarse aggregate, additives to improve specific properties of the concrete. These properties relate to their workability and/or strength. Additives or admixtures are used to alter and improve hardened properties of concrete, they may enhance the durability, workability or strength characteristics of a given concrete mixture. There are many studies on the use of more common mineral additives such as: rice husk ash Palm kernel shell is a waste product in palm oil mills. It is obtained by the extraction of palm oil from the fruit. The waste (palm oil husk and palm kernel shell) is used as fuel in the boiler of palm oil mill. Recent investigation on oil palm kernel shell concrete (OPKSC) gave results which show that palm kernel shell (PKS) can be used to produce concrete of medium and high strength

### ***Estimation of the compressive strength of high performance concrete with artificial neural networks***

***Pratiksha Deokar T. E. Civil***

High performance concrete is one of the most commonly used materials in non-standard building structures. Aside from the basic components used for its manufacture (water, cement, fine and coarse aggregates), other components such as fly ash, blast furnace slag and superplasticizers are incorporated. In the present study, two types of additives and two types of microsilica have been used. The proportions of all the elements involved in preparing concrete have an influence on its final strength. Artificial neural networks have been used to estimate the compressive strength of high performance concrete mixtures using the results obtained with 296 specimens corresponding to various fabrication parameters. The estimate given by the neural network was evaluated by measuring the correlation between network responses and the expected values, which are the strength values measured in the



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laboratory. The artificial neural network response obtained in the present work had a correlation of 92% with the expected values used for the training and 89% when predicting values for new data.

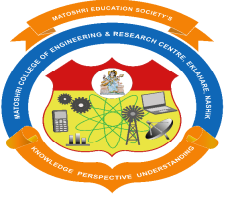
High performance concrete (HPC) is used for building structures subjected to high loads, in the construction of columns and beams of high-rise buildings, marine or military structures, security vaults, tunnels, bridges, among other applications. In all cases, a compression test is required after 28 days of immersion curing. The dynamics of HPC are very complex and the relationship between its strength and components is highly nonlinear. Several studies have shown that its strength depends not only on the water-cement ratio, but also on all concrete ingredients: cement, fly ash, blast furnace slag, water, superplasticizer, age, coarse, and fine aggregates (Chou et al., 2011; Yeh, 1998, 2007). In Peru, there are practical experiences in the manufacture of HPC with additions of microsilica, mineral additives and chemicals, achieving 28-day strengths over 700 kg/cm<sup>2</sup> and reaching 1200 kg/cm<sup>2</sup> or more at 90 days (Rivva, 2008). In some studies of HPC with unsupervised neural networks, groups or

In addition to the materials normally used in manufacturing concrete, additives and microsilicas have also been used. Two brands of polycarboxylate-based liquid (polymers in aqueous solution) additives and two brands of microsilica (silica fume) have been used. Microsilica is a by-product of high-purity quartz reduction and its content of silicon dioxide (SiO<sub>2</sub>) is above 85% and in some brands, exceeds 93%. The type of additive used for each sample has been introduced as a qualitative variable. For proprietary reasons, no further details can be provided on these additives

### Isolated Power Converters for DC Distribution System"

**Ms. Shruti Shintre ME Power System**

These days, renewable energy sources, DC electronic loads, and energy storage devices have been adopted to residential house and building applications. They have also been widely used in electrical vehicle and LED lighting applications in industrial fields and consumer areas. The DC distribution system can easily interface with different electrical systems composed of renewable energy sources and energy storage devices. The DC distribution system achieves higher power conversion and distribution efficiency because of the reduction of power conversion stages. In addition, it can easily integrate DC loads, electrical vehicle, and LED lighting into the distribution system, compared with the AC distribution system. Thus, DC distribution concepts for a residential house, telecommunication buildings and internet data centers were recently presented. With the increasing demands for electric power in future automobiles, uninterrupted power supplies (UPSs), renewable energy sources, telecom and computer systems, and aviation power systems, bidirectional dc-dc converters (BDCs) exhibit as an ever-lasting key component to interface between a high-voltage bus where an energy generation device such as a fuel cell stack and/or a photovoltaic array is installed, and a low-voltage bus, where usually an energy storage device such as a battery or a super capacitor is implemented, to actively provide clean and stable power and to enable high reliability, effectiveness, and maneuverability of the power systems aforementioned. In order to significantly reduce reactive component size and cost, high-frequency operation of BDCs is desirable. However, in a hard-switching converter, as the switching frequency increases, switching losses and electromagnetic interference increase. To resolve this problem, soft-



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switching converters are employed. Several isolated BDC topologies have been suggested for applications of the dc power distribution systems. A boost full-bridge ZVS PWM dc-dc converter was developed for bidirectional high power applications. This topology is proper to the bidirectional power conversion because it has a boost mode for low to high voltage power conversion and a buck mode for vice versa. However, this topology requires a snubber circuit to suppress the voltage stress of the switches, which increases circuit complexity and decreases power conversion efficiency. A Bidirectional phase shift full-bridge converter was proposed with high frequency galvanic isolation for energy storage systems. This converter can improve power conversion efficiency using a zero voltage transition (ZVS) feature; however, it requires input voltage variations to regulate constant output voltage because this topology can only achieve the step-down operation. The isolated unidirectional CLLC resonant converter has useful characteristics for regulating the DC-bus voltage. This converter shows soft switching capabilities of the primary and the secondary switches employing zero voltage switching (ZVS) and soft commutation under entire load ranges. In addition, it has a simple switching mechanism to control the power flow directions in the converter. The DAB converter is good for power interfacing between battery stations and load sides because of its wide gain range and high boosting ratio. This converter has bidirectional buck and boost capability with high frequency isolation and simple structure with soft switching property. Finally, the LLC resonant converter is a frequently selected topology for high power DC-DC applications because of its outstanding performance in high power conversion efficiency and high power density. Therefore, the LLC resonant topology is a good candidate for renewable energy simulators of a PV, fuel cell (FC), wind turbine, etc. The soft switching feature for the proposed converter is realized only by a very simple *CLLC resonant tank*. *In the proposed system without any other additional soft-switching auxiliary circuits and being snubber less, the overall component count can be dramatically reduced.*

### ***Technique to Mitigate Inrush Current of Load Transformer by Series Voltage Sag Compensator***

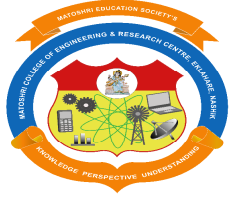
***Ms. Diksha Ahire ME Power System***

Now a days there is large increase in load demand as the improvement of technology is changing day by day. With the change in load Condition the power quality is issue must also be taken into consideration. Due to the sudden change in the load i.e., sudden increase of load the magnitude of the current in the distribution system is increased rapidly which leads to decrease in the voltage of the line creating voltage sag.

There are three negative side effects of inrush currents:

- 1) Mis-operation of protective devices for overloads and internal faults may and disconnect the transformer.
- 2) The windings are exposed to mechanical stresses that can damage the transformer; and
- 3) Power-quality problems may occurs and voltage sags.

Various transformer inrush reduction techniques have been presented, like controlling power-on angle and the voltage magnitude, or actively controlling the transformer current. These methods are not suitable for voltage sag compensators as they could alter the output voltage waveforms of the converter.



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The voltage sag means that the root mean square value of fundamental voltage temporarily reduces to 0.1~0.9 per unit and maintains 0.5 to 30 cycle. Hence, the load transformer is presented to the improper voltages before the restoration and magnetic flux deviation may be developed within the load transformers. Saturation of the core leads to significant inrush current. The compensator may be interrupted because of its own over current protection, hence, the compensation gets failed, and the critical loads are interrupted by the voltage sag.

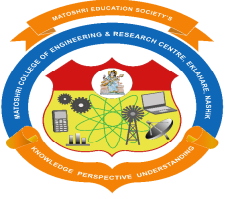
In this paper, an inrush mitigation technique is presented. This control can successfully reduce inrush current of load transformers.

In the Literature survey it reveals that voltage sag is a critical problem in power system. Many inrush mitigation techniques have been presented by various researchers like controlling power-on angle and the voltage magnitude, or actively controlling the transformer current [6-8]. These methods could easily alter the output voltage waveforms of the converter, and thus, is not suitable for voltage sag compensators, which demand precise point-on wave restoration of the load voltages.

The repeated switching of distribution transformers take place due to poor generation and load shedding. The transient inrush current may be as high as ten times the full-load current. Three methods are given here to avoid inrush currents in transformers and distributed lines:

1. The switching instant decides the nature and magnitude of the switching current and it is used here to control the inrush current.
2. Another method is adopted by placing a capacitor at the secondary side of the unloaded transformer connected at the sending or receiving end of the distribution line.
3. Third method is proposed using the distribution line as a low-pass filter.

These schemes are useful for traction transformers as well as for poorly supplied and poorly maintained distribution lines including traction line which are subjected to repeat switching [1]. A new, simple and low cost method to reduce inrush currents caused by transformer energization. The method uses a grounding resistor connected at a transformer neutral point. By energizing each phase of the transformer in sequence, the neutral resistor behaves as a series-inserted resistor and thereby significantly reduces the energization inrush currents. The presented method is much less expensive, however, since there is only one resistor involved and the resistor carries only a small neutral current in steady-state [2]. A sequential phase energization based inrush current reduction scheme. The scheme connects a resistor at the transformer neutral point and energizes each phase of the transformer in sequence. It was found that the voltage across the breaker to be closed has a significant impact on the inrush current magnitude. In this paper it is shown that the idea of sequential phase energization leads to a new class of techniques for limiting switching transients [3]. The magnetizing inrush current which occurs at the time of energization of a transformer is due to temporary over fluxing in the transformer core. Its magnitude mainly depends on switching parameters such as the resistance of the primary winding, the point-on-voltage wave (switching angle), and the remnant flux density of the transformer at the instant of energization .

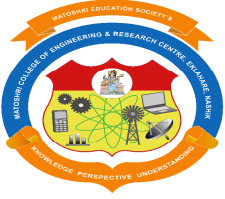


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### *Why we need microgrid .*

*Y .R . Shinde ME Power System*

The Microgrid is defined as one independent grid providing continuous power to load on grid and comprising two or more micro sources with enough capacity so as to operate independently storage assets and load. The Microgrid consists of a low- or medium-voltage distribution network containing loads and distributed energy resources. A microgrid includes central controller (CC), local controllers (LCs) [4], a static switch, loads, and various types of energy sources. A microgrid has operated in two different modes: grid-connected mode and islanded mode, depending on the connection state with the main grid. In grid-connected mode, a microgrid is connected to the main grid, which usually has large system inertia; this is reason of the microgrid frequency is almost identical to the nominal value [3]. So, DG units in a microgrid typically inject the desired output power, and the electrical power mismatch between supply and demand is balanced by the main grid. However, in islanded mode, using DG units the microgrid must supply its own demand and maintain its frequency solely. DG's can integrate eco-friendly renewable energy resources such as Solar cells, Wind turbines and Fuel cells to distribution networks. To offset the errors in active power sharing caused by Self-frequency recovery control, a compensation control scheme was developed. The main purpose of the compensation control is not to reduce transient frequency difference but to reduce the active power sharing error. In active power-frequency (P-f) droop control was developed for active power sharing by emulating conventional power systems composed of synchronous generators. In , oppose to conventional droop control, a tunable droop controller with two degrees of freedom was proposed, considering an adaptive transient droop function. Islanded microgrids as in [6], for Single-master and multiple-master operating modes considering secondary load-frequency control for frequency recovery. In [7], a virtual impedance control scheme was used for decoupling the active and reactive power to enhance the control stability and power sharing ability. A method for determining the droop coefficient based on the generation cost of each DG unit was proposed in. In ,a control method was used rather than frequency droop in a constant frequency and the state of charge of a battery energy storage system was used to monitor changes in the system load. Most literature have considered frequency deviation in sharing active power; however, the frequency must be restored to its nominal value according to the requirements of the grid code, and secondary control is required to achieve. Problems may arise if the frequency deviation is too great. Under these circumstances, this will impose too much burden on the frequency control units. It has been suggested that constant frequency control could be used making frequency restoration unnecessary; however, active power sharing was not considered. A DG control method that simultaneously implements accurate active power sharing and self-frequency recovery. Using this control method, DG units share the changes in load with a predetermined ratio and are able to restore their output frequency to the nominal value autonomously (hence the term "self-frequency recovery") immediately following a change in load. However, the self-frequency recovery action may lead to (small) errors in power sharing due to variations in the impedance among DG units.



## Technosavior

### *An Add on self tuning control system using PR controller for UPFC application*

*Ms. Ankita Singh ME Power System*

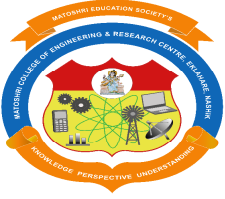
In recent years energy, environment, right-of-way, and cost issues have delayed the development of each generation facilities and new transmission lines, while the demand for electrical power has continued to grow. This situation has necessitated a review of the standard facility ideas and practices to attain larger operative flexibility and higher utilization of existing power systems. During the last two decades, if not revolution semiconductor, advances have been made in high management technology. These technologies have been instrumental within the broad application of HVDC transmission and facility intertie schemes, and they have already made a big impact on AC transmission via the increasing use of thyristor controlled static volt-ampere compensators (SVCs).

A Unified Power Flow Controller (or UPFC) is an electrical device for providing fast-acting reactive power compensation on high-voltage electricity transmission networks. It uses a pair of three-phase governable bridges to manufacture current that's injected into a cable employing a series electrical device. The controller can control active and reactive power flows in a cable. The UPFC uses solid state devices, which give purposeful flexibility, generally not possible by typical thyristor controlled systems.

The UPFC is a combination of a static synchronous compensator (STATCOM) and a static synchronous series compensator (SSSC) coupled via a standard DC voltage link. The main advantage of the UPFC is to manage the active and reactive power flows within the cable. If there are any disturbances or faults in the supply aspect, the UPFC will not work. The UPFC operates only below balanced sin wave supply. The controllable parameters of the UPFC area unit electrical phenomenon in the line are impedance, phase angle and voltage.

The UPFC allows a secondary however vital perform such as stability management to suppress power grid oscillations up the transient stability of power grid [1]. The UPFC can give synchronous management of all basic power system parameters (transmission voltage, impedance and part angle). The controller can fulfill functions of reactive shunt compensation, series compensation and phase shifting meeting multiple management objectives. From a functional perspective, the objectives are met by applying a boosting electrical device injected voltage and an exciting electrical device reactive current. The injected voltage is inserted by a series transformer.

Unified power flow controller (UPFC) has been the most versatile Flexible AC gear mechanism (FACTS) device because of its ability to regulate real and reactive power on transmission lines whereas dominant the voltage of the bus to that it's connected. UPFC being a multi-variable grid controller it's necessary to investigate its effect on power system operation. In recent years, greater demands have been placed on the transmission network, and these demands will continue to increase thanks to the increasing variety of nonutility generators and heightened competition among utilities themselves. Increasing demand on transmission, absence of long term planning and the ought to give open access to generating corporations and customers all at once have created tendencies toward less security and reduced quality of offer. This controller offers substantial advantages for the static and dynamic operation of power system. The UPFC is the most versatile and



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sophisticated power equipment that has emerged for the control and optimization of power flow in wattage transmission systems.

### ***STATCOM for Power System***

**Mr. Somnath S. Hadpe Faculty, Electrical Engineering Department,**

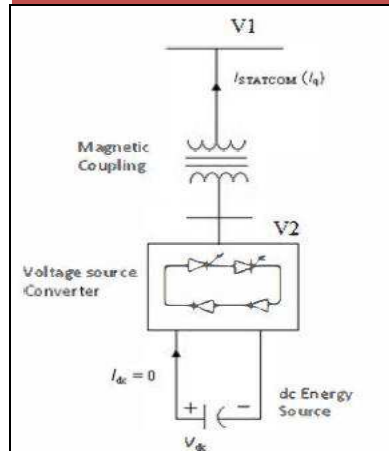
In power system active and reactive power is regulated by changing the voltage and phase angle difference between sending end and receiving end respectively. The electronic devices also very sensitive to power quality problems such as voltage sags, swell, harmonics and voltage dips. Due to such problems severe black out occurs in power grids. So it's to necessary to improve the reliability and stability in the power system. The fast response fact devices make efficient solution for improve power quality in power system. It can be of shunt connected, series. dyanamic and steady state condition. The fast response of STATCOM improve the power quality in power system. it inject current into the system to correct the power quality problems such as voltage sag, swell and harmonics. The voltage source converter is the main component of the statcom which is based on power electronics technologies. The amount of current injected in the system can be controlled by changing the firing angle of the switch or by controlling the value of dc voltage of VSC. The control of voltage source converter is done with sinusoidal pulse width modulation technique connected or combined series-shunt connected. It provide voltage support at critical buses. Power electronics devices are used to control the voltage, active and reactive power, transient and steady state that improves the operation of the power system. This devices provide quiet fast regulation and this enables control under dynamic and steady state condition. The fast response of STATCOM improves the power quality in power system. It injects current into the system to correct the power quality problems such as voltage sag, swell and harmonics. The voltage source converter is the main component of the STATCOM which is based on power electronics technologies. The amount of current injected in the system can be controlled by changing the firing angle of the switch or by controlling the value of dc voltage of VSC. The control of voltage source converter is done with sinusoidal pulse width modulation technique.

STATCOM provide reliability and stability in the system. It controls the flow of reactive power flow. It's employ shunt of voltage boost technology using solid state switches for compensating power quality problems.

Basic Operation:

The voltage source converter is power electronics device which convert input dc voltage into three phase output voltage at the fundamental frequency. It can generate sinusoidal voltage with required magnitude, phase angle and frequency. A STATCOM is shunt voltage controller which is shown in figure 1.

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The STATCOM regulate the voltage at it terminal by controlling the amount of reactive power injected or absorbed from the power system. The VSC uses power electronics devices like GTO's or IGBT'S to synthesize the voltage from dc voltage source or battery. The operating principle of STATCOM is shown in figure 2. From the figure we can see that if  $V_2 > V_1$  then reactive current  $I_q$  flows from converter to ac system through coupling transformer. On the other side if  $V_1 > V_2$  then current  $I_q$  flows from ac system to converter. If  $V_2 = V_1$  then there is no flow of reactive power.

### Water Level Indicator

Reference – [www.electronicsforu.com](http://www.electronicsforu.com)

The Water Level Indicator employs a simple mechanism to detect and indicate the water level in an overhead tank or any other water container. The sensing is done by using a set of nine probes which are placed at nine different levels on the tank walls (with probe 9 to probe 1 placed in increasing order of height, common probe (i.e. a supply carrying probe) is placed at the base of the tank). The level 8 represents the “tank full” condition while level 0 represents the “tank empty” condition.

When the water-level is below the minimum detectable level (MDL), the seven segment display is arranged to show the digit 0, indicating that the tank is empty, when the water reaches level 1 (but is below level 2) the connection between the probes gets completed (through the conducting medium – water) and the base voltage of transistor increases. This causes the base-emitter junction of transistor to get forward biased, this switches transistor from cut-off to conduction mode thus PIN (B7) of microcontroller is pulled to ground hence, the corresponding digit displayed by the seven segment display is 1. The similar mechanism applies to the detection of all the other levels. When the tank is full, all input pins of microcontroller become low. This causes the display to show 8 and also in this case a buzzer sound is given, thereby indicating a “tank full” condition. Most water level indicators are equipped to indicate and detect only a single level. The Water Level Indicator implemented here can indicate up to nine such levels and the microcontroller displays the level number on a seven segment display. So, the circuit not only capable of cautioning a person that the water tank has been filled up to certain level, but also indicates that the water level has fallen below the minimum detectable level. This circuit is important in appliances such as the water cooler where there is a danger of motor-burnout when there is no water in the radiator used up also it can be used in fuel level indication. In this project we show the water level indicator using eight transistors which conducts as level rises, a buzzer is also



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added which will automatically start as the water level becomes full, auto buzzer start with the help of microcontroller. With the help of this project we not only show the level of water on seven segment display but also indicate the water full condition using a buzzer.

### Water Level Indicator Project Circuit Features:

1. Easy installation.
2. Low maintenance.
3. Compact elegant design.
4. The Automatic water level controller ensures no overflows or dry running of pump there by saves electricity and water.
5. Avoid seepage of roofs and walls due to overflowing tanks.
6. Fully automatic, saves man power.
7. Consume very little energy, ideal for continuous operation.
8. Automatic water level controller provides you the flexibility to decide for yourself the water levels for operations of pump set.
9. Shows clear indication of water levels in the overhead tank.

### How to Design Water Level Indicator Project using AVR Microcontroller?

- A constant 5v power supply is given to the microcontroller and rest of the circuit from a battery.
- The tank has 9 conductive type sensors (other types of sensors have been mentioned earlier but in our project only conductive type are used) embedded into it and 8 wires of sensors out of 9 are connected to transistors and the 9th is connected to 5v+ supply.
- The use of transistor is it acts as inverter (i.e. in on state gives low voltage at output and in non conducting state gives high voltage at its output), all transistors outputs are connected to PORTB of microcontroller.
- Seven segment display is connected to PORTD. It is connected in common cathode fashion. The Output for the 7th level is not only shown on seven segment display but also indicated with a discontinuous buzzer sound.
- Output for the 8th level (i.e. tank full condition) is not only shown in seven segment display but also indicated with a continuous buzzer sound.

### How Water Level Indicator Project Circuit Works?

The operation of this project is very simple and can be understood easily. In our project “water level indicator” there are 3 main conditions:

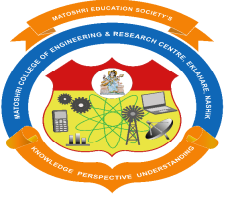
1. There is no water available in the source tank.
2. Intermediate level i.e. either of 3rd to 7th level.
3. There is ample amount of water available in the source tank.

So let us discuss more about these 3 conditions

#### CONDITION 1: Water not available

When the tank is empty there is no conductive path between any of the 8 indicating probes and the common probe (which is connected to 5v+ supply) so the transistor base emitter region will not have sufficient biasing voltage hence it remains in cut off region and the output across its collector will be  $V_c$  approximately 4.2v.

As in this case the microcontroller is used in the active low region (which means it considers 0-2 volts for HIGH and 3-5 volts for LOW) now the output of transistor which is 4.2v approximately will be considered as LOW by the microcontroller and hence the default value given by microcontroller to the seven segment display is 0 which indicates as the tank is empty.



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### CONDITION 2: Intermediate levels

Now as the water starts filling in the tank a conductive path is established between the sensing probes and the common probe and the corresponding transistors get sufficient biasing at their base, they start conducting and now the outputs will be  $V_{ce}$  (i.e. 1.2v-1.8v) approximately which is given to microcontroller.

Here the microcontroller is programmed as a priority encoder which detects the highest priority input and displays corresponding water level in the seven segment display.

In this project while the water level reaches the 7th level i.e. last but one level along with display in seven segment a discontinuous buzzer is activated which warns user that tank is going to be full soon.

### CONDITION 3: Water full

When the tank becomes full, the top level probe gets the conductive path through water and the corresponding transistor gets into conduction whose output given to microcontroller with this input microcontroller not only displays the level in seven segment display but also activates the continuous buzzer by which user can understand that tank is full and can switch off the motor and save water.

### CONDITION 1: Water not available

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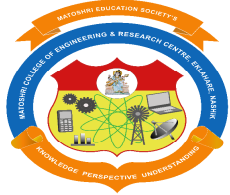
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## Technosavior

### *Autonomous Farming Robot with Plant Health Indication*

*Reference – [www.electronicsforu.com](http://www.electronicsforu.com)*

#### ABSTRACT

Agriculture is very labor intensive field and only field where the robots are not involved. Now-a- days many industries are trying to reduce this human labor by making robots and machines. A vision-based row guidance method is presented to guide a robot platform which is designed independently to drive through the row crops in a field according to the design concept of open architecture. Then, the offset and heading angle of the robot platform are detected in real time to guide the platform on the basis of recognition of a crop row using machine vision. And the control scheme of the platform is proposed to carry out row guidance. Here we are designing a autonomous intelligent farming robot which indicates the plant health by observing the color of their leaves and based on the height of the plant. The robot also notes the surrounding environmental conditions of the plant like temperature, moisture and humidity so that the robot will decide about health of plat and will display on the LCD. The robot has also watering mechanism it will water the plants according to their needs by observing soil moisture and humidity. It will also tell when the cutting process should take place by observing the leaf color.

#### INTRODUCTION

In this project, we are going to make a robot which uses vision based row guidance method to drive through the row crops. Ultimately, a unique system has been described for Plant & Food Research which makes use of a number of electrical and computer systems engineering theories. A prototype robotic arm has to be designed, developed and constructed, which should be integrated with motors, controllable using specific electronic components and custom computer software. A number of sensors are integrated into the robotic system including color, proximity, temperature and humidity systems. The system required the use of vision, with custom algorithms being developed to identify plant growth rates. The entire system will integrated into a fully automated package. This allowed the system to autonomously return to specified sites (i.e. individual plantlets) at set time intervals to identify subtle changes in growth rates and leaf color. This provided the potential for plant nutrient levels and the immediate environment to be routinely adjusted in response to continuous sensing resulting in optimized rapid growth with minimal human input.

#### PROPOSED SYSTEM

In this project we are designing the agricultural autonomous Robot which will sense the conditions in real time and then decide which plantation is best suited for that particular field. For this, we are analyzing the field parameters such as, Temperature, humidity, soil Moisture etc. The Robot will also have a Plough to plough the fields, and then a seed dispensing mechanism, Watering mechanism so, in all this is a completely autonomous robot. The main feature of the Robot is the Ability to sense the health of plants using Image processing. For this we are using a special purpose Web-cam which will take photos inside the field and analyze the growth according to the height, colorization of leaves etc. So, based on this we can generate an estimate of percentage of healthy plants in a given crop field. A vision-based row guidance method is presented to guide the robot platform driven along crops planted in row. And the offset and heading angle of the platform are calculated by detecting the guidance row in real time in order to guide and control the platform. Vision-based row guidance is to use camera to detect and identify crop plants and then to find accurate and stable navigation information from the binary image. The captured image are then processed by using image processing technique, the

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processed are then converted into voltage levels through MAX 232 level converter and given it to the microcontroller unit. In the microcontroller unit, c language coding is predefined, according to this coding the robot which connected to it was controlled. Robot which has several motors is activated by using the relays. Relays are nothing but electromagnetic switch which ON/OFF according to the control given by the microcontroller unit.

### FEATURES

1) Fully automated system thus reduces the human labor. 2) As we are making a fully autonomous robot which works on open architecture principle and done lot of work in farms so it reduces human labor. 3) Saves time. 4) As we are using machines which works faster than human efforts which definitely saves the time. 5) More Accuracy. 6) The system observes different environmental conditions and take actions accordingly which humans can't do accurately. 7) Low Cost. 8) We are using sensors and drivers for making this system which are easily available in market and cheap which reduces the cost of system.

## Multi-Room Audio Control with Raspberry Pi

*Reference – [www.electronicsforu.com](http://www.electronicsforu.com)*

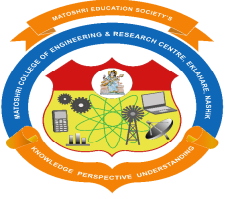
My parents' house has a whole-house audio setup where an amplifier can drive built-in speakers in each of 5 rooms. This system is great for background music during dinner and parties, but we've rarely used it: it's a hassle to go to the room with the sound system every time we want to turn it on, change the song, station, or volume, or turn a room on/off.

As a winter break project, I put together a controller using the \$35 Raspberry Pi computer and some custom hardware and software. From a mobile Web interface, you can:

- **Switch room speakers on and off** using a custom-built relay board.
- **Control the sound system.** You can switch between CD, AM/FM, and Aux inputs, change the volume, change the track/station, and turn the system on/off. The controller emits IR signals that simulate the sound system's remote control.
- **Stream music to the system using Apple AirPlay.** You can play Pandora, YouTube, or your own music from any iPhone, iPad or Mac on the network.

### Hardware

- **Raspberry Pi Model B.** A 700 MHz ARM-based Linux computer with 512 MB RAM. Ten programmable GPIO pins control the five relays: simply pulse the on or off coil for ~50ms. Another GPIO controls the IR diode.
- **IDE cable connector.** I cut up an old 40-pin IDE connector to connect to the 26-pin GPIO header.
- **DPDT latching signal relays.** Each relay controls left and right channels (hence dual poles). I opted for two-coil relays, so I could activate one coil to turn the relay on and the other coil to turn it off. (Digi-Key)
- **ULN2003A ICs to drive the relays.** The Raspberry Pi's GPIOs can't drive the relays directly, so we control them with this transistor array. Each chip has 7 NPN Darlington pairs. It also has built-in flyback diodes that will dissipate the inductive kickback from the relay coils. (Digi-Key)
- **Stick-on IR diode.** I had this emitter lying around. It came with a long cable that terminates in a mono 3.5mm headphone jack. I cut off a female headphone jack from a patch cable to make a plug for this and wired a 270 ohm current-limiting resistor to this.



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### Software

I wrote a Python script to control the relays and a Flask/jQuery Mobile web app for control from our phones/tablets. I've posted my code on GitHub. This project also leverages other open-source software:

- **Raspbian.** The Debian distribution for Raspberry Pi.
- **Python, Flask, and jQuery Mobile** for the control app.
- **RPi.GPIO** to control GPIO ports from Python.
- **ShairPort**, to enable AirPlay streaming to the Pi.
- **LIRC** to learn and send IR commands to the sound system, using the **lirc\_rpi** module.
- **uWSGI and Supervisor** to run and deploy the webapp.

More details about the software setup can be found in the README on GitHub.

### *Minimizing Electricity Theft by Internet of Things*

*Reference – [www.electronicsforu.com](http://www.electronicsforu.com)*

#### Abstract:

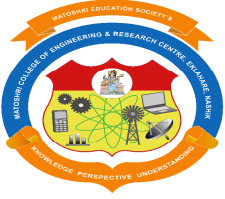
IOT use things to things connection to access the internet of things, allow data to store and access services. Services over internet of things development according to need of person to person and thing to person, machine to machine interaction without human interaction. As there is limited non-renewable resources are present in our daily life, Electricity is one of them which utilized in every country that results abundant losses due to electricity larceny. Power theft is going to be the key challenges. A smart energy meter is used to minimize the electricity larceny. Basically energy meter is a device that calculates the cost of electricity consumed by homes, business, or an electrical device. It reduces the theft of electricity. In this paper a government person can find the dishonest user by showing the status of energy meter at the back end of electricity office. To attain this, energy meter communicate with raspberry pi through GPIO pins. GPIO pins fetch the effective data from energy meter and it send effective data to the raspberry pi and connect raspberry pi with the internet. At the backend, government person can see the status of energy meter in the form of graphs.

#### INTRODUCTION

With the increasing of internet connectivity in home environment electronic gadget used to create home network services. IOT use things to things connection to access the internet of things, allow data to store and access services, such as remote home sensor [1]. Services over internet of things development according to need of person to person and thing to person , machine to machine interaction without human interaction . Technology used in this system is radio frequency identification. Transmission and delivery of electricity is smartness from the utilize of renewable energies and advanced measurement and latest communication technologies as well utilities grow to be smart. So with smart utility latest measurement and energy sources and load efficiently manage.[2].The key element of such a measurement and control network could be a smart meter. A smart energy meter is used to minimize the electricity larceny. Basically energy meter is a device that calculates the cost of electricity consumed by homes, business, or an electrical device. It reduces the theft of electricity. Electronic energy meter measures current in both Phase and Neutral lines and calculate power consumption.

#### SOFTWARE AND HARDWARE USED

##### A. IOT



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With the increasing of internet connectivity in home environment electronic gadget used to create home network services. IOT use things to things connection to access the internet of things, allow data to store and access services, such as remote home sensor [1]. Moreover lights will automatically shut off when leaving a room or apartment when exiting for work. In addition, the room temperature can be reduced when leaving for work and increased in advance of coming home. Other functions that can be controlled away from home include determining whether or not the apartment windows are closed or the coffee maker is shut off. An energy provider can read the energy consumption for a day, week, or month. Services over internet of things development according to need of person to person and thing to person, machine to machine interaction without human interaction. Technology used in this system is radio frequency identification. The operation of buildings and/or homes will be more simple, safe, reliable, environmentally friendly, and cost effective by using smart devices in conjunction with IOT

**B. ELECTRIC ENERGY** Electric Energy is a necessary resource in everyday life and a backbone of the industry. Its limited, so proper use and measurement is very important. Before utilization of electricity it passes some phases. It is first Generated (G) then Transmitted (T) over long distances and finally Distributed (D) to consumers. In this process of GTD energy losses take place. Energy loss is defined as the difference between energy generated and consumption. There are mainly two types of losses.

i) Technical losses. ii) Non-Technical losses. i) Technical losses Technical losses are those losses which occur due to properties of materials used in transmission and distribution system. For example, energy dissipated due to resistance of conductor used in transmission lines Technical losses are easy to simulate and calculate; computation tools for calculating power flow, losses, and equipment status in power systems have been developed for some time. Improvements in information technology and data acquisition have also made the calculations and verifications easier.

ii) Non-technical losses Non-technical losses are electricity theft and non-payment. Electricity theft is defined as a conscience attempt by a person to reduce or eliminate the amount of money he or she will owe the utility for electric energy. This could range from tampering with the meter to create false consumption information used in billings to making unauthorized connections to the power grid. Non-technical losses are difficult to quantify. They refer to losses that occur independently of technical losses in the power system. Two easy examples of sources of such losses are component breakdowns that drastically increase losses before they are replaced in time, and electricity theft. The reason that meter inspection is the main method of NTL detection is because the utilities consider electricity theft to be the major source of NTL and the majority of electricity theft cases involves meter tampering or meter destruction.

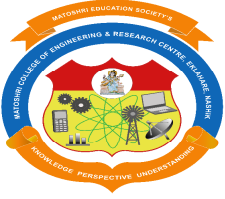
Main reasons for non-technical losses

1. Electricity theft: Electricity theft means that electric energy distributes to consumer that is not calculate by energy meter of consumer. Consumer break the mechanically, place a strong magnet also by remote control try to stop meter.

2. Metering inaccuracies: Metering inaccuracies define as difference between actually energy deliver to the energy meter and energy measured by energy meter. Small amount of Error are present in all energy meter.

### ENERGY METER

Energy meter and watt hours meter is a device which calculate amount of electricity energy which is utilized by consumer. Energy meter is install at each place like as home, organization and industries to measured the consumption of electricity by load like fans, lights and many more. Being a limited and very important resource the metering of electricity consumption is essential. Generally people don't care



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for the consumption of electricity in their day to day processes and are concerned about it when they get their electricity bills or in case of power shortage. Measuring of electricity consumption was started with Electromechanical Induction meter which operates by counting the revolutions of a metal disc rotating at a speed proportional to the power. The number of revolutions is proportional to the energy usage. The electric meter had taken more important roles in power system. The power meter can be utilized to detect or measure the presence of voltage, current, power and other parameters.

### CONCLUSION AND FUTURE SCOPE

The planned system has mentioned implementation of IOT. It is concluded that by using IOT technology the government person can find the dishonest user, it can make the assignment of the agents impracticable to steal the electricity. This analysis work has been implemented to find the dishonest user. To implement our objective, get hardware raspberry pi and install the operating system. Energy meter communicate with raspberry pi through GPIO pins. GPIO pins fetch the effective data from energy meter and it send effective data to the raspberry pi, then connect wifi module with raspberry pi. After this, connect raspberry pi with the internet. At the backend, where government person see the status of energy meter after successfully login with username and password and the status of energy meter are shown in the form of graphs. The entire implementation is being taken place in PYTHON surroundings. From the results it has been concluded that if there is any dishonest user then government person can find that dishonest user. In further implementation smart meter automatically cut electricity when any one tried to theft and it also monitor the electricity consumption through smart phone and smart meter that sends status if any fault occurred in transmission line. Furthermore it create bill by our self and also pay it and anyone can check the online status of energy meter as well as the consumption of energy.

### *Auto Intensity Control of Street Lights*

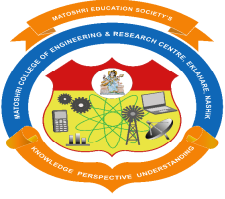
*Reference – [www.electronicsforu.com](http://www.electronicsforu.com)*

Street lights are controlled manually in olden days. These days automation of street lights has emerged. But one can observe that there is no need of high intensity in peak hours i.e. when there is no traffic and even in early mornings. By reducing the intensity in these times, energy can be saved to some extent.

There are many methods to save the power like Switching the street light on detecting vehicle , Street light controlling using LDR and relays etc. The proposed circuits controls street light intensity by calculating the peak hours.Two circuits are shown in this article,one explaining the street light control using ATmega8 and second explains street light controlling using PIC microcontroller. Most commonly found street lights are HID or High Intensity Discharge lamps, which consume a lot of power. In order to save energy, the circuits are designed with high intensity LEDs in place of HID lamps.

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found street lights are HID or High Intensity Discharge lamps, which consume a lot of power. In order to save energy, the circuits are designed with high intensity LEDs in place of HID lamps.

### Circuit Components

- ATmega8 micro controller
- DS1307 IC
- Light Dependent Resistor
- LED array.
- LCD display

### Circuit Design

The auto intensity control of street lights circuit is simple but it requires more coding part. This circuit consists of Atmega8 controller, DS1307, LDR, Relay and LEDs.

**LDR:**LDR is used for calculating the light intensity of the environment .The light dependent resistor is connected to ADC1 (PC1) pin of the micro controller. The analog light value is converted to digital value using ADC.

**RTC:**Current time is calculated using RTC. Real time clock has 8 pins out of which SCL and SDA are connected to PC5 andPC4 pins respectively. SCL is serial clock while SDA is serial data RTC is I2C compatible, where I2C means inter integrated circuit. One bit of data is transmitted on data bus for each clock cycle.

Data can be transferred between devices, using only two bi-directional buses. Each device can act as a slave or master. The slave devices will have one address and these devices can be accessed using this address.

**LCD:**LCD is the display used for displaying time which is read from RTC IC. Interfacing of LCD in 4-bit mode is shown in circuit diagram. D4-D7 pins of LCD are connected to PD0-PD3 pins of microcontroller.

RS pin of LCD is connected to PD4 pin of micro controller. RW and Enable pins are connected to PD5 and PD6 pins of controller.

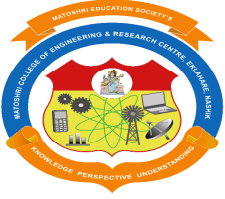
LED array is number of high power LEDs connected in series. It is connected to PWM pin of the microcontroller.

### I2C Protocol

I2c is a communication protocol invented by Philips Company. This is well suited for communication between integrated circuits and peripherals. This uses two lines to transfer data.

- Serial Data – SDA
  - Serial Clock – SCL.
1. This can connect up to 128 devices using two wires. Each device connected will have an address. The device which initiates the data transfer is called Master.
  2. Every device will have 7 bit address.
  3. Master initially sends the START bit on the data line.
  4. Then it sends the address of the device with which wants to communicate and the mode of operation i.e. read or write.
  5. The slave devices listen to the incoming data and checks if its address matches to the received data. The device whose address matches send an acknowledgement signal.
  6. Then master starts transmitting or receiving the data from the slave.
  7. After completion of the transmission, Master sends a STOP bit.
  8. Data on SDA can be changed only if SCL pin is low.





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### How Auto Intensity Control of Street Lights Circuit Works?

1. Initially power the circuit.
2. Time is displayed on the LCD display.
3. Place the LDR in darkness as the street lights switches on only when there is no light on LDR.
4. Now check the time if the time is between 9 pm to 2 am street light glows with full intensity.
5. From 2 pm intensity of the lights slowly starts decreasing and finally in early morning it glows with least intensity. When the light is sensed by the LDR lights are switched off automatically.

Code is written in such a way that up to 2 am lights will glow with full intensity. From then it slowly starts decreasing and finally it drops to zero in the morning.

### Working

We use both LDR and RTC in the circuit for the following reason: if only LDR is used, then there is no chance of saving any energy as the street lights will glow as soon as the intensity of light on LDR decreases and when the intensity increases, the street lights are turned off.

If only RTC is used, the street lights are turned on and off at preset time irrespective of the outside lighting conditions. When the device is turned on, RTC starts with the preset time in the code.

The microcontroller waits for the signal from LDR and when the intensity of light on LDR decreases, the output of the microcontroller is activated and the street lights start to glow. This event occurs only when the current time is in the range of preset time i.e. only after 5PM.

The lights continue to glow at full intensity up to 3 AM. When the time reaches 3 AM, the intensity of the street light gradually decreases and will turn off either at 6 AM or when the light on LDR is increasing, whichever is first.

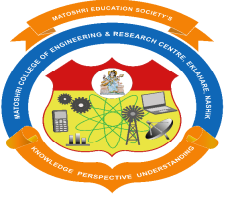
Hence, the auto intensity control of street lights is achieved with the above circuit which has an LDR, an RTC, a PIC microcontroller and an LED array.

### Auto Intensity Control of Street Lights Circuit Advantages

- Power wastage can be reduced.
- Using LED array reduces the cost.
- Using of RTC and LDR produces accurate results.

## **Application of SVM in Automatic car license plate recognition -Sneha Patil (B.E I.T)**

A lot efforts is taken to monitor the law breakers in the Automatic car license plate recognition system has always attracted researchers. It is a dynamic region of exploration in machine vision and its application. Over the years there have been many techniques where in car license plate recognition systems have been successfully proposed and developed. Broadly the car license plate recognition systems are classified as template matching based and extracting features based. Template matching based is simple and straight forward method but it is vulnerable to any font change, rotation and noise. Extracting feature based method is a fast method and more accurate but feature extraction is a challenge and any no robust feature decreases the recognition accuracy. On the basis of literature, proposed work is presented which is an integrated template and feature based method for automatic car license plate recognition system for INDIAN cars license system. Research is in progress aiming in developing an automatic car license recognition system based on still images. Image database set is collected for



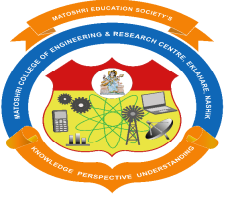
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different categories of car license system adopted in INDIA. Template matching is done via implementation of optical character recognition system which shall help in recognizing characters of the license plate. But to enhance the speed and to increase the accuracy of the system the images are classified using a new variant of state vector machine known as Multiclass SVM. A support vector machine (SVM) is a supervised machine learning model that uses classification algorithms for two-group classification problems. After giving an SVM model sets of labeled training data for each category, they're able to categorize new text. SVM is a supervised machine learning algorithm which can be used for classification or regression problems. It uses a technique called the kernel trick to transform your data and then based on these transformations it finds an optimal boundary between the possible outputs. It can solve linear and non-linear problems and work well for many practical problems. The idea of SVM is simple: The algorithm creates a line or a hyperplane which separates the data into classes. The idea is to implement the proposed system using the computational intelligence concept, image processing concept and artificial intelligence concept. The proposed system is then evaluated via MATLAB's Computer Vision Toolbox and Artificial Intelligence toolbox.

The proposed way of identifying the law breakers if implemented using machine learning and AI tool kit, can help the police and officers to monitor the traffic precisely. Which can further add to improvement in fast development of the government system.

### *Data Hiding in encrypted images - Tanmayi Katkade(B.E I.T)*

Today the digital data is increasing and almost all sectors are going digital. As the use digital techniques for transmitting and storing images are increasing; it is becoming an important issue how to protect the confidentiality, integrity and authenticity of images. With the popularity of computers and Internet, data is commonly transformed into digital forms and transmitted on Internet. Digitized data can be texts, images, audios or videos. A problem arose from sending digital data on Internet is how to ensure the secrecy of data transmission. Any modification of digital data makes it hard to protect the security of digital data. Consequently we know that digital data can also be transmitted through data communication networks without losing quality in a fast and inexpensive way. With digital multimedia, distribution over World Wide Web Intellectual Property Right (IPR) is more threatened than ever due to the possibility of unlimited copying. So by using some encryption techniques this easily copying of the data need to be restricted. However encryption does not provide overall protection. Once the encrypted data are decrypted, they can be freely distributed or manipulated. This problem can be solved by hiding some ownership data into the multimedia data which can be extracted later to prove the ownership. This technique mostly used in bank currency where a watermark is embedded which is used to check the originality of the note. The same concept called watermarking may be used in multimedia digital contents for checking the authenticity of the original content. So one solution of these things is to hide our valuable information in encrypted image. In this paper we make a survey of different data hiding methods. Here we first describe the purposes for image hiding, then data hiding in encrypted images. This survey gives the analysis of data hiding using image encryption based on image. But due the visibility problems it is possible to tamper some sensitive by the simple attacks, detection disabling attacks, ambiguity attacks or removal attacks. Hence there is need of some constructive, robust secured method of data hiding in encrypted image which we would be trying in future course



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### *Software as a service-Akash Jobanputra(T.E I.T)*

In the world of Information Technology, Softwares have become a part of everyone's life. Software as a Service (SaaS), sometimes referred to as "on-demand software" is a software delivery model in which software and related data are centrally hosted on the cloud. Users typically access SaaS via a web browser. For many business applications SaaS has become a common delivery model. In this paper SaaS is discussed in detail; its basic characteristics and its architecture. Various parameters which should be followed while purchasing software and its implementation is elaborated. The pros and cons of SaaS are also discussed.

Software as a Service (SaaS) is defined as a software application delivery model, where a software vendor deploys and hosts software applications in a multitenant (cloud) platform for its customers to operate the application over the Internet as services. SaaS has some unique features. SaaS applications are usually hosted at the service provider's network instead of being installed on premise, delivered as web applications, and serve as services for multiple tenants. SaaS applications can be deployed in a cloud computing environment and accessed through Internet by web browsers or users. As a result, it drastically reduces the upfront commitment of resources. As a consequence, SaaS applications can be deployed with minimal effort and be available in a very short span of time to a large group of users, and therefore, it makes SaaS model quite attractive to enterprises.

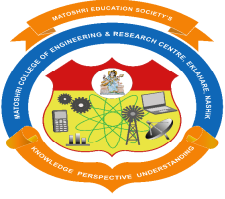
Advantages of using SAAS:

No infrastructure or software to purchase or maintain. Application and data are available anywhere with network connectivity. • Operating costs are reduced by managing infrastructure in central locations rather than at each customer's site. • Improved availability and reliability. • Lower Total cost of ownership.

SaaS will be the way most applications will be delivered. A single server handing multiple customers which greatly reduces hardware cost. The numbers show that SaaS is a far more attractive economic model than the perpetual license model.

### *Enhancing web app development using firebase - Swapnil Mulane (B.E I.T)*

Firebase is a platform for mobile and web application with tools and infrastructure which allows developers to build high quality applications. Firebase consists of features that developers can use together to meet their needs. Earlier Firebase was used as a real-time database, which provides developers an API to sync and store data across various clients. Over time, its product has been expanded to become a full suite for an app development. Platform has merged into many diverse fields, and is becoming more complex due to the expansion in the field. With changing requirements from customers is making it even more difficult. Old platform approaches are not adequate and able to satisfy the new requirements of the market. As a result, new platform approaches are evolved. Firebase is a powerful API to sync and store data in real time helping to build real time apps for the web. Firebase takes care of most of the backend concerns and is dubbed a Backend as a Service (BaaS). Firebase also



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pushes state to your application utilizing web sockets. This means that an interactive app can be even more interactive as you don't need to refresh the browser to get updates; they are pushed in real-time. Data is made easier by the backend by visualizing it in a no-SQL type of setup. You can easily add nodes to your data set or import an existing JSON file. You can also watch as data is updated, deleted, or added and see the flashes of colors that signify these actions. Add a node and it flashes green. Update some data and the node flashes orange. Completely remove or delete a node and you'll see it flash red before disappearing

A great set of features are provided by Firebase. The Firebase's database is a blessing for app developers. All the changes made on one instance of the application will be automatically reflected on other instances which means it's a real time database. New features introduced adds to the already amazing feature set of Firebase, making it capable of handling most of the application database requirements and as well as remote configurations and the cloud notifications. Firebase provides you with a set of essential features which can be utilized by almost every application. It's recommended to use FCM rather than any other service to notify your users. The syncing and offline capabilities is flawless. Firebase is the service to go for if you don't need to query much.

### ***Remove Unwanted object from video using removal base In-Painting - Pratiksha Magar***

One of the main problems of most related video completion and video in-painting techniques is the processing time. Image in-painting, is sometimes it is also known as "image completion" is the reconstruct and recovers removed or corrupted pixel of an image in a given section so that the reassemble image looks real. These image in-painting techniques recover the eliminated pixel in images by increase continues structures into the target section via diffusion. Many selfstarting techniques for video in-painting are convenient, but most of them are compellingly demanding and fail to repair the damaged areas. Also, from the existing video in-painting algorithms a cryptic video classification has to be provided. To decrease this problem, in-painting process is introducing by using the background registration method which is suggested in this paper. The video is converted into no of image frames and the frame is registered. After, the edges of an object to be removed are detected by matching the roster frame with each adjacent frame of the video. Later an outlined is reproduced for each time frame. Then the in-painting process is winding up uniquely for each and every time frame of the image. Finally, these reconstructed image frames are displayed one by one, or continuously, so that it appears as a better quality video.

Now a day's intercommunication between the people been done with the help of the images and video data. So videos are an important intermediate of communication and expression in nowadays. Image in-painting, is conceptually to regenerate and recover of missing or corrupted pixel of an image. Frames registration process which is used in video in painting in that process, we are aligning the neighboring source frames with the destination frame. Recovery or in painting methods use information from outside of the corrupted area for rebuilding removed pixels. There are a lot of applications for video completion, including video analysis and film post production, cellular video transportation, video recovering, removal of information such as spatial coordinates from aerial. The goals of this technique ranging from the regenerate of damaged videos and image to the removal of the unnecessary objects in the video. The

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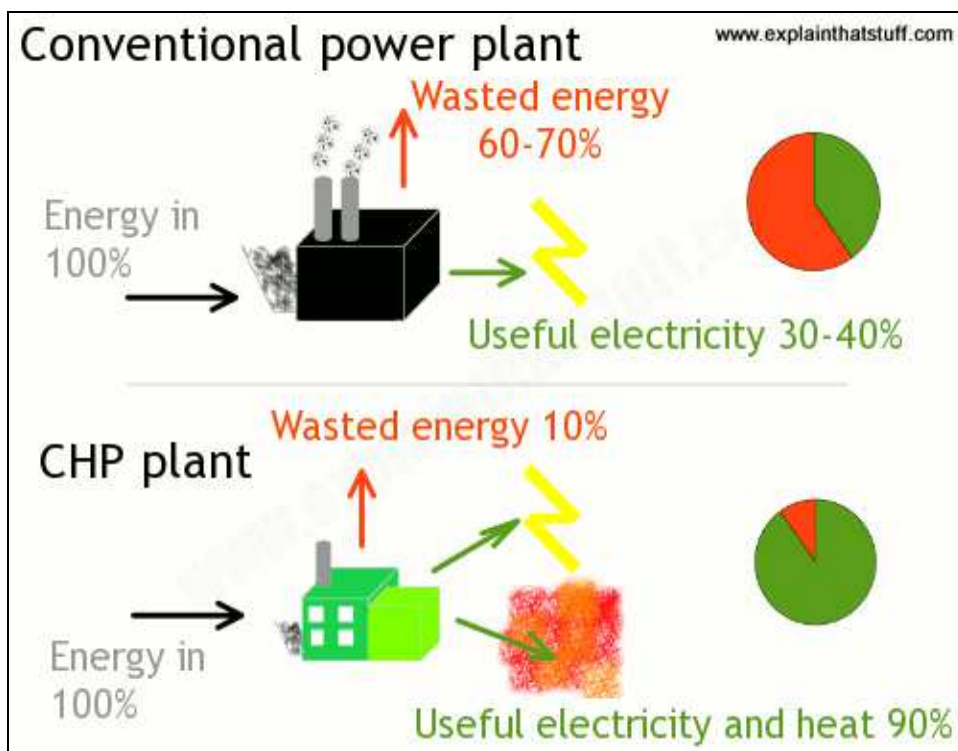
main objective is to create a video sequence in which the in painted area is blending sleekly in the video thus maintaining visual texture, i.e. no distortion is observed by the human eye when that video is played.

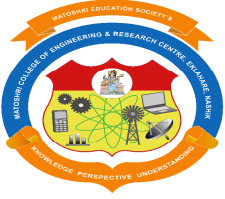
Video in-painting using NNF algorithm is sufficient for many practical applications like object removal, scratch repairing, object reshuffling and repairing of old selected videos. NNF algorithm avoids the costly Computations of the joint patch compatibility term and inference or optimization algorithms. The given algorithm does have some failure cases. Most highly, for pathological inputs, In addition, more edits to video frame can sometimes produce “feathering” artifacts where the algorithm simply can’t escape a large local minimum depression. However, the speed of the algorithm makes it feasible to either introduce additional repression or simply rerun the algorithm with a new random input to obtain a different solution. Although such repeated trials can be a difficulty with a slower algorithm. Nearest-neighbor algorithm use for in-painting the damaged area in video frame and it quickly computes the almost nearest-neighbor fields between pairs of images .The proposed algorithm increase the speed of matching nearest neighbor.

### *Cogeneration- Need of society*

*Mr. Dipak P. Patil*

Cogeneration is also called as **combined heat and power** or combine heat and power. As its name indicates cogeneration works on concept of producing two different form of energy by using one single source of fuel. Out of these two forms one must be heat or thermal energy and other one is either electrical or mechanical energy.





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Cogeneration is the most optimum, reliable, clean and efficient way of utilizing fuel. The fuel used may be natural gas, oil, diesel, propane, wood, bagasse, coal etc. It works on very simple principle i.e the fuel is used to generate electricity and this electricity produces heat and this heat is used to boil water to produce steam, for space heating and even in cooling buildings.

In a conventional power plant, the fuel is burnt in a boiler, which in turn produces high pressure steam. This high pressure steam is used to drive a turbine, which is in turn is connected to an alternator and hence drive an alternator to produce electric energy.

The exhaust steam is then sent to the condenser, where it gets cool down and gets converted to water and hence return back to boiler for producing more electrical energy. The efficiency of this conventional power plant is 35 % only. In **cogeneration plant** the low pressure steam coming from turbine is not condense to form water, instead of it its used for heating or cooling in building and factories, as this low pressure steam from turbine has high thermal energy.

The **cogeneration plant** has high efficiency of around 80 – 90%. In India, the potential of power generation from **cogeneration plant** is more than 20,000 MW. The first commercial cogeneration plant was built and designed by Thomas Edison in New York in year 1882.

In conventional power plant, with 100 % energy input, only 45 % of energy is used and rest 55 % is wasted but with cogeneration, the total energy used is 80% and energy wasted is only 20%. It means with cogeneration the fuel utilization is more efficient and optimized and hence more economical.

\*Source: <https://www.electrical4u.com/cogeneration-combine-heat-and-power>

### ***Title: Energy Audit- Need for individual home***

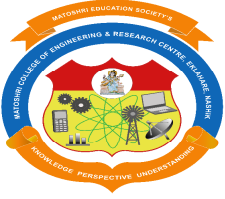
***Ms. Rohini Jorve***

A home energy audit is a service where the energy efficiency of a house is evaluated by a person using professional equipment (such as blower doors and infrared cameras), with the aim to suggest the best ways to improve energy efficiency in heating and cooling the house.

An energy audit of a home may involve recording various characteristics of the building envelope including the walls, ceilings, floors, doors, windows, and skylights. For each of these components the area and resistance to heat flow (R-value) is measured or estimated. The leakage rate or infiltration of air through the building envelope is of concern, both of which are strongly affected by window construction and quality of door seals such as weather stripping. The goal of this exercise is to quantify the building's overall thermal performance. The audit may also assess the efficiency, physical condition, and programming of mechanical systems such as the heating, ventilation, air conditioning equipment, and thermostat.

A home energy audit may include a written report estimating energy use given local climate criteria, thermostat settings, roof overhang, and solar orientation. This could show energy use for a given time period, say a year, and the impact of any suggested improvements per year. The accuracy of energy estimates are greatly improved when the homeowner's billing history is available showing the quantities of electricity, natural gas, fuel oil, or other energy sources consumed over a one or two-year period.

Some of the greatest effects on energy use are user behavior, climate, and age of the home. An energy audit may therefore include an interview of the homeowners to understand their patterns of use over



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time. The energy billing history from the local utility company can be calibrated using heating degree day and cooling degree day data obtained from recent, local weather data in combination with the thermal energy model of the building. Advances in computer-based thermal modeling can take into account many variables affecting energy use.

A home energy audit is often used to identify cost effective ways to improve the comfort and efficiency of buildings. In addition, homes may qualify for energy efficiency grants from central government.

Recently, the improvement of smartphone technology has enabled homeowners to perform relatively sophisticated energy audits of their own homes. This technique has been identified as a method to accelerate energy efficiency improvements.

\*Source: [https://en.wikipedia.org/wiki/Energy\\_audit](https://en.wikipedia.org/wiki/Energy_audit)

### *Mechanical Energy- One of the source of energy for Life*

*Mr. Dipak P. Patil*

**Mechanical energy**, sum of the kinetic energy, or energy of motion, and the potential energy, or energy stored in a system by reason of the position of its parts. Mechanical energy is constant in a system that has only gravitational forces or in an otherwise idealized system—that is, one lacking dissipative forces, such as friction and air resistance, or one in which such forces can be reasonably neglected. Thus, a swinging pendulum has its greatest kinetic energy and least potential energy in the vertical position, in which its speed is greatest and its height least; it has its least kinetic energy and greatest potential energy at the extremities of its swing, in which its speed is zero and its height is greatest. As the pendulum moves, energy is continuously passing back and forth between the two forms. Neglecting friction at the pivot and air resistance, the sum of the kinetic and potential energies of the pendulum, or its mechanical energy, is constant. Actually the mechanical energy of the system is diminished at the end of each swing by the tiny amount of energy transferred out of the system by the work done by the pendulum in opposition to the forces of friction and air resistance. The mechanical energy of the Earth-Moon system is nearly constant as it is rhythmically interchanged between its kinetic and potential forms. When the Moon is farthest from Earth in its nearly elliptical orbit, its speed is least. Its kinetic energy has become least, and its potential energy is greatest. When the Moon is closest to Earth, it travels fastest; some potential energy has been converted to kinetic energy.

\*Source: <https://www.britannica.com/science/solar-energy>

### *Global Warming: A key issue for refrigeration and air conditioning*

*Mr. P.R.Soanwane*

Temperature is a magnitude and a key variable in physics, chemistry and biology, and characterizes the state of matter and liquid, solid and gaseous phases, which is vital to all living beings. Thus, thanks to research and development for almost 200 years, refrigeration technologies have progressively led to the providing of goods and the setting up of services vital to mankind:

Cryogenics: air separation for medical uses (cryosurgery, anaesthesia); petrochemical refining, steel production.; space propulsion fuels, superconductivity for large research instruments, energy

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(thermonuclear fusion...), medical applications (scanners..), transport and distribution of natural gas or hydrogen, manufacturing of semi-conductors, sequestration of CO<sub>2</sub>, conservation of species. Other health uses: preservation of cells, tissues, organs, embryos... surgery and operating theatres, manufacturing and transport of drugs, vaccines..

Air conditioning: vehicles, living areas, integrated systems (heating and cooling) with heat pumps, offices and factories, particularly in hot climates but also for technologies (electronic components, computer technology, data centres, biotechnology)...

Food: manufacturing (texturation, formulation, freeze-drying, fermentation, concentration and separation), storage, transport, commercialization, domestic refrigerators. - Energy and environment applications: cryopreservation of genetic resources, capture and underground storage of CO<sub>2</sub>, heat pumps, new energies

### Refrigeration and air conditioning have an important impact on the environment

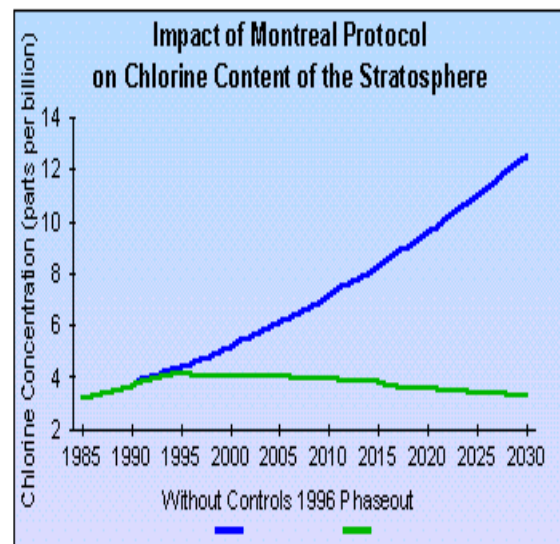
On the stratospheric ozone layer More than 90% of refrigeration equipment relies on vapour compression using refrigerants and this figure will not change in the near future: other technologies do not generally have enough efficiency. Chlorinated refrigerants (chlorofluorocarbons – CFCs, and to a lesser extent, hydrochlorofluorocarbons - HCFCs) contribute to the depletion of stratospheric ozone if released into the atmosphere due to equipment leaks or if refrigerants are not properly recovered when disposal of the equipment takes place.

CFCs and HCFCs are gradually being phased out thanks to the Montreal Protocol. Current measurements of the ozone layer show overall stability and probable recovery to the previous level around 2060. They are often replaced by hydrofluorocarbons (HFCs) which do not deplete ozone layer but are potent greenhouse gases, as are HCFCs, when released into the atmosphere. CFCs were also greenhouse gases and their global warming potential was much higher. The impact of Montreal Protocol is thus also positive regarding global warming. However, it is not enough.

\*Reference: Refrigeration Drives Sustainable Development – State of the Art – report card, IIR-UNEP. 2007.

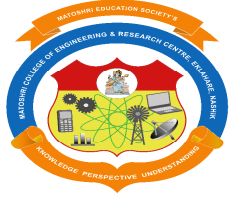
\*Source:<https://www.energy-learning.com/index.php/archive/86-global-warming-a-key-issue-for-refrigeration-and-air-conditioning>

The Cold Chain



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*Solar energy: Need of the hour*

*Mr. Pratik Sonawane*

The central government of India is walking along a right track to achieve its goal of 100GW by 2022. This becomes evident from the recently concluded "International Solar Alliance". The future looks bright for this energy to flourish in India. Recently government has decided to auction 30GW solar energy capacities each in 2018-19 and 2018-20 to achieve the target of 100GW.

For rural areas, solar energy has worked wonders. By the end of 2015, almost 1 million solar lanterns were sold in the rural areas reducing their dependability on kerosene. Apart from the large scale grid-connected solar PV initiative, India is also developing off-grid solar powers for rural and semi urban areas. India observes on an average 300 sunny days every year which makes it a possibility to achieve 5000 trillion kWh every year. This is more than enough for a population of 1.3 billion. But there are many challenges which impede the government from achieving its potential energy needs.

Solar PV has become obsolete and demands for evolution. This is not in line to become cost competitive which deter solar energy from being able to compete on the same scale as other energy generation technologies. Adding to the cost are Transmission and Distribution (T&D) losses that at approximately 40 percent make generation through solar energy sources highly unfeasible. However, the government is supporting R&D activities by establishing research centers and funding such initiatives. The government has tied up with world-renowned universities to bring down the installation cost of solar power sources and is focusing on upgradation of substations and T&D lines to reduce T&D losses. There is another challenge of "Per capita land" availability that is very low in India, and land is a scarce resource. Dedication of land area near substations for exclusive installation of solar cells might have to compete with other necessities that require land.

Funding of initiatives like National Solar Mission is a constraint given India's inadequate financing capabilities. The finance ministry has explicitly raised concerns about funding an ambitious scheme like NSM.

The conclusion is that if we could beat the challenges aforementioned then our future energy needs can be secured for many more years and we will be able to provide a clean and green energy for our upcoming generations.

\*Source: <https://www.theceo.in/the-ceo-magazine/solar-energy-need-of-the-hour>

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