# Increasing Efficiency of a Solar Power Plant Using Mirror and Water Pump

**A Project submitted in partial fulfillment of the requirements for the Award of Degree of**

**Bachelor of Science in Electrical and Electronic Engineering**


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# Certification

This is to certify that this project and thesis entitled "**Increasing Efficiency of a Solar Power Plant Using Mirror and Water Pump**" is done by the following students under my direct supervision and this work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on 31 October 2019.

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The project and thesis entitled **"Increasing Efficiency of a Solar Power Plant Using Mirror and Water Pump"** submitted by Md. Farhad Hossain and Md. Bulbul Ahmed, ID No: 162-33-301 and 162-33-313, Session: Summer 2016 has been accepted as satisfactory in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electrical and Electronic Engineering** on 31 October 2019.

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**Dedicated to**

***Our Parents***

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# 2 List of Abbreviations

| | |
|---|---|
| LNG | Liquefied Natural Gas |
| CD | Chromatic Dispersion |
| EMI | Immune to Electromagnetic Interference |
| FBG | Fiber Bragg Gratings |
| PIC | Programmable Interface Controllers |
| I | Voltage |
| V | Current |
| FWHM | Full Width at Half Maximum |
| GVD | Group Velocity Dispersion |
| GDP | Gross domestic product |
| P | Power |
| LED | Light Emitting Diodes |
| MD | Material Dispersion |
| NLSE | Nonlinear Schrödinger Equation |
| PMD | Polarization Mode Dispersion |
| PUA | Piecewise Uniform Approach |

| | |
|---|---|
| RMS | Root Mean Square |
| SSMF | Standard Single Mode Fiber |
| TFBG | Tilted Fiber Bragg Gratings |
| ICFEI | International Council for native Environmental Initiatives |
| UV | Ultraviolet |
| WD | Wave-guide Dispersion |
| WDM | Wavelength Division Multiplexed |

# 3 List of Symbols

| | |
|---|---|
| $\lambda$ | Wavelength |
| $\lambda_B$ | Bragg wavelength |
| $n_{eff}$ | Effective index |
| $Z$ | Position along the grating |
| $N$ | Mode index |
| $F$ | Fundamental Frequency |
| $\omega$ | Angular frequency |
| $M$ | Modulation Index |
| $T$ | Fundamental Time Period |

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First of all, we give thanks to Allah or God. Then we would like to take this opportunity to express our appreciation and gratitude to our project and thesis supervisor **Farhan Sadik Sium, Lecturer** of **Department of EEE** for being dedicated in supporting, motivating and guiding us through this project. This project can't be done without his useful advice and helps. Also thank you very much for giving us opportunity to choose this project.

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To our beloved family, we want to give them our deepest love and gratitude for being very supportive and also for their inspiration and encouragement during our studies in this University.

# ABSTRACT

At present energy crisis is the main problem that we are facing now. As an engineer, we should overcome this power crisis by some innovative alternate methods. Solar energy is the right source to put down this power crisis as well as power demand. For maximizing output power of solar cell MPPT (Maximum Power Point Tracking) is followed. But this method is costly and requires power. So in this research an improved and adaptive mirror system is introduced to get better output in a cost effective way. When the sun rises in the east, then the solar panel cannot get light. By using mirror w cat get light. Again when the sun is west side, then we can light by the mirrors. So then the efficiency is increased. Another problem of solar cell is over-heating .When sun light intensifies the panel gets over heated and efficiency falls. An automated water pumping method is introduced to remove the heat and maximize efficiency.

# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

Solar energy is pure and is abundantly available. Solar technologies appliance the sun to provide heat, light, electricity's for domestic and industrial applications. With the alarming rate of depletion of the major conventional energy resources such as Coal, Petroleum and Natural gas, coupled with the environmental degradation caused by the process of harnessing these energy sources, it has become an urgent necessity to vest in renewable energy resources that would power the future sufficiently without degrading the environment through greenhouse gas emission. The energy potential of the sun is infinite, but despite this unlimited solar energy resource, harvesting it is a challenge mainly because of the limited efficiency of the array cells. The conversion efficiency of most commercially available solar cells is in the range 10 to 15%[1].Although recent breakthrough in the technology of solar cells shows significant improvement but the fact that the maximum solar cell efficiency still falls in the less than 20% range shows there are enormous room for improvement`

### 1.1.1 Power scenario of Bangladesh:

Bangladesh is a mid-income country. Her GDP growth rate is one of the world's largest. For any country, development is the precondition for continued growth of GDP. And the main driving force of the country's development is energy. Proper use of energy is essential to meet the country's growing energy demands as well as to lift up from a mid-income country to a developed country. Energy is playing a vital role in implementing Vision-2121, Vision-2041 and achieving Sustainable Development Goals. In Bangladesh, about 70 percent of energy demand is met from natural gas. Among other fuels- oil, coal, biomass etc. are vital. There is a huge reserve of coal in our country, but coal is less produced as well as less used here. On the other hand, natural gas reserve is not that substantial, but its production and consumption are the highest among the available resources. Be-sides those, energy demand is being met through imported oil and LPG. Moreover, the government has already started importing LNG to meet increasing gas demand. Biomass is being used as a lion's share of energy. The energy demand is also being met by importing electricity from India. The use of renewable energy instead of gas, coal and oil has been started in the whole world and is essential for sustainable development and keeping up with the environment by preventing carbon emissions. Many countries in the world like Sweden, Germany, China and USA are currently using renewable energy as a significant part of their energy demand. Bangladesh is also using renewable energy, but it's very less than necessity. The government has taken various steps to increase the use of renewable energy in the future, including solar home sys-tem, solar irrigation system, Rooppur nuclear project, etc. Development of energy sector is the key factor for continued development of the country. Bangladesh needs to emphasize on the new exploration activities using latest techniques to explore new mines. Apart from reducing dependence on natural gas, it needs to be coordinated with the imported LNG and enhance the percentage of usage oil and LPG; thereby Bangladesh will succeed in reaching its desired goal of development.[2]

**Table 1: Energy calculation for 2017-18. (MTOE) [2]**

| Name of Fuel | Unit | MTOE |
|---|---|---|
| Oil (Crude + Refined + LPG ) in K ton | 6948 | 6.9 |
| LPG | 554 | 0.5 |
| Natural Gas in Bcf | 961 | 22.3 |
| Coal (Imported) in K ton | 3395 | 2.1 |
| Coal (Local) in K ton | 923 | 0.6 |
| RE (Hydro) in MW | 230 | 0.2 |

| | | |
|---|---|---|
| RE (Solar) in MW | 350 | 0.3 |
| Electricity (Imported) in MW | 650 | 0.5 |
| Sub- total | | 33.4 |
| Biomass | | 13.6 |
| TOTAL | | 47.0 |

### 1.1.2 Solar power scenario of Bangladesh:

The present placed generation capacity including captive power: 16,046 MW (310.4 kWh/capita) .The population of only 62.4% have access to electricity. Two third of the population alive in rural areas51.4% of them have access to the electric grid. Bangladesh's primary energy consumption was mainly natural gas (21.2 Mtoe) and oil (5.7 Mtoe).[3]

Millions of tons of oil equivalent (Mtoe) are a unit of energy used to narrate the energy content of all fuels, typically on a very large scale. It is equal to $4.1868 \times 10^{16}$ Joules or 41.868 peta-joules which is a tremendous amount of energy. [4]

The long term average sunshine data inform that the period of bright sunshine hours in the coastal regions of Bangladesh varies from 3 to 11 hours daily. The insulation in Bangladesh varies from 3.8kWh/m2/days to 6.4 kWh/$m^2$/day at an average of 5 kWh/$m^2$/day. These indicate that there are good expectations for solar thermal and photovoltaic application in the country. The population in Bangladesh with a calculation 40% for having no access to electricity, the government introduced a scheme known as solar home systems (SHS) to provide electricity to households with no grid access. The program arrived 3 million households as of late 2014 and, with more than 50,000 systems being added per month since 2009, the World Bank has called it "the fastest rising solar home system program in the world. "Towards universal electricity access the Bangladeshi government is operating by 2021 with the SHS program projected to include 6 million households by 2017

## Solar power advantages:

Solar energy is a perfect and renewable energy source. Once a solar panel is put, solar energy can be produced free of charge. The solar energy will last forever whereas it is calculated that the world's oil store will last for 30 to 40 years. This solar energy causes no pollution. Solar cells build absolutely no noise at all. On the other hand, the giant machines improved for pumping oil are extremely noisy and therefore very impractical. Very little maintenance is needed to protect solar cells running. There are no moving parts in a solar cell which create it impossible to really damage them. In the long term, there can be a high return on investment due to the amount of free energy a solar panel can generate, it is calculated that the average household will view 50% of their energy coming in from solar panels.

## Solar power Disadvantages:

Even though there are many unique advantages of solar panel there are few demerits of solar cells. In the case of practical implementation and robustness these points should be considered.

Solar panels can be expensive to run resulting in a time-lag of many years for frugal on energy bills to match initial investments.

Electricity generation confides entirely on a countries exposure to sunshine; this could be narrow by a countries climate.

Solar power stations do not suit the power output of similar sized conventional power stations; they can also be very expensive to make.

Solar power is applied to charge batteries so that solar powered devices can be applied at night. The batteries can often be plenty and bulky, holding up space and needing to be changed from time to time.

## 1.2 Problem statement:

For maximizing output power of solar cell MPPT (Maximum Power Point Tracking)is followed. But this method is costly and requires power. So in this research an improved and adaptive mirror system is introduced to get better output in a cost effective way. Another problem of solar cell is over-heating .When sun light intensifies the panel gets over heated and efficiency falls. An automated water pumping method is introduced to remove the heat and maximize efficiency.

## 1.3 Objective:

The objectives of this project are

i. To investigate simple yet cost effective solar power plan

ii. To study different criteria of this solar panel

iii. To apply the previously investigated and simulated idea to get better efficiency.

iv. To design more improved and cost effective solar panel.

### 1.4 Scopes:

There are many other scopes that might develop this thesis work even further. Firstly Ge or GeAs based solar panel might be used instead of silicon based solar cell. To improve the solar spectrum more efficiently, multifunctional, intermediate, and thermo photovoltaic solar cell structures might be proposed. The single junction solar cells of G and In As that are used as cells below the triple junction solar cells can be investigated to replace Si. These might provide a cost effective solution.

Secondly this solar panel was not connected to grid lines there might be huge research scopes to connect this solar panel to national grid. A whole new SCADA (supervisory control and data acquisition, a computer system for gathering and analyzing real time data) system might be devised to optimize the grid level connection and power storage.

## 1.5 Research Methodology:

Firstly we work the simulation process then from the simulation we get some errors that name is simulation error mitigation .Then from the simulation error mitigation to change the another process that name is row hardware implementation .then from this implementation we get error cancelation .then we get final user end product implementation .Finally, from final user end product implementation we get some characteristics.

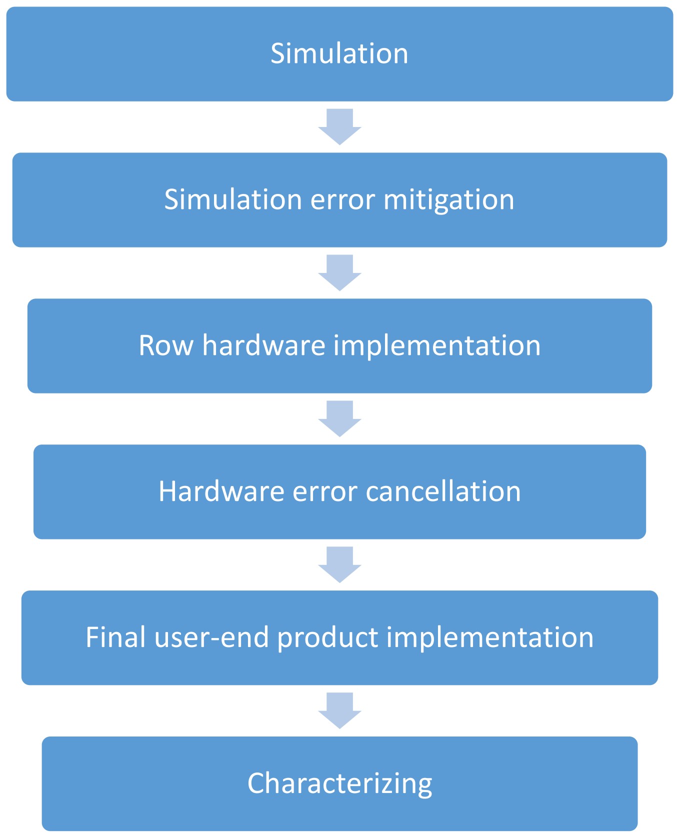


Figure 1: Flow chart of research methodology.

# CHAPTER 2

# Literature Review

## 2.1 Introduction:

The literature review on modern solar panels can be divided into three broad categories:

1) Technical papers dealing with a specific aspect of the technology, method of installment, or feasibility;

2) Policy papers that analyze the effect of government policies; and

3) Social-psychological papers that focus on consumer motivations to purchase solar systems.

### 2.1.1 Technical Papers

A number of reports specialize in the technical aspects of solar power adoption like the simplest variety of system for a region or the simplest angle for the panels. As an example Payne (2000) explores the practicable ness of a brand new variety of PV technology. His focus is on abundant what proportion what quantity a lot economical the technology is and the way much cost-saving it'd generate. Holbert (2007) instead focuses on one space, Phoenix Arizona, and calculates the simplest direction and angle for star panels to get the foremost energy. As he's watching only one city he's conjointly ready to discuss the particular laws and incentives that have an effect on the native star market. Perez (2004) conjointly focuses on the technical aspect of the discussion, though in his to live profitableness of star systems for owners.

### 2.1.2 Financial and Regulatory Papers

Just as there are a spread of presidency policies and incentives geared toward promoting residential star panels over the last forty years (Both within the U.S. and in different countries round the world ), there are variety of studies done that decide to confirm however victorious these policies and incentives were and what created them succeed or fail. Some studies specialize in analyzing specific government programs, as an example Hoffman and kiefer's (2001) study on the German one thousand upper side program or Hass' (1998) study on the Austrian upper side program. Still different studies specialize in a particular neighborhood and take a look at to see the most effective policies for it, given native conditions. One such study is Holbert's (2007) study of the Phoenix space. Other studies apply a range of methodologies so as to answer the question, like long's (1993) economic science analysis, Hassest's (1993) use of panel information, and Hayne's (2002) use of case studies. While the methodologies and specific focus of the studies square measure all terribly totally different, there square measure some overarching concepts and conclusions created regarding the residential solar battery trade. The primary is that, in general, monetary incentives work for developing the trade by lowering the prices of star panels. This can be as a result of because the trade develops; suppliers and installers recover at creating and putting in star panels. As a result, they cut back prices and may so charge customers less. Conjointly because the market grows, supplier square measure able to build larger factories and make the most of economies of scale. Where the studies differ is in what financial incentives work the best at doing this. Another common conclusion is that without the necessary infrastructure in place, financial incentives will have a very limited impact. In alternative words, if there aren't enough installers or internal control checks, or if it's tough to truly connect the electrical device system to the energy grid, then it will take a long time to completely install all the new solar panel systems that the financial incentives will bring. This will hurt the reputation of the program and the industry, leading to fewer consumers buying solar panels. Similarly to the previous conclusion, many studies such as Haynes (2002) and Plainly (2001) have found that quality control is integral in both lowering costs and ensuring the reputation and thus success of a program or incentive. Programs or incentives that have a poor internal control method not solely result in additional solar array failures, so damaging the name; however conjointly fail to properly promote trade growth. This can be caused by the actual fact that poor internal control implies that installers are sub-par and unlikely to enhance and can conjointly result in poorly designed star panels being supported on the market by the incentives, lowering the quality of the trade. Haynes (2002) conjointly states that a stable and adequate supply of funding is significant for any money incentives. This is not quite as crucial at the residential level as it is at the utility level, where many incentives and contracts are very long-term, but it still plays a significant role in the ridden market as well. For example, if funding runs out in a given year, or there is not a guarantee there will be enough funding, then consumers are more likely to wait and not purchase a solar panel system until they can be sure that they will receive the funds from the incentive.

### 2.1.2 Socio-Economic Papers:

There are a number of papers, especially in the last ten years, which look into what motivates consumers to purchase solar systems and go beyond just the financial aspects of that decision. Palm (2011) conducted a series of interviews with consumers in Sweden who had adopted green technology, either PV or micro wind turbines, or were in the process of doing so, to uncover their motivations and any barriers to adoption. There were two major motivations reported for adopting green technology. One is for environmental reasons, each within the strict sense of eager to cut back pollution associate degreed conjointly as being an integral a part of their self-image of living an inexperienced fashion. The other motivation is to be more independent, whether that is the desire to be more independent from the electricity companies, society, or to be more financially independent, the underlying motivation is that green technology makes them less dependent on others. The major barrier to adoption is the high upfront cost combined with the long pay-back period. Fairs(2009) conducted associate in-depth review of residential star adoption within the United Kingdom so as to work out why many incentive programs were succeeding whereas another program was failing. Fairs analyzed differences in motivations of early adopters as compared to early majority adopters, the next consumer group to adopt a technology. What he finds is that early adopters base their decision primarily off of environmental concerns and their interest in solar technology. While those motivations are still important to the early majority, they also care about aesthetic, financial, and operational issues and find solar technology lacking in those regards. Gillingham (2010) and Roth field (2010) both look at the impact that previous adoption of solar technology in an area has on future adoptions in that area.

They both used different methods: Gillingham ran three different experiments each analyzing different levels of data and Roth field used a zero-inflated negative binomial model that allowed her to also analyze the effect of several other variables. In the end they both came to the same conclusion that a previous adoption in an area (both at the street level and the zip-code level) increases the likelihood of further adoptions in that area. The two most likely reasons for this are that seeing a neighbor with a solar system motivates people to adopt solar as well in order to not be outdone, or that they will learn more about solar systems from the neighbor and with this increased knowledge on the subject, feel confident enough to adopt the technology as well.

## 2.2Study Review:

Finally the article “Greening Local Energy” by Zahran et al. (2008) endeavors to help policy makers design appropriate policies for household adoption of solar energy by looking at county-level data for the entire country. Zahran et al. do not compare the different policy tools available, but instead provide all the other information a policy maker might need, such as the location of households that are already using solar energy as well as pertinent environmental, economic and sociopolitical factors that would explain why households are willing to pay to install solar panels on their building. Zahran et al. maintain that the most important factor to consider is how much solar radiation a county receives, as higher amounts of solar radiation produce more solar energy per square foot, requiring fewer panels to collect the same amount of energy. This means that solar energy systems will be cheaper and take up less space, both of which should encourage adoption. Another important environmental factor is the climate of a county, which they measure using maximum temperature. This is important as counties that have a hot climate do not have as great a need for heating while counties with a cold climate are much more likely to have their solar panels damaged in winter periods. Solar energy systems have very high up-front costs so naturally economic factors play a large role in solar energy adoption. The most obvious factor to consider is how wealthy somebody is, as the wealthier they are, the less of a financial burden it is to install a solar energy system. The article uses the median home value of a county to measure this, as this gives a general idea for how wealthy the county is while also indicating a source of ready capital to finance installation. Simply because someone is moneyed doesn't mean that they're willing to truly pay that money on pricy product. several studies, like Gourinchas and Parker (2002), have shown that buyers between the age of forty to forty nine area unit the foremost probably to get pricy consumer goods, like alternative energy systems, and then Zahran et al. conjointly live the proportion of the population in a very county between age forty and forty nine. The article also measures whether there is a solar energy retailer in the county or not. Without a retailer nearby, adoption is unlikely. Another economic factor measured by Zahran et al. is the level of urbanization in a county. This is an important factor largely due to the fact that more urbanized counties have dense social networks that increase the effectiveness of word of mouth propagation of the technology as well as informational campaigns. The last set of factors that predict solar energy adoption are the sociopolitical factors. In short there are major environmental benefits to using solar systems and so counties with populations that are both aware of and care about this are more likely to adopt solar systems. The article uses three different measures to determine the likely attitude of a county. The first is what share of the population area unit Democrats, as Zahran, Brody, Grover, and Vedlitz (2006) found that Democrats area unit additional doubtless to adopt policies designed to conserve the environment and thus more likely to switch to solar energy. The next is the number of nonprofit environmental organizations in the county. Environmental nonprofits function to increase awareness of environmental issues, including the benefits of solar energy. The last live is whether or not or not a county could be a member of The International Council for native Environmental Initiatives (ICLEI).ICLEI works to help members promote environmental sustainability, which means that the county is invested in working on those issues so members of the community are more perhaps to adopt solar energy. After explaining the reasoning behind all the factors the article constructs a statistical model to determine how many households have adopted solar energy for home heating. The technical problem they had in modeling the count of solar energy users in a county was that many counties had zero households that use solar energy, which invalidated most ordinary statistical approaches. A common way to account for excess zeros is to use a zero-inflated count model as advanced by Lambert (1992). In the finish they used a zero-inflated negative binomial regression (ZINB regression).The ZINB regression splits the calculation into two smaller models, one that simply determines whether or not a county will have any households that use solar energy and another that determines just how many households use solar energy in counties that do have some household users. They created four separate models by starting without using any of the factors and then adding in first environmental, then economic, and finally sociopolitical factors. In the end the final model that incorporates all of the factors was the best predictor of household adoption. Overall their statistical model did a good job of predicting household adoption although it did systematically overestimate zero count counties. Next they use predicted values to create standardized residuals to determine which counties were significantly above or below expectations from the model. If the model is a good predictor for solar energy adoption based on environmental, economic, and sociopolitical reasons, that means counties that are performing above expectations are likely providing their households with additional incentives such as financial assistance and other policies while counties that are performing below expectations have untapped potential and that proper policies could provide the boost needed to get households started. Zahran et al. end by discussing the significance of spatial predictors. Solar radiation is extremely significant with counties having high levels of solar radiation being very likely to have households using solar energy. Maximum temperature was also a significant predictor. Using the square of maximum temperature, Zahran et al. were able to show that as expected, counties with either high or low temperatures were less likely to have households using solar energy. On economic factors, measures of wealth, urbanization, and the percent of the population aged 40 to 49 were all significant positive predictors of household adoption. The presence of a solar energy retailer was not significant however. This is likely due to using a coarse measure, however the no significance of retailer presence as a predictor of the count of solar energy users in a county, might also mean that it is easy for households to purchase their solar energy systems from outside the county and online. For the sociopolitical factors, the percentage of the population that vote Democrat and whether the county is a member in ICLEI are both significant positive predictors and have at least as great an influence on solar energy adoption as solar radiation received. The number of environmental nonprofits in a county did not have any impact however and no explanation is given as to reasons behind this. The article shows that environmental, economic, and sociopolitical factors play an important role in determining household adoption of solar energy. Zahran et al.'s paper serves as a basis for policy makers to design their policies around. Moreover, the 12 inventory of variables analyzed serve as a basis for the investigation of the effect of financial and regulatory incentives enacted between 2000 and 2009 on present period solar adoption. [5]

# CHAPTER 3

## Hardware and Development

## 3.1 Introduction

This chapter will be explaining different part of the full hardware system, their working principle and exquisite characteristics. Further their development process and robustness is highlighted.


Figure 2 : The full Hardware of the solar power plant.

### 3.1.1 **Description of different hardware parts:**

Different hardware parts are discussed below according to the number presented in the figure above.

1**. Solar Panel:** Solar cells are individual silicon cells that form a solar panel. The panel can contain a large number of solar cells. The number of cells will determine the size of the panel and the potential power output.

Photovoltaic Solar Cells Are Made Of Silicone Substance.

Here I am using one panel whose modules and size (PV Size [mm]: 294*184*18)

Pmax: 5Wp N. W: O.70Kg

Voc: 10. 8V Isc: 600mA

Vp: 9. 0V Ip: 555mA

Figure 3 : Solar panel.

**Working principle of solar panel:**

A solar cell is the main generator in a sunlight based PV framework, it is one of the most significant parts in a sun based PV framework. In the accompanying sections, a basic presentation of a sun powered cell and how it works is examined, with reference joins for better understanding.

A sun oriented cell: A sunlight based cell is a strong state electrical gadget (p-n intersection) that changes over the vitality of light straightforwardly into power (DC) utilizing the photovoltaic impact. The procedure of change initially requires a material which ingests the sun powered vitality (photon), and afterward raises an electron to a higher vitality state, and after that the progression of this high-vitality electron to an outer circuit. Silicon is one such material that utilizations such procedure. A sun based cell structure is appeared and a sun based board design in figure 1. [5]

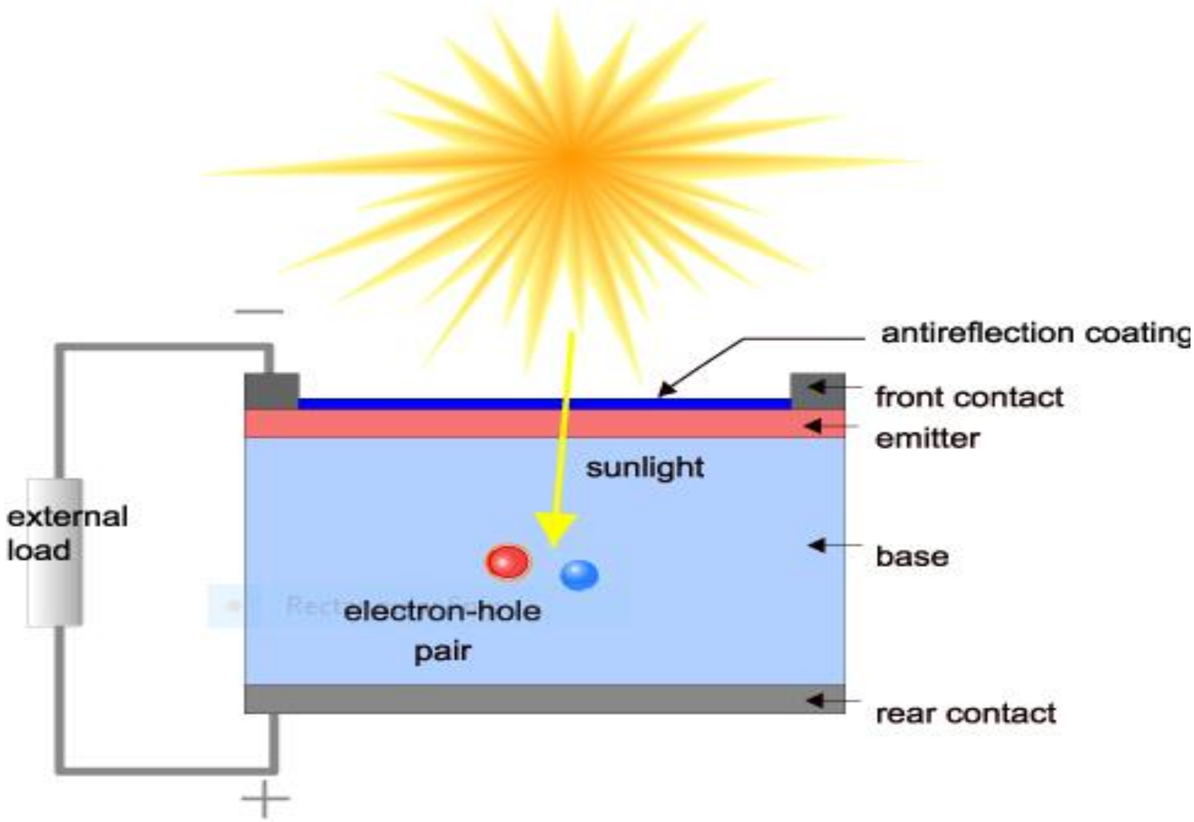


Fig4. Solar cells structure.

**Features of solar panel:**

1. There are 60(6*10) pcs high efficient mono-crystalline silicon cells to component.

2. It has stable electrical performance, low light performance. Its voltage is very stable under different radiation power.

3. High conversion rate, close to the sum of solar cell power prior products.

4. Anodized aluminum alloy frame, beautiful and durable for commercial solar panels.

5. Long time working guarantee, 25 years warranty for power output.

6. Manufacture ring plant complies with ISO9001.

7. Clean and renewable energy, non-maintenance, free to get power electricity, don't produce any pollution for environment.[7]

**2. Charge Controller:** Charge controller, charge controller limits the defeat of stream of electricity an electronic battery. This can prevent overvoltage by preventing excessive charging, which can reduce battery life and create a safety risk.

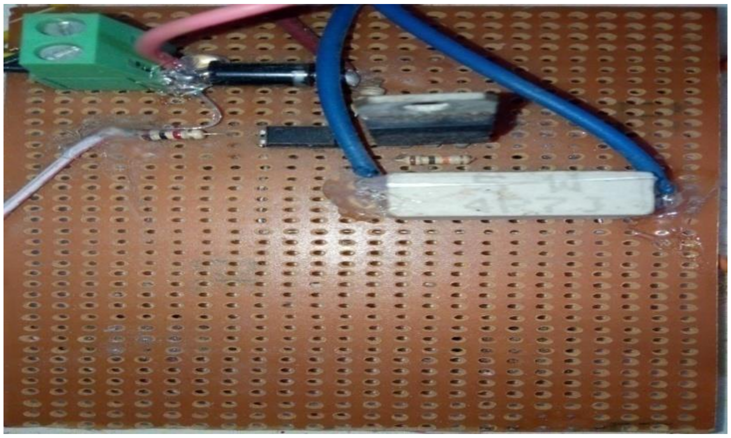

Figure 5: Charging controller.

**Equipment of charge controller:** Name of the equipment used in the charge controller with diagram is given below:

**DIODE:**

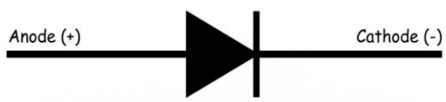


Figure 6: Block diagram of diode.

**N CHANNEL MOSSFET:**

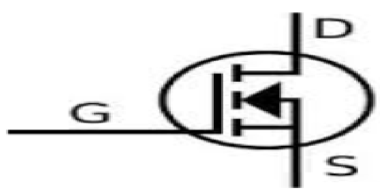


Figure 7: Block diagram of mossfet.

**RESISTOR:**

Fig8: Resister.

**CONNECTOR:**

Fig8: Connector.

**Working principle of charging controller:**

In this a solar panel is used to charge a battery. A set of operational amplifiers are used to monitor panel voltage and load current continuously. If the battery is fully charged, an indication will be provided by a green LED. To indicate under charging, over loading, and deep discharge condition a set of LEDs are used. A MOSFET is used as a power semiconductor switch by the solar charge controller to ensure the cut off load in low condition or over loading condition. The solar energy is bypassed using a transistor to a dummy load when the battery gets full charging. This will protect the battery from over charging.

**Features of charging controller:**

a. Appropriate Battery Charging

   A decent charge calculation ought to be to incorporate temperature remuneration. This should be possible locally with an installed sensor if the controller is in a similar situation as the batteries (for example same walled in area), or should be possible with a remote sensor.

b. Indicator Lights

A decent charge controller ought to likewise incorporate marker lights (LEDs). LEDs outline charging status, battery status.

3. **Battery**:  A battery is a component that contains one or more electrochemical cells, and which has a connecting mechanism on the outside. Here I am using three batteries whose modules are (ultraFire 18650 7800mAh 3.7V Li-Ion). [8]

**Block Diagram of Battery Connection:**

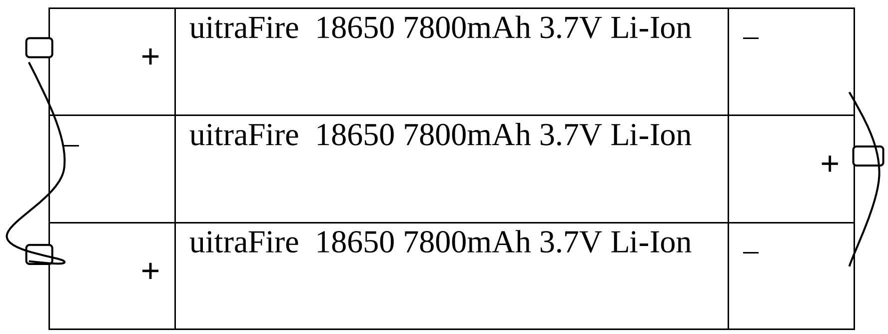


Fig9: Block Diagram of Battery Connection.

**4. Microcontroller (PIC16F73I):**A microcontroller is a device that is controls any system. The microcontroller has at least the following components.

1. A computer processor, which performs programs.
2. A small RAM which stores variable data during the program.
3. A small ROM which saves programs.

4. Input / output device port which establishes microcontroller communication with external connection.

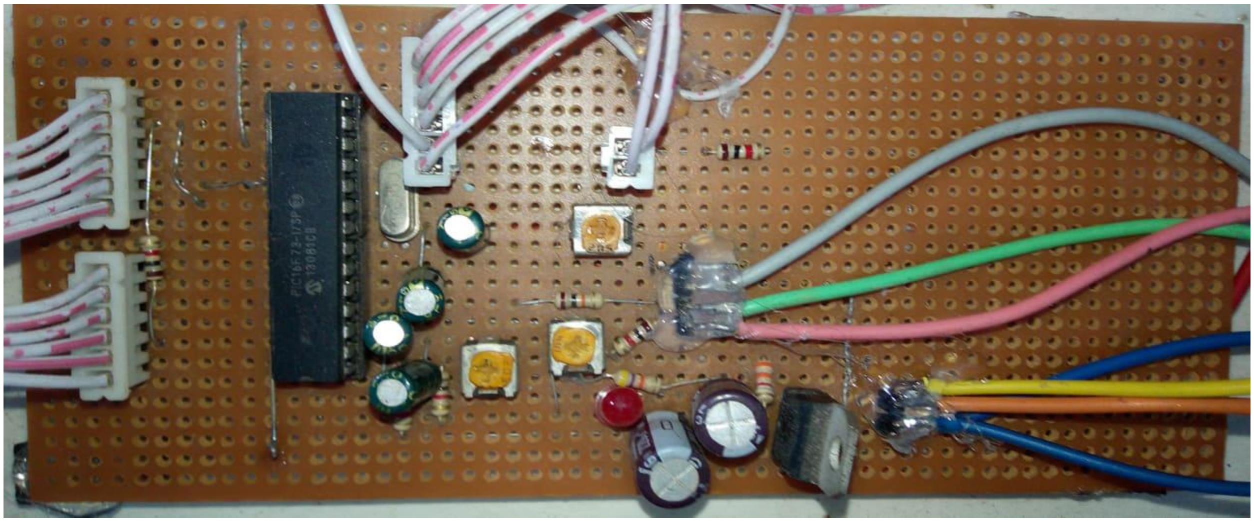

Fig10: Microcontroller.

**Equipment of Microcontroller Circuit: Name** of the equipment used in the Microcontroller Circuit;

1. Microcontroller chip (PIC16F73I/ SP, 13081CB) [9]
2. N Channel MOSFET
3. Resistor
4. Capacitor
5. LED Light
6. Thermal Sensor
7. Connector

**Working principle of (IC PIC16F73 Microcontroller):**

PIC microcontrollers (Programmable Interface Controllers), are electronic circuits that can be of programmable microcontrollers. These are programmed to carry out a vast range of tasks. They can be programmed to be timers or to control a production line and much more. They are found in most electronic devices such as alarm systems, computer control systems, phones, in fact almost any electronic device. Many types of PICmicrocontrollers exist, although the best are probably found in the GENIE range programmed and simulated by Circuit Wizard software.

PIC Microcontrollers are relatively cheap and can be bought as pre-built circuits or as kits that can be assembled by the user.


Fig11: Microcontroller chip (PIC16F73I/ SP, 13081CB).

A computer is needed to run the software, such as Circuit Wizard, allowing you to program a PIC microcontroller circuit. A fairly cheap, low specification computer should run the software with ease. The computer will need a serial port or a USB port. This is used to connect the computer to the microcontroller circuit. Software such as, Genie Design Studio can be downloaded for free. It can be used to program microcontroller circuits. It allows the programmer to simulate the program, before downloading it to a PIC microcontroller IC (Integrated Circuit).Simulating the program on screen, allows the programmer to correct faults and to change the program. The software is quite easy to learn, as it is flow chart based. Each 'box' of a flow chart has a purpose and replaces numerous lines of text programming code. This means that a program can be written quite quickly, with fewer mistakes.

A USB lead connects the computer to the programmable circuit, allowing the transfer of the program to the PIC microcontroller IC. [10]

**Diagram of Microcontroller chip (PIC16F73):**

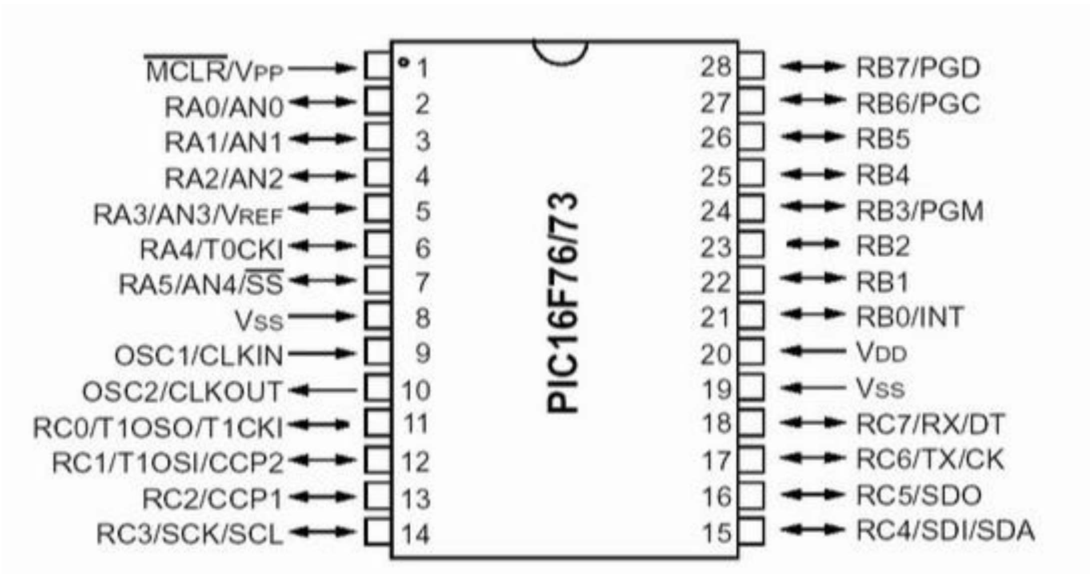


Fig12: Diagram of Microcontroller chip.

**It contains following components:**

I. (CPU) Central processing unit
II. (RAM) Random Access Memory
III. (ROM)Read Only Memory
IV. (I/O) Input/output ports
V. Timers and Counters
VI. Interrupt controls
VII. Analog to digital converters
VIII. Digital analog converters

IX. Serial interfacing ports

**PIC Microcontroller Architecture:**

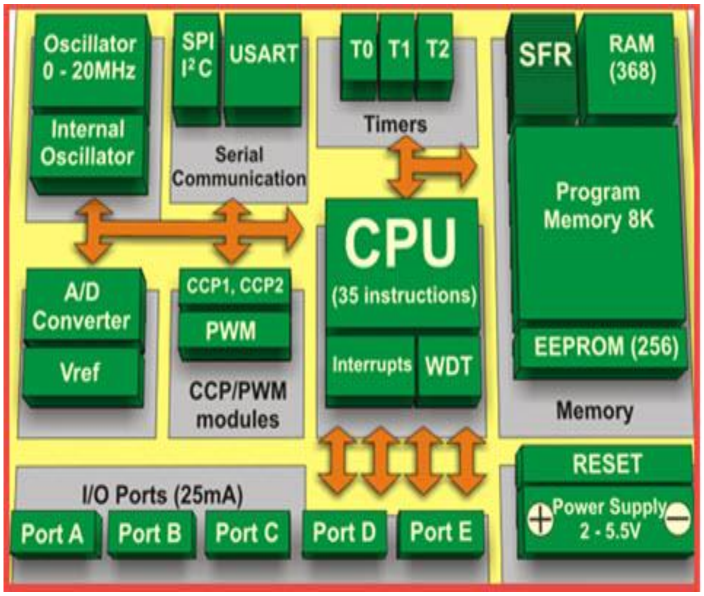


Fig13: PIC Microcontroller Architecture.

The term PIC represents the fringe interface controller was created in the year 1993 by "Microchip Technology". Right off the bat, this controller was created for supporting PDP PC to direct its fringe gadgets, and along these lines, named as a fringe interface device.PIC miniaturized scale controllers are quick and executing a program can be made simple contrasted and different controllers. The design of this small scale controller dependent on "Harvard engineering". The details of this small scale controller incorporate wide accessibility, simplicity of programming, sequential programming limit, enormous client base, interfacing of miniaturized scale controller with different peripherals, and so on. [11]

**Features of PIC Microcontroller:**

a. The reliability is good. Because all kinds of functional components of micro controller are integrated on a chip, especially memory is integrated into the chip, the wiring is short, the data are mostly transferred inside the chip, it is not easy to be subjected to external interference, enhance the anti-interference ability, and make the system run more reliably. Therefore, the reliability is obviously superior to the general CPU system.
b. Strong control function. In order to meet the requirements of industrial control, the instruction system of general microcontrollers has a wealth of conditional branching transfer instructions, logical operation and bit processing function of I/O port. In general, the logic control function and running speed of the microcontroller are higher than the CPU of the same level.
c. Easy to expand. There are many three buses and parallel, serial input / output pins for extension, and it is easy to form a computer application system of various sizes.
d. There is no monitoring program or system management software in the general microcontroller, and the development needs the corresponding simulation system.[3.3]

## 5. Inverter:

An inverter is an electrical device which converts DC voltage to AC voltage.

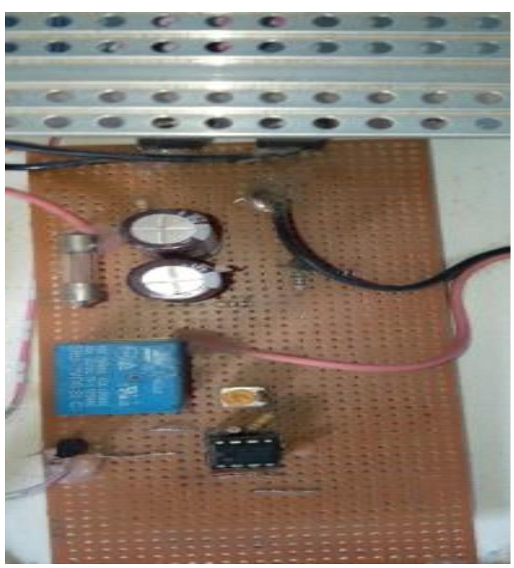

Fig14: Inverter.

Working principle: Transistors are key components of power inverters, which convert direct current (DC) to alternation current (AC) power. The transistor is used to change the steady voltage and one-way flow of DC to the constantly changing voltage and oscillating current of AC. Transistors are used as switches to control electrical flow through a circuit. The key feature of the transistor in the generation of AC power is that it can be rapidly switched on and off. A pair of transistors is used in tandem with a transformer to make the conversion. Direct current power is fed into transistors on both sides of a transformer input, and those transistors are alternately switched on and off, which creates alternating current.[12]

**Circuit Diagram of Inverter:**

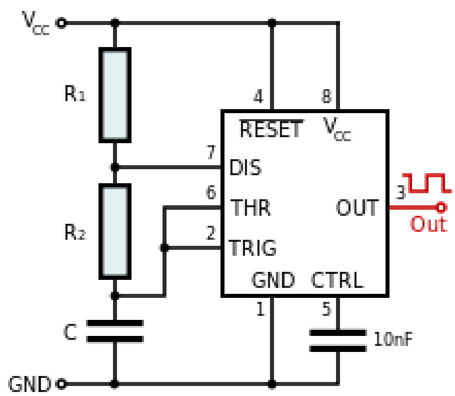


Fig15: Diagram of inverter.

**Diagram of DC Wave:**


Fig16: Direct Current.

**Diagram of AC Wave:**

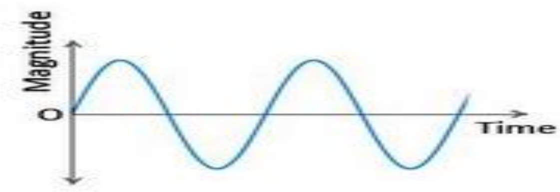


Fig17: Alternating current.

**Features of Inverter:**

Demonstrated and dependable innovation more than 15,000 MW of a similar inverter innovation introduced around the word (in the breeze business applications).

Adjusted for Indian conditions – More than 1,500 MW of these inverters have been made by ReGen and are running in our ReGen wind turbines all over different states (Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh) in India. Continuing differed climatic conditions: High temperature ~50+°C, High mugginess, along the coast and extraordinary residue. Higher yield voltage – Output voltage is 620VAC and thus the yield 3 stages AC current is less contrasted with contenders with comparative power rating. Lower flows bring about diminished misfortunes at the LV/MV transformers and AC transmission side by and large. Modern innovation – Ready for the to-be presented framework code in India and LVRT agreeable. Driving the world with the principal megawatt-class wind-sun oriented half breed innovation brought to the real world. Ahead of schedule to rise and late to bed – The progression up IGBT usefulness, ace slave setup and stage shrewd power age empowers the inverter to begin delivering power in the early and late hours of the day; increasing the value of the venture.

Measured mounting framework – Makes routine support and overhauling rapidly and guarantees most extreme uptime (The inverter can keep running on fractional burden while few IGBTs are being supplanted). [13]

**6. Transformer:**

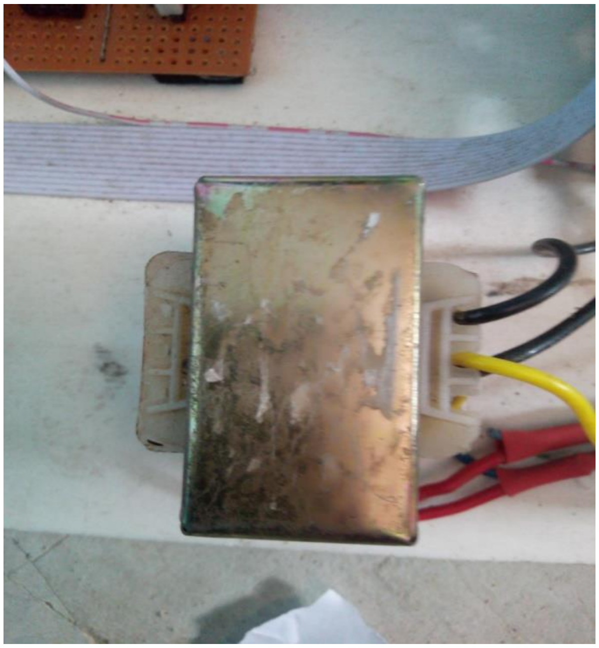

Fig18: Transformer.

A step-up transformer acts as a voltage-increasing device. The amount by which it increases the input voltage depends on the ratio of the number of turns in the primary coil to the number of turns in the secondary coil.

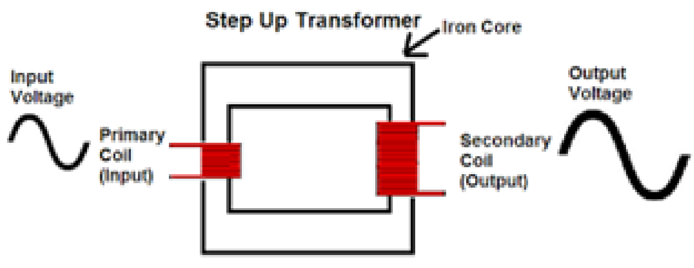


Fig19: Diagram of step up transformer.

If, for example, the secondary coil has double the amount of turns as the primary coil, the ratio will be 1:2 and the output voltage will be double the input voltage.

Though step-up transformers increase the voltage of the output voltage, it comes at a price. Transformers are simply conversion devices. They do not create voltage or power. So if a step-up transformer increases voltage, it decreases current. If it doubles the voltage output, the current output gets cut in half. So that the output signal now has half the current capability as the input signal. Step-up transformers never create power; they only convert it into different forms.

**Working principle of transformer:**

Transformer deals with the rule of "Faraday's law of electromagnetic acceptance". Common acceptance between the windings is liable for transmission activity in a transformer.

Faraday's law expresses that "when the attractive transition connecting a circuit changes, an electromotive power is initiated in the circuit corresponding to the pace of progress of the motion linkage". The emf (Electro Motive Force) actuated between the two windings is dictated by the quantity of turns in essential and optional twisting individually. This proportion is called as Turns Ratio.

The voltage decrease capacity of venture down transformers relies upon the turn proportion of the essential and optional curl. As the quantity of windings in auxiliary curl is less when contrasted with the quantity of windings in essential loop, so the measure of transition linkage to the optional curl of the transformer will likewise be less contrasted with the essential curl.

As needs be, the emf instigated will be less in the auxiliary curl. Because of this, the voltage lessens at the auxiliary twisting contrasted with essential winding.[14]

7. **Transmission and distribution side and load:**

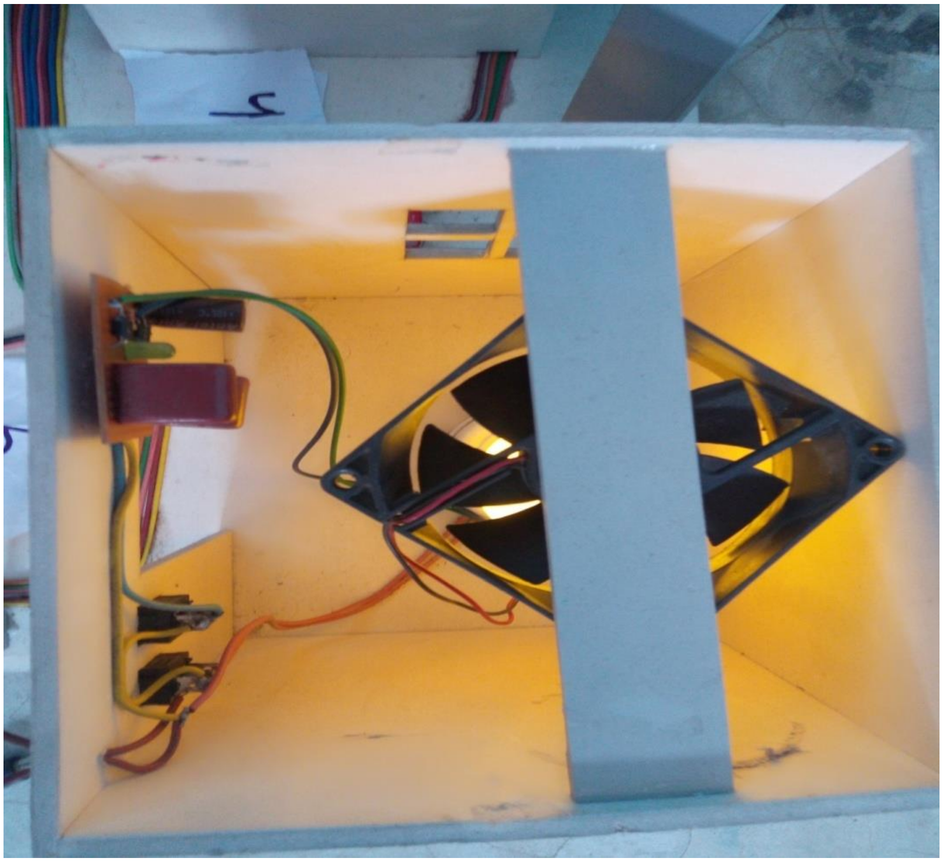

Fig20: Load.

8. **Mirror:** The mirror is a smooth surface where the reflection of light reflects on a regular basis. Mirrors are usually made with metal plates on one side because glass is a transparent and rigid material. The surface of the glass where the silver is reversed is also called the mirror surface or the reflector surface.

Fig21: Solar panel and mirror.

How to work mirror in Solar panel: In the mirror we have to put the sun light on the panel, then the efficiency of the solar panel increased naturally.

**Pump:** A pump is a mechanical gadget used to move liquids or fluids.

Fig22: Pump.

**Working principle of Pump:**

The working rule of a pump is it upgrades the liquid's strain to give the driving quality which is vital for stream. As a rule, the weight channel supply siphon is a radial kind siphon, and the working rule is that slurry enters the siphon during the pivoting impeller's eye which illuminates a round movement.

**10. LCD Display:**

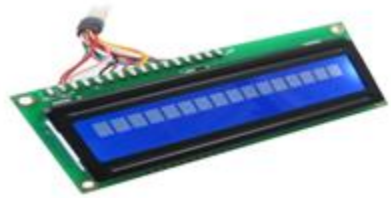

Fig23: LCD Display.

Characteristics of LCD display:

1. LCD (Liquid Crystal Display) screen is an electronic showcase module
2. These modules are favored more than seven sections and other multi fragment LEDs
3. LCDs are affordable

**Construction and Working Principle of LCD Display:**

A liquid crystal display or LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screen that are generally used in laptop computer screen, TVs, cell phones and portable video games. LCD's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology.

Liquid crystal display is composed of several layers which include two polarized panel filters and electrodes. LCD technology is used for displaying the image in notebook or some other electronic devices like mini computers. Light is projected from a lens on a layer of liquid crystal. This combination of colored light with the grayscale image of the crystal (formed as electric current flows through the crystal) forms the colored image. This image is then displayed on the screen.

An LCD is either made up of an active matrix display grid or a passive display grid. Most of the Smartphone's with LCD display technology uses active matrix display, but some of the older displays still make use of the passive display grid designs. Most of the electronic devices mainly depend on liquid crystal display technology for their display. The liquid has a unique advantage of having low power consumption than the LED or cathode ray tube.

Liquid crystal display screen works on the principle of blocking light rather than emitting light. LCD's requires backlight as they do not emits light by them. We always use devices which are made up of LCD's displays which are replacing the use of cathode ray tube. Cathode ray tube draws more power compared to LCD's and are also heavier and bigger.

**Features:**

1. Cost effective:

Although LCDs started off with a way-too-costly-for-me status, the prices are fast reducing. Today, LCDs are more affordable and considering its long term benefits, are considered cost-effective.

2. Energy efficient:

LCDs offer high amount of energy savings over its total life span. In general, LCDs consume half to two-thirds of the energy required by a conventional CRT monitor. Further, STAR rated LCDs offer even higher savings in energy. Several websites provide web-based calculators that can be used to ascertain the exact energy savings through the purchase of a LCD monitor.

3. Space economy:

LCDs commonly referred to as flat screen monitors provide savings not only in terms of cost and energy, but also space. For an organization, this means more space for employees, meaning more employees can be accommodated in lesser space and ultimately this means cost savings in office space.

4. Reduced radiation:

LCDs generate much lesser heat compared to the radiation emanated from CRTs. This not only means lesser stress for the user, but also lowers the need for air-conditioning. Lower air-conditioning contributes to lesser electricity bills, and ultimately lesser energy costs.

One of the other major benefits of LCD monitors relates to health benefits. Continuous exposure to monitors is the cause of various health problems such as migraine headaches, nausea and dizziness, loss of focus, disorientation, eye pain or grittiness in eyes, sore throat, increased metabolism, lack of sleep, and irritation.

5. Lighter weight:

CRT monitors are bulky and heavy, LCD's on the other hand are light and easily manageable. Although a user is unlikely to carry around their systems or monitors every day, when the user does have to move to other desks or transport their systems for whatever reasons, LCD's would be more light and conveyable, when compared to CRT's.

6. Lesser eyestrain:

CRT monitors are smaller and more stressful on the eyes. While LCD monitors allow a user to see images and read text, better and more easily. LCD monitors offers the following benefits. **LCD's:**

• Are free from flickering

• Eliminate geometric screen distortions on the edges of the screen

• Offer uniform screen brightness

• Reduce glare

The above features of LCD monitors translate to reduced headaches and lesser eyestrain for users.

7. Improved image quality:

Sharpness of image is another great benefit of LCD monitors. LCD monitors do not flicker and every specific aspect in an image is displayed using individual pixel element, adding to the picture quality and clarity. When compared to the normal screen you can get the great quality of the images. The images mostly focus on the quality. Not only will the images all the other features that are shown in the LCD monitor be of greater quality.

8. Better screen privacy:

LCDs have a smaller viewing angle, meaning the user can view the contents displayed on the screen only if the user is at a particular angle. Although this can be a disadvantage in certain circumstances, it is also an advantage by providing screen privacy for the user. But sometimes this can also be a little bit disturbing for the user till the user gets practiced to it and because of the LCD display there will not be any visibility when it is viewed in the hot sun.

9. Long life:

When compared to the traditional monitors the liquid crystal display monitors are nice all told the aspect and within the similar means the liquid crystal display monitors give long life than the traditional monitors. Once the traditional monitors are used than there are variant potentialities that there are well be a frequent drawback and you may right to carry that to a store for obtaining it repaired? However within the liquid crystal display monitors there will not be any issue like that.

10. Easy options and features:

When you focus on the options that are available in the LCD monitor we can very well tell that the features and the advanced options available are very easy to work and make the necessary changes. When we focus on making changes to the screen display or any other feature then we can find it very easy to perform the task. The features are more convenient for the normal users and also for the high end users. [15]

# CHAPTER 4

# SOFTWARE AND SIMULATION

## 4.1 Introduction

This chapter will be explaining program that runs the hardware, analysis, how to code save micro Controller IC. PIC16F73I microcontroller was used. There are a couple of choices if to program. PIC16F73I:

- **Hitech C** - Integrates with the MPLAB IDE, free download from Microchip, in free mode it produces fairly bloated and inefficient code but no other restrictions for non-commercial use. Very good ANSI C89/ISO C90 compatibility.
- **CCS C -** Integrates with the MPLAB IDE, Poor ANSI compatibility + other limitations (which I can't remember) which made me decide not to even bother installing it!
- **Source Boost BoostC** - own IDE + MPLAB integration, fair ANSI compatibility, free mode is fully optimized but limits code size and RAM banks used.
- **Mikro Elektronika MikroC** - Own IDE, NO MPLAB INTEGRATION, no assembler support, very difficult to debug using standard Microchip tools so you are locked in to their hardware and software tool chain. Again it is seen no point in getting involved with it assuming my needs would expand.

Here we used HiTech C. This compilers in bold. HiTech C is more "mainstream" and far better supported here.

## 4.2 Different parts of CODE:

```
#include <16F73.h>

#use delay (clock = 16000000)

#define ACRL PIN_C3

#define PVRL PIN_C0

#define LCTR PIN_C1
```

```
#define LEDH PIN_C4

#define LEDL PIN_C5

#define LEDac PIN_C6

#define LEDpv PIN_C7


void main()

{

lcd_init();

lcd_gotoxy(1,1);

printf(lcd_putc, "  WELCOME TO    ");

lcd_gotoxy(1,2);

printf(lcd_putc, "     DIU        ");

delay_ms(1500);


while(true)

{

LOAD_CTRL();

lcd_show();


set_adc_channel( 0 );

delay_ms(1);
```

```
BV = read_adc();

set_adc_channel( 1 );
delay_ms(1);
I = read_adc();

W=(BV*I);

set_adc_channel( 2 );
delay_ms(1);
ACV = read_adc();

}  // END while(true)

}  // END MAIN()

void lcd_show(void)
{
lcd_gotoxy(1,1);
printf(lcd_putc, "B:%2.1fV  AC:%3d",BV,ACV);
```

```
lcd_gotoxy(1,2);

printf(lcd_putc, "I:%1.2fA P:%2.1fW ",I,W);



}


//////////////////////////////////////////////////////////////////////////////


void LOAD_CTRL(void)

{

//////////////////////////   LOAD RELAY CONTROL

IF(BV < 110)

{

IF(ACV > 110)

{

output high (ACRL);

SYS=0;

}

}

IF(BV > 129)

{
```

```
output low (ACRL);

////////////////////////   PV FET CONTROL

IF(BV > 145)

{

output low (PVRL);

output high(LEDH);

}

IF(BV < 135)

{

output high (PVRL);

output low(LEDH);

}

 IF(tp < 33)

 {

output low (pump);

}

\ IF(tp > 33)

{

output high (pump);

}
```

## 4.3Summary

At first open my computer and open microcontroller coding software. Then we code the microcontroller IC. Finally I have completed using this code the following program;

IF (BV < 110): If the battery voltage is less than 110, the relay is ON. Then AC load will close. So the battery is not charged.

IF (BV > 129): When the battery voltage is greater than 119, the relay is OFF. AC load will start.

IF (BV > 14.5): If the battery voltage is greater than 14.5, the battery is not charged. So LED gives bright light.

IF(BV < 13.5): If the battery voltage is less than 13.5,the battery starts to take charge. Then a LED will off.

IF(tp<33): If the temperature is less than 33, then the pump does not work. IF(tp>33):If the temperature is greater than 33, then the pump starts to work.

# CHAPTER 5

# CONCLUSION

## 5.1 Conclusions

In this experiment of the result to improve efficiency of solar panel using mirrors and water pump are come out to be highly encouraging. The use of mirrors plus water pump is better than the other two of efficiency is approximately in this case. The simple solar panel of the output power using mirrors ware 3 watts and from solar panel with mirrors and water pump 5 watts which means instead of purchasing new solar panel one can obtain 52 percent more power from the same solar panel using this technique.

## 5.2 Limitations of the Work

Standard lattice associated sun based is intended to separate from the matrix and quit creating vitality when the framework goes down. In the event that it stays 'on', it'll input power out to the framework – which is exceptionally risky for any fix or upkeep works required. Notable sun based feed-in duties have been compelling in getting the private market ready. Be that as it may, similar to the private market, the business feed-in tax rate has diminished from a cycle 40 pennies for each every kilowatt hour (kWh) sold back to the matrix, to simply 8c/kWh with a standard stock pace of 33.91c/kWh and pinnacle rate around the 50c/kWh mark [Origin NSW reality sheet]. The monetary motivating force to offer sun based to the network has evaporated. Accredited commercial, industrial or utility businesses with surplus renewable energy may be able to sell Large-scale Generation Certificates (LGCs) to coal fire generators or electricity providers who are required to purchase a set amount under the Renewable Energy Target scheme. Read: How to participate in the REC for eligibility criteria.

## 5.3 Future Scopes of the Work

Scientists and environmentalists urged to move towards renewable energy, especially solar and wind power, as it is the only solution to electricity in future. All reserve of fossil fuel, such as gas, oil and coal, which are the key ingredients for conventional power generation, will run out in the next few decades Therefore, most of the countries -- including the US, Germany and India -- are moving towards the renewable solution, and they are doing it successfully. Bangladesh should follow their path, they added. Bangladesh has a good future in solar power generation as the country can use its land to produce food and power simultaneously. If it can be done, the land will be used properly. For setting up solar panels, land should not be an issue as those can be placed anywhere and at any angle, like on rooftops or walls. The government should give highest priority to solar power generation.

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