THE DESIGN OF LOW POWER CONSUMPTION LED WITH PHOTOVOLTAIC SOURCE

Conceived as one of the conditions of complete Course of studies I in Strata of electrical engineering
faculty of engineering
Muhammadiyah University Of Surakarta

By :

RAID M.M ALMOHTASEB

D400144011

ELECTRICAL ENGINEERING COURSES

THE FACULTY OF ENGINEERING

MUHAMMADIYAH UNIVERSITY OF SURAKARTA

2018

APPROVAL PAGE

THE DESIGN OF LOW POWER CONSUMPTION LED WITH PHOTOVOLTAIC SOURCE
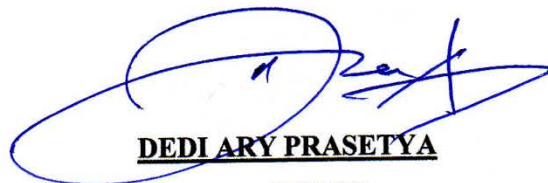

SCIENTIFIC PUBLICATIONS

by:

RAID M.M ALMOHTASEB
D400144011

Has been reviewed and approved to be tested by:

Supervisor

DEDI ARY PRASETYA

NIK 982

ENDORSEMENT PAGE

THE DESIGN OF LOW POWER CONSUMPTION LED WITH PHOTOVOLTAIC SOURCE

By:

RAID M.M ALMOHTASEB

D400144011

Has been maintained in front of the Examiners Board

Faculty Of Electrical Engineering

Muhammadiyah University Of Surakarta

On the day of 26 / jul / 2018

and has been declared ineligible

Dewan Penguji :

1. Dedy Ari Prasetya, ST .MEng
   (Chairman Of The Board Of Examiners)   (...............)
2. Dr. Ratnasari Nur Rohmah
   (Member Of The Board Of Examiners I)   (...............)
3. Heru Supriyono, Phd
(Member Of The Board Of Examiners II)   (...............)

Dekan,
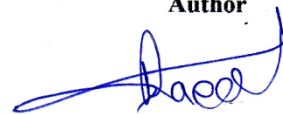
H. Sri Sunarjono, MT., PhD

NIK. 682

STATEMENT

I hereby declare that in this scientific publication there are no works ever put forward to earn a scholarship at a college and all my knowledge, there is also no work or opinion ever written or published another person, except in writing, referenced in the script and is mentioned in the bibliography.

When later proved there is injustice in my statement above, then will I pertanggungjawabkan completely.

Surakarta, 26 jul 2018

Author

RAID M.M ALMOHTASEB

D400144011

3

THE DESIGN OF LOW POWER CONSUMPTION LED WITH PHOTOVOLTAIC SOURCE

Abstract

Pada saat energi terbarukan modern seperti saat ini sangat diperlukan bagi manusia untuk mendukung kebutuhan sehari-hari, laporan ini menjelaskan desain "konsumsi daya rendah yang dipimpin dengan sumber fotovoltaik". Jelaslah bahwa pertumbuhan pesat bisnis dan populasi menempatkan tekanan semacam itu pada sumber daya dunia karena permintaan energi meningkat dari hari ke hari. Bagaimana cara memanfaatkan energi hijau secara wajar dan menjaga pembangunan berkelanjutan adalah tantangan yang paling penting sekarang atau suatu hari. Sebagai sumber energi hijau besar yang dihasilkan dari matahari, industri PV akan mendapatkan kesempatan terbaik untuk tumbuh besar. Kita harus memahami peluang untuk membangun pembangkit listrik PV ramah lingkungan yang paling sesuai, dan menyambut hari esok yang lebih baik. Dalam makalah ini kami memfokuskan pada light street dengan rangkaian pengontrol muatan yang melindungi baterai dengan menghindari overcharge atau debit yang berlebihan melalui beban, yang juga dapat memperpanjang kinerja baterai atau masa hidup. Kami juga memperagakan operasi senja hingga fajar menggunakan resister, relai, dan sirkuit-sirkuit lainnya yang bergantung cahaya

Kata kunci : energi terbarukan, lampu jalan, sel surya, energi hijau

At the time of the modern renewable energy as it currently is very necessary for a human being to support the needs of the everyday, this report describes the design of the "low power consumption led with photovoltaic source"
It is obvious that the rapidly growth of business and population are puting such a pressure on world power resources as energy demand increases day by day. How to reasonably utilize green energy and keep sustainable development is the most important challenge now-a days. As a huge green energy source generated from the sun, PV industry will gain the best opportunity to grow up. We should grasp the opportunity to build the most suitable environmental friendly PV power plant, and welcome a better tomorrow. In this paper we are focusing on light street with charge controller circuit which protects the battery by avoiding overcharge or excessive discharge through the load, which can also extend the battery performance or life span. We also demonstrate the dusk to dawn operation using light dependent resister, relay and other circuitaries

Keywords :renewable energy,street light, solar cells, green energy

1.INTRODUCTION

A Solar lantern is a simple application of solar photovoltaic technology, which has found good acceptance in rural regions where the power supply is irregular and scarce. Even in the urban areas people prefer a solar lantern as an alternative during power cuts because of its simple mechanism Home lighting System is powered by solar energy using solar cells that convert

solar energy (sunlight) directly to electricity. The electricity is stored in batteries and used for the purpose of lighting whenever required. These systems are useful in non-electrified rural areas and as reliable emergency lighting system for important domestic, commercial and industrial applications. The SPV systems have found important application in the dairy industry for lighting milk collection/ chilling centers mostly located in rural areas. Solar Street Light system is designed for outdoor application in un-electrified remote rural areas. This system is an ideal application for campus and village street lighting. The system is provided with battery storage backup sufficient to operate the light for 10-11 hours daily. The system is provided with automatic ON/OFF time switch for dusk to down operation and overcharge / deep discharge prevention cut-off with LED indicators.

The project is designed for LED based street lights with auto intensity control using solar power from photovoltaic cells. As awareness for solar energy is increasing, more and more individuals and institutions are opting for solar energy. Photovoltaic panels are used for charging batteries by converting the sunlight into electricity. A charge controller circuit is used to control the charging and prevent the battery to overcharging from the solar panel. Battery charger should have over voltage protection, short circuit protection and reversed polarity protection. Intensity of street lights is required to be kept high during the peak hours. At late night intensity of light should be max after some time the intensity can be reduced progressively till morning to save energy. Thus final it completely shuts down at morning 6, and again resumes at 6pm in the evening. The process repeats every day.

LED lights are the future of lighting, because of their low energy consumption and long life they are fast replacing conventional lights world over Hence we used LEDs to control the intensity of light.

1.1 Formulation Of The Problem

Based on the aforementioned background problem in formulation in submission of research for the design of low power consumption led with photovoltaic source among others:
a. How do I create a design of low power consumption led with photovoltaice source
b. Answer the community's disappointment against the high price of electricity .

1.2 Research Objectives

The goal of resarch is to:

a . To make the electricity world environmentally friendly.

b .To answer complaints about the lamentations of society against high price of electricity

.

1.3 The Benefits Of Research

a.To introduce renewable energies (solar panels) against the community.

b. To introduce the technology as a means of controlling the ardunio at society.

2. METHOD

2.1 Time and Place of Implementation

Implementation of work will be done on agency / company and schedule as follows:

Place: Laboratory in Electrical Engineering of Muhammadiyah University of Surakarta.

Schedul :april 2018 until juni 2018.

2.2 Design Research

Research with the title of the application design solar cells for street vendors, the authoruses the method of writing as follows:

A.Study Of Literature

Study of literature is about the study of the authors of the references obtained references either in the form of scientific papers, books, internet related or in accordance with the research supporting a research.

Arifin (2011) built a digital mass measurement device that has more accurate in measuring the load and the process become shorter and better. The main study of his research was using the load cell as the sensor for a measuring instrument with maximum load up to 8 kg. It used microcontroller AT89S51, weight sensor (Load Cell), LCD (Liquid Crystal Display), operational amplifier, and a 10 bit ADC circuit (Analog to Digital Converter). Load cell will give some values related to the force on it. Once the sensor (load cell) gets a pressure, signal conditioner circuit will receive a small change as the measuring points. Analog voltage from the signal conditioning circuit is converted into digital data by the ADC circuit then this digital data will be processed by a microcontroller and will display the results to the LCD. From the test results can be seen that the average error rate displayed -0.6%.

Purwanto (2008), has been designing and building load cell as a force sensor on a test system that discusses the load cell as the major component in the test system. His research covers some parts, which are the selection of materials, design calculations, attachment and configuration of the strain gauge bridge. Verifying the load cell and calibrating method was conducted by determining the suitability of planning calculations and applications in the plant. This research has a result of load cell design with capacity of 100 kN for workload pull-press the second class, in accordance with BS 1610 part 1; 1992 had uncertainty measurement value $U_c = 0.36235$ kN.

Han (2010), already designedan effective and simple way to reconstruct displacement signal from a measured acceleration signal. To reconstruct displacement signal by means of double-integrating the time domain acceleration signal, the Nyquist frequency of the digital sampling of the acceleration signal should be much higher than the highest frequency component of the signal. On the other hand, to reconstruct displacement signal by taking the inverse Fourier transform, the magnitude of the significant frequency components of the Fourier transform of the acceleration signal should be greater than the 6 dB increment line along the frequency axis. The proposed method utilizes curve-fitting around the significant frequency components of the Fourier transform of the acceleration signal before it is inverse-Fourier transformed. Curve-fitting around the dominant frequency components provides much better results than simply ignoring the insignificant frequency components of the signal.

Setiawan (2011), has made a digital height measuring devices using a microcontroller based ultrasonic ATMega 16 with LCD display. This instrument is capable of measuring an object with a precision sensor for reading data that is 197 cm maximum height and minimum height 110 cm. It's just that this system still has a total error average of 0:37% were influenced by the construction of the sensor appliance or error in data collection. One of the advantages of this tool is already using modern technology, such as the sensor and the LCD, but itsweakness lies on the construction of tools and data reading by the sensor.

Meanwhile, Kusumaningrum (2008) has also been doing a test on the variable resistor which is used to measure the limited distance, especially in deflection testing in Civil Engineering Laboratory UMS. Test results are not so good because of non-linearity of the variable resistor which is used. In addition, the lever on the variable resistor is also very limited in mechanical range when it is connected to the device.

B. ManufactureOf Tools

Making tool street light consists of the material in the form of control circuit and battery , and use an alternative energy sources as a source the primary.

C. Data Collection

Data collection can be obtained by performing the measurement of voltage, current, measurement accuracy of heat controller on the system tool street light using solar cells.

2.3Tools and materials

a . solar panel   b. battery   c. solar charge controller

d. lamp (LED)   e. LDR f.battery level indicator

2.4Research Flowchart

Figure.1 Research Flowchart

    a.   The data collection

        1.   Collect the datasheet of each component.

        2.   Collect software data

3. Collect the data from other research.

    b. Tools design

       1. Mechanic tool design.

       2. Electronic tool design.

    c. Tool Making

       1. Make mechanical and mechanism.

       2. Manufacture of electronic circuits..

    d. Testing

       1. Repeated testing tool to assess the success of the system.

       2. Testing tools, in Electrical Engineering Laboratory UMS, conducted by chief Laboratory and electrical engineering student.

    e. Data Analysis

       Data analysis was conducted on thesystem test.

    f. Conclusion

       The conclusions will take from the results of the systemtesting

2.5 Panel Controller

Circuit diagram of solar charge controller is shown below. If you want to use this circuit for higher rating, you can use more than one solar charge controller in series to increase current rating of charge controller. Circuit diagram shown below is simplest circuit diagram of charge controller. Because It do not have any microcontroller. This circuit of charge controller used analog electronics instead of digital electronics.
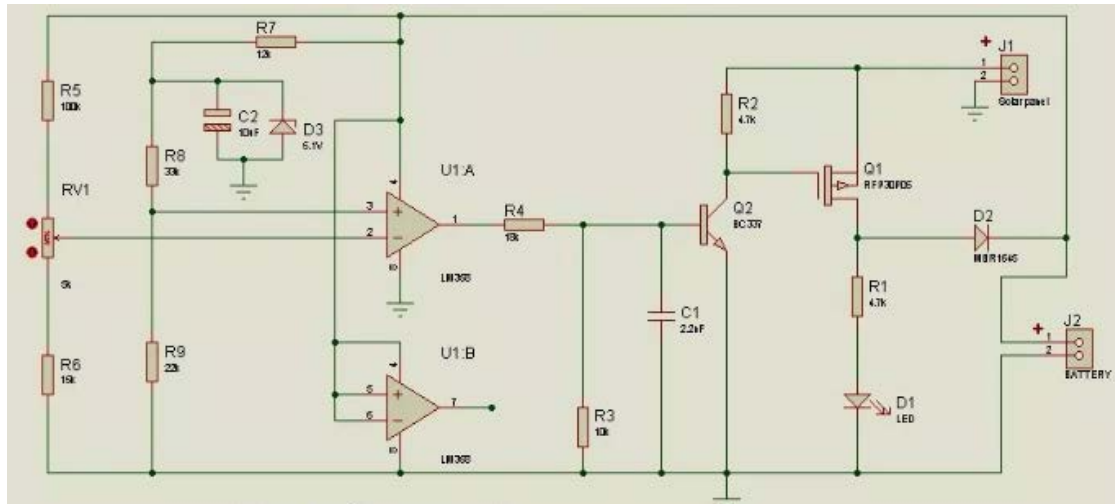
Figure .2. Panal controller

Ampere charge controller circuit diagram used analog electronics components to control the flow of charges from solar panel to battery. RFP30P05 P-channel MOSFET is used to charge battery. RFP30P05 MOSFET have about 20A rating. Its mean this MOSFET can easily pass current upto 20 ampere. For more information check data sheet of RFP30P05.

LM358 operational amplifier is used to turn on or off P channel MOSFET when battery is charged upto 13.6 volt. When battery is charged upto 13.6 volt. LM358 turn off MOSET by giving low signal to resistor R4. LM358 is used as comparator which compare battery voltage through voltage dividers connected to inverting and non-inverting pin of LM358 operational amplifier. Connect solar panel to connector J1 and battery terminals with connector J2. LED D1 shows the status of charging.

3. RESULTS AND DISCUSSION

3.1 The Design Of Low Power Consumption Led With Photovoltaice Source

The design of low power consumtion led using solarenergy as its primary source
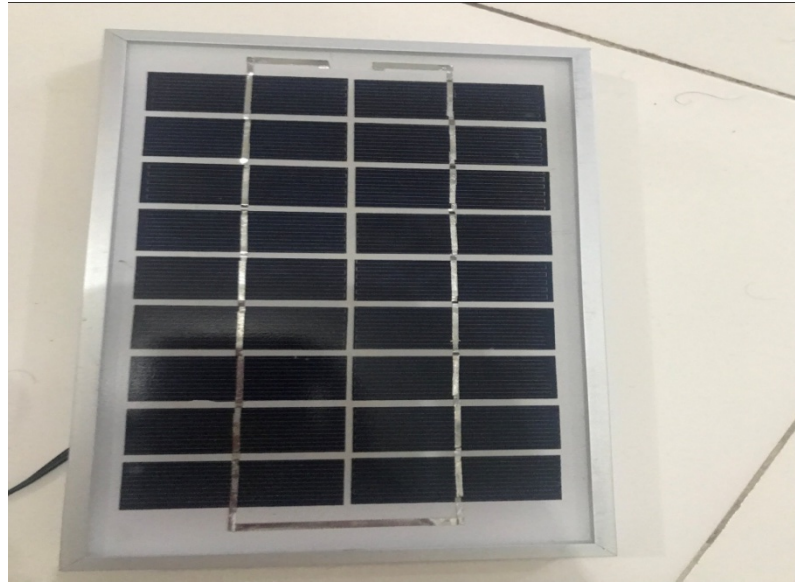
Figure .3. Solar Cell

A solar panel is a collection of solar cells. The solar panel converts the solar energy into electrical energy. Output of the solar panel is its power which is measured in terms of Watts or Kilo watts. Solar power uses multiple reflectors to collect more sun's thermal energy.(3w \0.33A)

Figure .4. LDR

Light-Dependent Resistor " LDR"is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. ... A photoresistor **is** made of a high resistance semiconductor.

Figure .5. Rechargeable Battery

Rechargeable Battery: A rechargeable battery, storage, secondary battery or accumulator is a type of electrical battery which can be charged, discharged into a load, and recharged many times, while a non-rechargeable or primary battery is supplied fully charged, and discarded once discharged. Several different combinations of electrode materials and electrolytes are used, including lead–acid, nickel cadmium (NiCd), nickel metal hydride (Ni-MH), lithium ion (Li-ion), and lithium ion polymer (Li-ion polymer).(6v\4.5Ah)
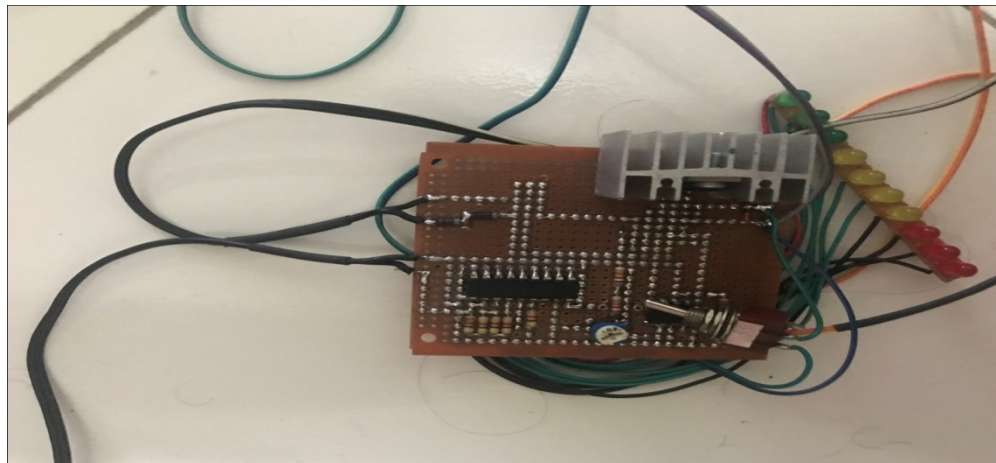
Figure .6. Panel Controller

The control panel is the initial interface on your system. With the system control panel, you can determine processor activity, read error codes to help determine component failure analysis, turn the system on and off, and change initial program load (IPL) characteristics.
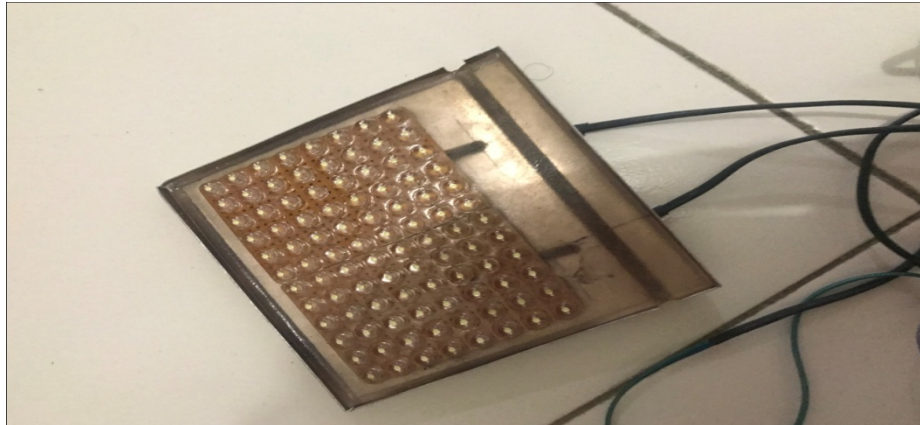
Figure .7. Lamp

Table .1.Value Of Lamp

Type	Number of LED	voltage	current	capacity
lamp 1	96 LED	3.3 V	1.92 A	6.34 W
lamp 2	48 LED	3.3 V	0.96 A	3.17 W

3.2 The results of the measurement of charge and discharge time of battrey

The measurement of charge time and discharge time and in a battery capacity 27 w at the same place with time measurement has been determined , and the measurement of lumens from the lamp as following table :

Tabel .2. Measurement

Type	discharge time	charge time	lumens/M
lamp 1(96 LED)	3 houre	4 houre	194
lamp 2(48 LED)	7 houre	4 houre	115

 Here in this tabel below show the lumens for all of lamps we used, and we note that lamp (1) "hand made " has the highest light intensiity compared to lamp (3) "available in the market" which carries approximatly the same value of power , so we conclude that lamp (1) better than lamp (3) hence we automatically choose the best one which made by hand (lamp 1) .

Tabel .3. Lumens Of Lamps

type	capacity	lumen
lamp 1	6.34 w	194 L\M
lamp2	3.17 w	115 L\M

The measurement of charge time and discharge time and in a battery capacity 27 w in the tabel below show the ideal result that i got from the formula following :

$$\text{Charger time} = \frac{Ah x Tolerance}{chargerate} \qquad \text{Ah : Amper hour removed x 50\%} \qquad (1)$$

Tolerance : from the source

$$\text{Discharge time} = \frac{battery\ Ah\ x\ battery\ voltage}{applied\ load\ (W)} \qquad (2)$$

Tabel .4. Charge And Discharge Time

Type	discharge time	charge time
lamp 1(96 LED)	4.26 houre	3.09 houre
lamp 2(48 LED)	8.5 houre	3.09 houre

The following Graphshow the realationship between intensity of light with time :
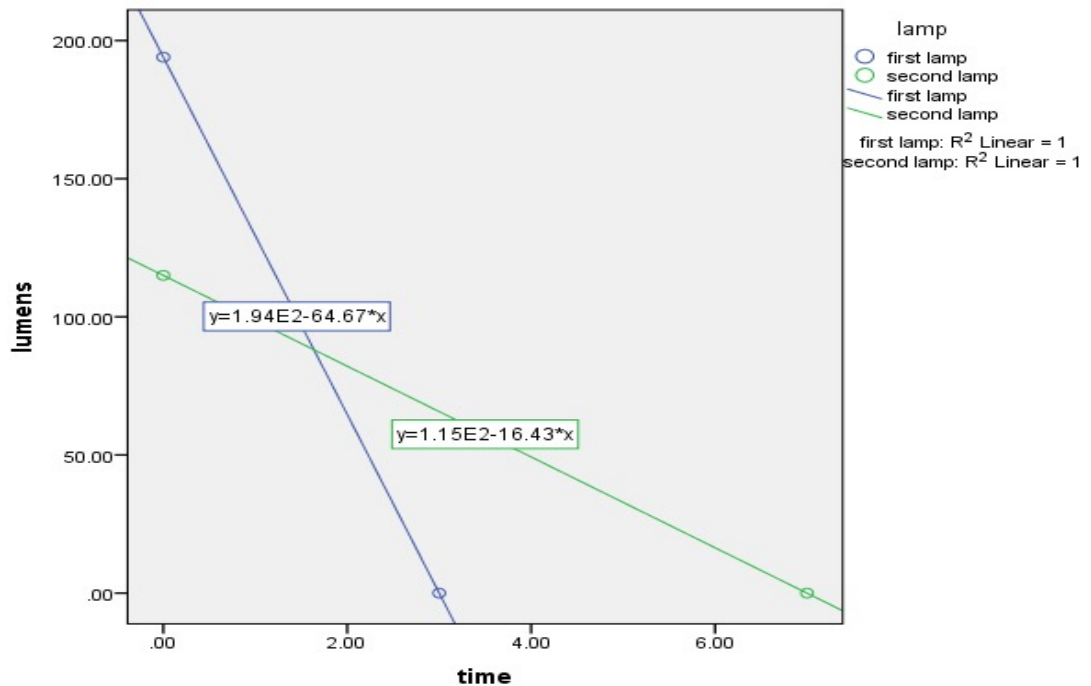
Graph .1.Intensity

We can see the result between intensity of light with time and we found that when the battery is full, ttensity of the light is at its highest level, and so gradually when the charge ratio decreases, the intensity of the light decreases .

4. CLOSING

The solar energy is one of the important and major renewable sources of energy and has also proven it useful in functioning of applications like street lights.

Solar powered automatic street light controller is one of the applications of electronics to increase the facilities of life. The use of new electronic theories has been put down by expertise to increase the facilities given by the existing appliance. Here the facility of ordinary street light is increased by the making it controlled automatically ,the charge control is necessary in order to achieve safety and increase the capacity of the battery. In cities, currently thousands of street lights are operated and the yearly electricity maintenance cost is very high

The project was vast. It was a race against time to complete the project with certain things like non availability of all the components,that got substituted also the design of subeircuits and whole circuit with testing. This project in a sense allowed us to know each other in a

more better way, know each other's weakness and strengths and thus design and plan in such a way that everyone was comfortable with the task assigned which ensured timely completion of the project. Most importantly this project taught us to be team players.

.

The initial cost and maintenance can be the draw backs of this project. With the advances technology and good resource planning the cost of the project can be cut down and also with the use of good equipment the maintenance can also be reduced in terms of periodic checks.It saves around 40% of electricity from per street light. So throughout the world if we use this concept then it will eliminate the energy crisis to a larger extent.

It is eco-friendly and utilizes the renewable source of energy very well .

REFERENCES

1. Oke A. O., Adigun A. A andFenwa O. D. 2013. *Design and construction of Solar power based lighting system*. International Journal of Engineering Sciences & Research Technology.

2. Sabbir, HumayraShariful. 2013. *Development of Electric Stove for Smart use of Solar PhotovoltaieEnergi with NasionalGied*. Thesis, BRAC University, Dhaka.

3. *Strategie Plan for New and Renewable Energy For the Period 2011-17, A Report by Ministry of New and Renewable Energy, Govemment of India, February, 2011*

4. B.Marion, J. Adelstein, K. *Boylen and H. Hayden, Performance parameters for grid-connected PV systems". 31st IEEE Photovoltaics Exhibition, Lake Buena Vista, Florida Specialisits Conference*

5.S.M. Pietruszko*, B. Fetlinski, M. Bialecki Analysis of the Perfromance of Grid Connected Photovoltaic Systems" photvoltaic Specialists Conference (PVSC) Philadelphia June 200*

6. Yuzuru Ueda Kosuke Kurokawa*, Takamitsu Itou, Kiyoyuki Kitamura Yusuke Miyamoto, Masaharu Yokota, Hiroyuki Sugihara. Performance Ratio And Yield Analysis Of Grd Connected Clustered Pv Systems In Japan TEEE 4th World Conference on Photovoltaic Energy Conversion. Wakoloa May 2006*

7.H. Hacberlin and Ch. Beutler. *"Yield of grid connected PV systems in Burgdorf Considerably higher than the average yield in Switzer land". 14th European Photovoltaic Solar Energy Conference Barcelona (Catalunya), Barcelona Spain.*

8. *SOLAR PV SYSTEM PERFORMANCE ASSESSMENT GUIDELINE. San Jose University, Califomia January, 2012.*