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A REVIEW ON DESIGN & FABRICATION OF A SOLAR BASED LED HOME & STREET LED LIGHTING SYSTEM

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Abstract: **The project is planned for LED-based street lights that use solar energy from photovoltaic cells with an auto intensity control. For battery charging, a load controller circuit is used and an LDR is used to feel daytime ambient light. We also tried to calculate solar cell parameters by acquiring multiple sensor data. In this device, a microcontroller in the PIC16F8 family monitors various parameters of the solar panel, such as light intensity, voltage, current and temperature. During peak hours the intensity of street lights must be maintained high. The street lights are activated in the dark and then automatically turned off at dawn with a sensor system Left Due to its low energy consumption and long life, LED lights are the future of lighting and quickly replace the world of traditional lights. White LED diode replaces HID lamps where pulse width modulation can monitor strength. A programmable microcontroller from the 8051 family uses PWM techniques, for energy savings on solar systems and also a battery safety charging controller to defend against overcharging, overcharging and deep discharging. A Light Dependent Resistance system (LDR) is used, which greatly decreases its resilience for sensing purposes in daylight. The light intensity is controlled in the measurement circuit using an LDR sensor, a voltage divider law, a current sensor current and a temperature sensor. All the data is shown on a PIC microcontroller interface of 16X2 LCD.**

Key words: ***Dual PWM intensity control, battery management , LED based solar street lighting***

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I INTRODUCTION

The inspiration for system design comes from life. Traditional porch lamp is controlled with a less controllable and uncomfortable switch, with a traditional light source. We have to find a switch in the dark, get up at night. It'd cause light up the moment. Suddenly, the light influences the rest. When the porch lights at night, energy is wasted and the environmental sustainability requirements of light-sensitive people are not met. It affects sleep quality simultaneously. The porch light often doesn't take seriously the design of the smart home system as an auxiliary light source at night. The porch lamp system actually plays an important role in the life of your home. It can light up at night with great comfort of living and security, especially for elderly people. LED lighting saves energy, protects the environment, offers long life and other advantages compared to traditional lighting. Again, different colours can be produced for the better light quality and improved visual effects in the production process, different colour temperatures of the LED chip integrated with the adjustment of colour and colour temperature that have laid theoretical foundations. The design is based on the green energy principle, energy efficiency and user-friendly design[1]. The design of an intelligent lamp control system enables the environment brightness and human information automatically to be detected. In addition, the porch lamp control system gradually has the following functions: lighting, colour temperature, anti-theft and other:

(1) Power supply mode: It automatically switches from solar to commercial power. In general, solar energy is used and when the weather is bad or the solar battery charge level is low, it automatically switches the power supply into commercial energy to ensure uninterrupted power supplies.

(2) Ordinary working mode: The system is standby (quite bright), starts at night automatically (insufficient brightness), and the electricity consumption of the system is very low; if the brightness is dark or not sufficient, the corridor light will

automatically turn on as the resident approaches and automatically turn off when the resident leaves.

(3) Night mode: When the resident gets up at night, the system automatically switches onto the corridor lights, and switches off automatically after a certain delay.

(4) Anti-burglary: the system irregularly activates lamps of various combinations at night to mimic a situation in which the inhabitant lives at home, in anti-burglary mode, when an unlawfully intruding person, alerts and alarms and turns on all corridor lamps during the night in order to frighten the illegal intruder;

(5) Power back up: If lamps fail, the corridor lamps can be started as backup and in this case the corridor lamps light up in the lighting mode;

(6) Mode setting: The operating mode of the system can be configured using a control panel or wireless remote controller buttons.

1.1 Solar Lighting

Solar lights are now everywhere, from home beautification to road signs and lights. This solar lighting technology is reasonably priced and can be used from basic design to advanced design to online shopping places in local hardware stores (such as Amazon.com).

Skylight Solatube is a solar indoor lighting system that can increase natural light while reducing energy consumption.

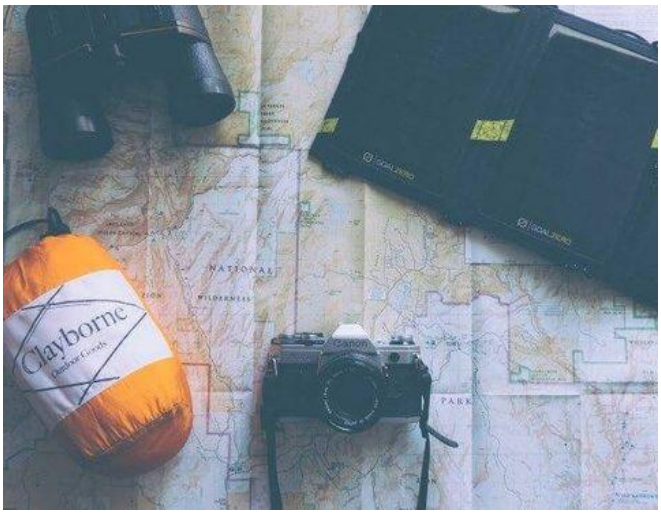

Figure 1.1: Solar Lighting

1.2 Electrical Lighting

An electric light is a device that produces visible light. It is the most common artificial lighting and is essential for modern society and both indoor and outdoor night and night activities. For technical purposes, alternative components that generate electricity are called lamps. The torch is often called a light bulb. For example, incandescent bulbs. In order to protect the lamp holder, the lamp is usually made of ceramic, metal, glass or plastic. The electrical connection of the socket can consist of a threaded base, two metal pins, two metal caps or bayonet caps. The three main electric lights categories include electrical lights that supply light through filaments with heated white-hot electrical current, gas-drawn light bulbs, flashing light bulbs and LED lamps that supply electric light over the belt gap within the semi conductive.

Candles, gas lights, oil lights and fires were common features at the beginning of the 2000s before electronic lighting. In 1806, English chemist Humphry Davy developed the first incandescent light to follow the first practical arch light. By the 1870s, a successful marketing of Davy's Arc Light had lit many public areas. Joseph Swan and Thomas Edison tried to make the most of commercial incandescent lamps during the 1880s, replacing archaeological lamps completely at the beginning of the 20th century.

The energy efficiency of electric lighting has increased dramatically since the initial demonstration of arc lamps and light bulbs in the 19th century. For modern electrical light sources that suit many uses a variety of different types and sizes is available. Central power is the main source of modern electronic lighting, but electric generators or mobile or standby battery systems power the lighting. If and where stationary lighting fails, both in vehicles and battery powered light is often reserved. Electric lanterns or flashlights are frequently used.

1.3 Structures of solar LED street lighting

Photovoltaic effects principle ensures the radiation of the solar panels through day and then converts them to electricity through charges and unloading controls. The battery provides the light energy of the LED for transmitting visible light to some direction where the intensity of the LEDs is reduced to around 10 lx by night, while the panel's open circuit tension is of certain value. The controller detects and acts voltage. After some time, the discharges of batteries will act again to end the next charge or disc preparation of batteries. After a while, the battery discharges.

1.4 PWM (Pulse Width Modulation)

The modulation of the pulse width (PMW) or the modulation of the pulse density (PDM) is a method which effectively reduces the electric signal's average power to discrete parts. With quick opening and closing of the switch between power supply, the average voltage (and current) value fed into the load can be adjusted. The longer the switch activation time, the higher the total load power. Compare time of closure. This is one of the main methods used to reduce battery output, in addition to maximum power point tracking (MPPT). For inertial loads, such as engines, PWM is particularly suitable. The discreet switch's inertial load does not easily influence its inertial load. The frequency of the

PWM switching needs to be large enough to prevent load effects, meaning that the waveform created is maintained as smoothly as possible.

The rate (or frequency) at which the power supply needs to be switched depends on the load and application. For example, the switch must be performed multiple times per minute in an electric furnace, 120 Hz in a dimmer, and a drive between several kilohertz (kHz) to ten kHz for a motor, and the switch requires tens or hundreds of kHz. The main advantage of PWM is that the power loss of the switching device is very small. If you turn off the switch, you can hardly find electricity. When the power is turned on and transferred to the load, there is no voltage drop across the switch. As a result, the power loss in both cases is almost zero due to voltage and current. PWM can also be used in conjunction with digital controls. Due to its on/off characteristics, the required service period can be easily set. In some communication systems, PWM can also use its duty cycle to transmit information through the communication channel.

Many modern MCUs use internal programming interfaces to integrate PWM controllers into electronic devices exposed to external pins as peripherals under firmware control. They are commonly used for direct current (DC) motor control in robotics and other applications.

1.5 Duty cycle

In the duty cycle, the time period ratio is described; a low duty cycle is equivalent to low power consumption, because the power supply is mostly off. The duty cycle is expressed as a percentage, that is, 100%. When half of the digital signal passes through, the duty cycle of the digital signal is 50%, and the other half is similar to a "square wave." When the digital signal spends more time in the off state, its duty cycle is greater than 50%. If the digital signal spends more time than the state, its duty cycle is less than 50%. This is a photo showing three situations.

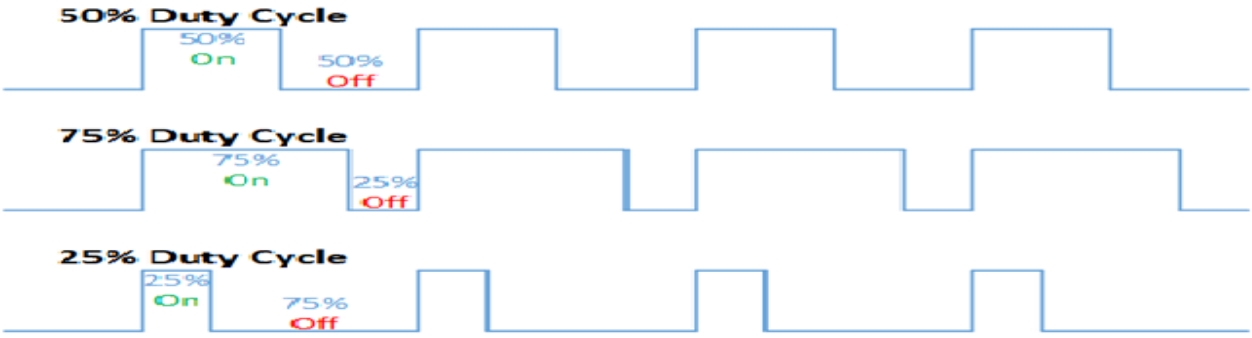

Figure: 1.2 Duty cycle

II LITRATURE REVIEW

A very important part of the smart home system is the porch lighting control system. The conventional light source control system cannot control and adjust the light source colour temperature. This design uses the STC15 Series MCU Smart Steering Unit and Wireless Sensor LED and solar porch lamp. This proposed control system is more humane and intelligent, with multi-function mode compared to other similar systems. Indoor brightness and human information can automatically be perceived, the gallery lights turn off or adjust, and the owner automatically detects when he is lit at night and lamps start up. Porch lamp has gradually worked which can be adjusted by the gradual process, luminosity and colour. When he really goes out and alarms the illegal return home the porch lamp control system can analogize someone at home. [1]

A relatively comprehensive and understandable teaching and an indoor VLC survey have been provided by authors. In order to pave the way for its use as a complementary RF technique with efforts to limit spectrum crunch, a VLC context within optical wireless communication methods was developed. The efficiency of the new solid-state equipment for lighting and their easy adjustment to establish communication are one of the major factors in driving VLC research, both in terms of energy efficiency and cost effectiveness. This paper covers the theory of lighting and optical detection as an aid in the elaborate layout of both the system and VLC architecture. The system architecture helps to understand the configurations of the links, while the structure explains aspects including the connection properties. Some of the characterisation parameters explained in this article include modulation techniques, dimmage schemes, LED drivers, and media access control link layer properties. We also present some of the recent developments over the past decade and the challenges that continue to inhibit the practicality of VLC. The final part of this paper looks at the feasibility of using VLC as one of the capable technologies for technological trends beyond 5G. In its infancy, however, VLC is one of the most attractive trends

capable of providing extremely efficient and cost-effective wireless communication services. [2]

A single stage LED street-light driver with power factor corrections and digital PWM dimming capacity has been proposed in this paper. The driver includes an AC–DC conversion system with coupling inducers and an LLC DC-DC resonant converter in half bridge type in one power conversion phase. A prototype driver has been developed and tested with input power line voltages ranging from 100 to 120 V for supplying a 144- W LED street light module. This experimental results showed the high-circuit efficiency of the high-light LED driver (maximum value of 93.13% for 120 VAC), high power (maximum value of 0.99 for 100VAC), low current THD (12.02% for 110VAC) and the low voltage rifle. [3]

The 'Solar power strands' system is an affordable, practical, eco-friendly and most safe way to save energy. SOLAR power strands with auto energy consumables. It tackles the two problems facing the world today in a very effective way: energy saving and the disposal of incandescent lamps. At different times of the night, it provides various intensities. It can be somewhat saved with this energy. It saves over 40 percent of the electricity now consumed by the basic solar street light according to statistical data. So the energy crisis will be eliminated to a large extent worldwide if this concept is used. [4]

The rapidly increasing urban sector requires considerable energy in India, which shows that Renewal Energy, in the form of solar energy, is currently being used for both the domestic industry and the corporate sector in the urban sector of India. The high intensity discharge lamps (HID) are now being used in urban street light for a few days by using the Light Emission Diode lamp (LEDs), which allows intensity management by modulating pulse width based upon vehicle sensing. In this text, the intensity of the vehicle continues to grow for the few lights ahead and the intensity is decreased as the street light passes. This document gived basic thoughts on how the programmable microcontroller control the intensity of street light to reduce and save energy, which resulted in different intensities for different conditions being employed by the programmable microcontroller. [5]

The main purpose of this paper is to offer a better solution for reducing waste in street lights, which is human restless in this electronic era. Manual control is susceptible to errors and leads to electricity losses and it is impossible to dim manually at night. Rapid progress in embedded systems had paved the way for the microcontroller-based virtual systems. A photo resistor made from cadmium sulphide, an 8052 microcontroller programmed using a C language to act as a pulse width modulator, can be found in this paper. It has been used to control light dependence resistance (LDR). The circuit also includes a charging circuit, and the solar cell is measured via a PIC16F8 family microcontroller. A LDR sensor, voltage-by-voltage divider, current by current sensor and temperature by temperature sensor monitor the light intensity. All these information is shown on a PIC microcontroller interface with a 16X2 LCD. [6]

III COMPONENT DESCRIPTION

3.1 SOLAR CELLS

Photo Voltaic (PV) system's component is solar cells. It is a photo-electric cell that can produce and support electric current without being connected to any external power source when exposed to light. Solar cells produce sunlight direct electricity, which can be used for power or battery charging. Solar cells require environmental protection and are generally tightly packaged behind a glass sheet. In cases where more power is required than a single unit can supply, photovoltaic modules or solar panels, as shown in Fig., are connected electrically. Solar cells are often connected electrically and embedded as module. There are numerous applications for solar cells. It has been used when power from the grid is not available, for example in the remote power supply and in the urban power supply system. With the intensity of the sunshine the power produced by the PV cells fluctuates. First and then the batteries used should be charged.

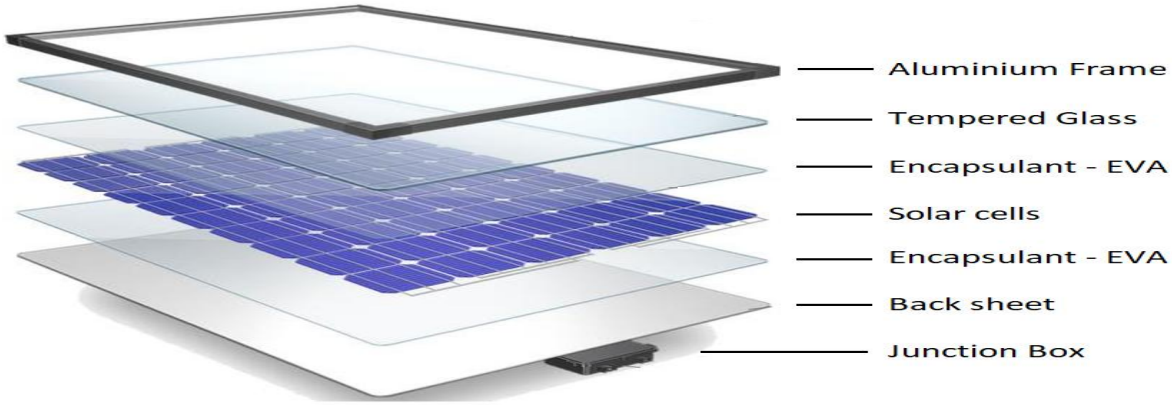

Figure: 1.3 Solar Cell Components

3.2 Charge Controller

The rate at which the power is added or drawn from batteries is limited by a load controller, load controller or battery regulator. A battery pack, battery-powered device, or battery-energized battery-recharge circuitry may be referred to as a "charge controller" or "charge regulator." It prevents overloading and can prevent over-voltage, reducing bacterial performance or durability and posing a safety risk. It can also prevent a battery from draining completely (deep discharge).

3.4 Off-Grid System

Basically divided into two types of solar charge controller: the standalone charge controller and the integrated charge controller. Self-containing charger controllers are sold as a separate device for uses like PV, boat and home battery storage, often in conjunction with solar or wind power generators. Solar control can also be called solar regulators in solar applications. Features such as low-voltage disconnection, a separate system that power down the charge when the batteries overly discharged, have been added to some charge controllers and solar controls. Just stop charging the battery if they exceed a set high tension level and re-activate the charging if the battery tension drops below it. PWM and maximum power point tracking pulse width modulation (PWM) (MPPT). In the case of integrated load controllers, it functions as a load controller that can consist of several electrical components or can be encapsulated in a single microchip.

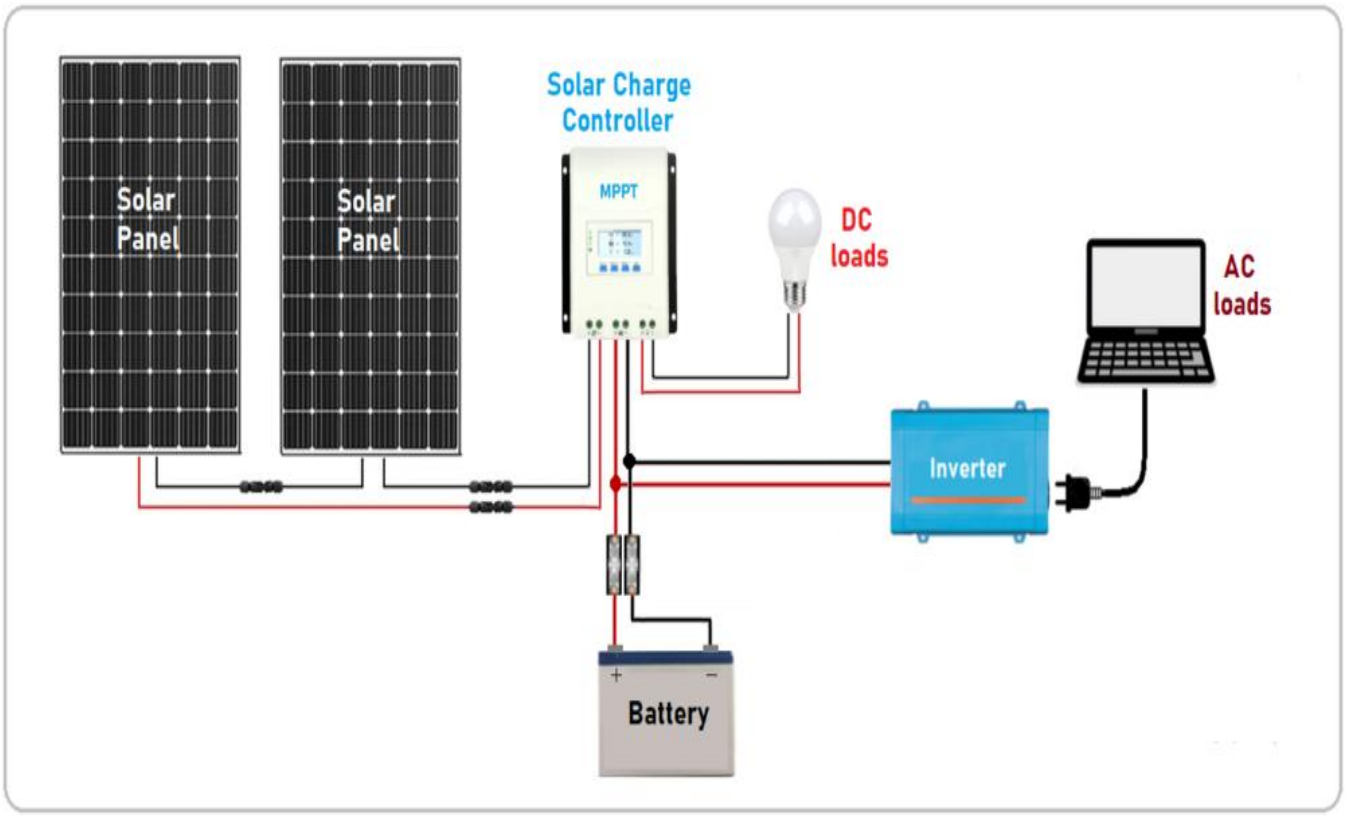

Figure: 1.4 Solar Charge Controller

3.5 Software Design

According to the functions of the system, the smart corridor lamp control software includes a main programme, wireless input data detection, regular operative mode sub-program, night mode, anti-burglary mode.

3.5.1 Software Requirements

1. MPLAB with Hitech 'C' Complier
2. MPLAB IDE
3. PIC Simulator
4. Matlab

IV METHODOLOGY

In this topic we discuss about block diagram. This is one type block diagram.

In this we have employed two no's solar panels (12V 10W), their power is routed through diode in unidirectional way, then we have employed a relay to switch on/off charging of battery (12 V 7AH) lead acid battery. We employed 2Nos potentiometers to measure solar and battery voltage on pin (AN0 & AN1) of the micro controller.

Also we have employed a RTC Module connected to (I^2C) bus of the microcontroller and a 16X2 LCD Module at Port

B. A 4*4 Keypad is also attached to Port D. From microcontroller 2Nos channels PWM 1 & PWM 2 attached to separate MOSFET's to individually control 2Nos PWM Lighting. And that MOSFET's drive Home LED array and Street lights. The Street lights are controlled via Relay and IR sensor for vicinity/presence detection based operation.

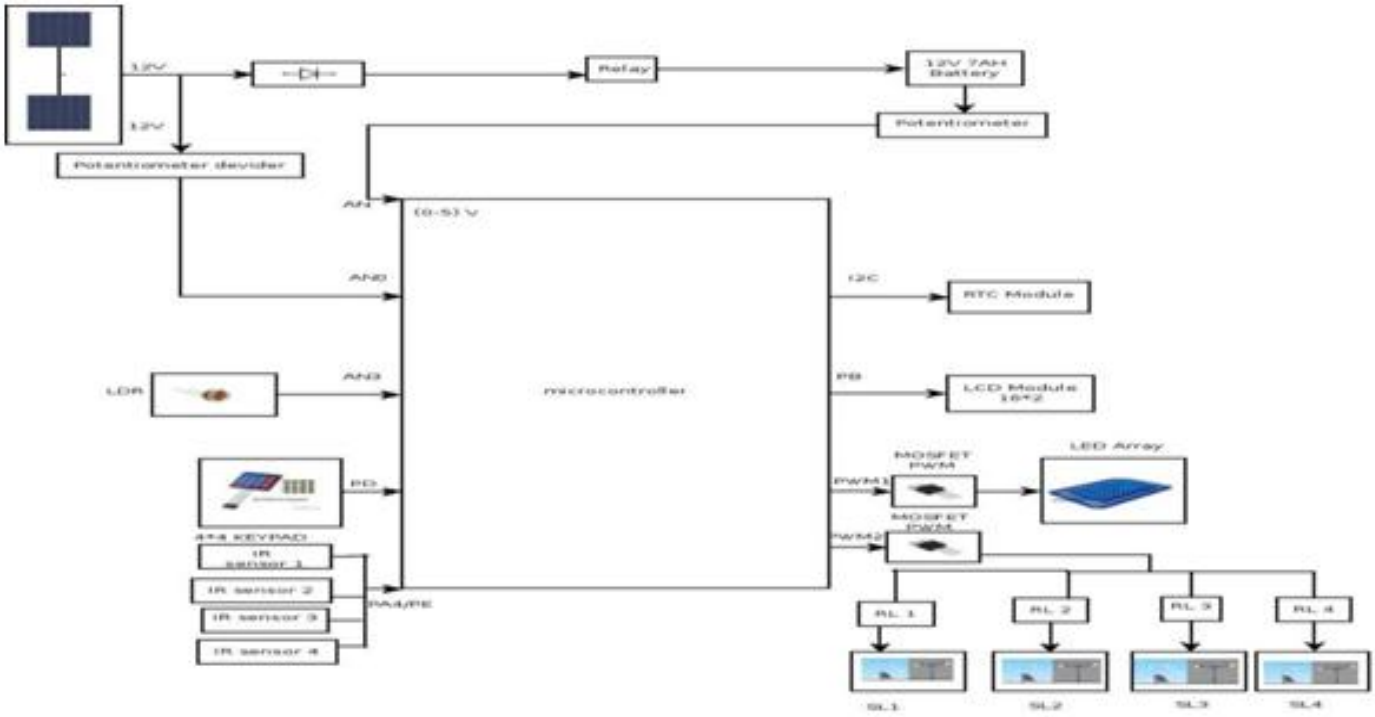

Figure: 1.5 Block Diagram of System

V CONCLUSION

The solar LED green lighting system Gallery Light Control System has smart controls in one system with green energy efficiency, low carbon protection and user efficiency. The system can detect ambient illumination automatically and determine whether light is required on or off. The system can also solve the problem of exploring the nightly switch by gradually illuminating the human eye. The LED porch light is free to set the brightness and colour temperature as per the owner's needs. Porch lamp can simulate lighting at home for the owner.

REFERENCES

[1.]Xiangrong Ding1,a, Ping Jia "Corridor Lamp Control System Based on Solar and LED Lighting" ISCA 2013.

[2.]Chun-An Cheng, and Tsung-Yuan Chung "A single-stage LED streetlight driver with PFC and digital PWM dimming capability" INTERNATIONAL JOURNAL OF CIRCUIT THEORY AND APPLICATIONS 2016.

[3.]T.RAJASEKHAR1, Dr. K. PRAHLADA RAO "SOLAR POWERED LED STREET LIGHT WITH AUTO INTENSITY CONTROL" IJTIMES 2017.

[4.]Malaya Kumar Rout, Sushant Meher, Jagannath Dhar, Yashraj Sahu, Satyabrata Das "Design of Modern Solar Street Light Intensity Controller: An Energy Saving Approach" IJRAET 2015.

[5.]Ch Kavitha, Swathi, Satyaprakash, Vinitha "Solar Powered LED Street Lighting with Auto Intensity Control" International Journal of Scientific & Engineering Research 2016.

[6.]Satyendra Kumar Mahto, Neha Tiwari "Design and Construction of Solar PV LEDs Lighting System" International Journal of Science and Research (IJSR) 2013.

[7.]Mr. Girish S. Mule,Prof. Ashok M. Jain "Optimization of Solar-PV Model for LED Lighting by Simulated Annealing With Improved Reliability and Less Capital Cost" International Journal of Science, Engineering and Technology Research (IJSETR) 2013.

[8.]Mokhtar Ali , Mohamed Orabi , Emad Abdelkarim , Jaber A. Abu Qahouq and Abdelali El Aroudi "Design and Development of Energy-Free Solar Street LED Light System" IEEE 2011.

[9.]David R. Riley, Michael J.Horman, Richard G.Mistrick "Design and Construction Evaluation of a Photovoltaic Dc Led lighting System" SPIE 2008.

[10.]Fares S. El-Faouri, Munther Sharaiha, Daoud Bargouth, and Ayman Faza "A Smart Street Lighting System Using Solar Energy" IEEE 2016.