



Solar Smart Classrooms by Using at Mega 328 Microcontroller

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Abstract

Today, "Electricity is one of the largest requirements and this requirement of electricity is one of the biggest problems". So, it is very essential to give emphasis on power saving. So we are proposing a Solar based system which will reduce unnecessary bill of electricity and also provide light to the area like classroom where we have to use electricity in days. This system can effectively work in areas where electricity is excessively used especially, during day time in college classrooms where all work done in the day time and in between 9AM to 5PM. The working of system is in real time it will contain solar panel which harvest the energy from sun and provide to lights. The real time clock will ON and OFF the load according to timing and can be set with help of remote controlled. In absence of solar light system will run on battery and if that not possible it will switch to AC mains supply. The proposed system will remain OFF when there is no presence of human being and will activate upon the arrival of human being in specified area. This presence will be detected by sensor at input side. One of the biggest utility concerns is the fact that by detecting the presence of person whenever enters in the area of corridor of premises, the light and fan will remain in ON state, otherwise it will remain OFF. The switching action of LED light will take place by using MOSFET. This entire process is controlled by Microcontroller.

Index Terms-Solar Panel; At mega 328 Microcontroller; PIR Sensor; DS1307 RTC; Voltage Sensor and battery; LCD Display; MOSFET

1. INTRODUCTION

Solar energy is the most abundant stream of energy. This energy derived from the heat and light of the sun. There are so many ways to do this. Solar cells (photovoltaic) convert sunlight directly into electricity. Solar energy is the energy received by the earth from the sun. This energy is in the form of solar radiation, which makes the production of solar electricity possible. Wind power comes from uneven heating of the earth's atmosphere by the sun. Solar energy is rapidly gaining notoriety as an important means of expanding renewable energy resources. It is vital for engineering fields to understand the technologies associated with this area. Our project design the solar smart class room where the system is based on At Mega328microcontroller. So we are proposing a Solar based system which will reduce unnecessary bill of electricity and also provide energy to the area like classroom where we have to use electricity in days.

2. HISTORY

Energy is very important for the human being and nature. It is gift of nature to the mankind to various form. The consumption of the energy is directly proportional to the progress of the mankind with ever growing population. The global demand for the energy is increase day by day. The primary source of energy is sun. It is renewable source. Electricity generation is the process of generating electric energy from the sun. The transformation of light into electrical energy in a solar cell is done in the photoelectric effect. The solar power is tapped through a solar panel and the charge is stored in a battery. This charge stored during the day time is used at night for the operation of the classroom. The automatic on-off control ensures that the circuit remains turned off when natural illumination is available.



3. DESIGN OF MICROCONTROLLER BASED SMART CLASSROOMS KIT

The solar power is tapped through a solar panel and the charge is stored in a battery. This charge stored during the day is used at night for the operation of the class room. The class room is made functional from 9 AM to 5 PM. An indoor Lighting System with Automatic on-off control and a human sensor is designed. The automatic on-off control ensures that the circuit remains turned off when natural illumination is available. When a person is approaching, the brightness increases till the person enters in area. A human sensor is used to enhance the conservation of energy. It makes the class room operate on low brightness/switch off the light and fan when there is no movement.

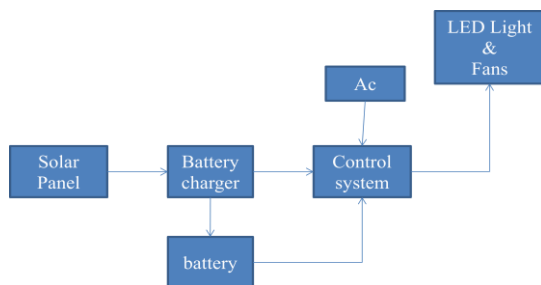


Figure1. Main block diagram

3.1.Solar Panel

Solar Panels of 12W are commonly available and were installed as the source of the Light. An extended study of the project includes the effects of the placing the Solar Panels in the direction recommended as per Fig. It would be impossible to manually change the inclination of the Solar Panels when placed in large numbers. An automated system is under development to sense and aid the change in angle of inclination as per the following:

- ✓ January to April - 50⁰
- ✓ April to September - 0⁰
- ✓ September to January - 50⁰

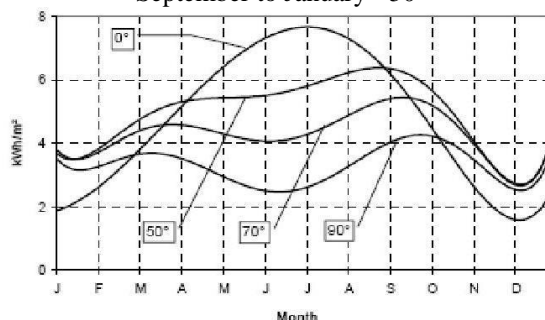


Figure. Calculated annual distribution of solar radiation on tilted surfaces.[2]

3.2. At mega 328 Microcontroller

The at mega 328 is a single chip microcontroller created by Atmel and belongs to the MegaAVR series. The microcontroller controls all the operations. It is the major part of the system. The solar panel is aligned according to the intensity of sunlight under the control of the microcontroller.

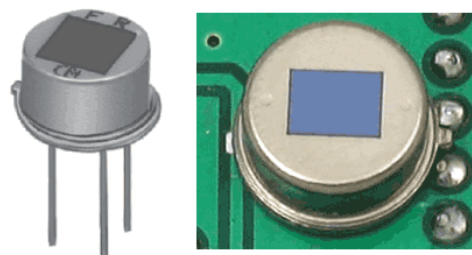
Specification:

- ✓ The Atmel ATmega328P is a 32K 8-bit microcontroller.
- ✓ The ATMEGA328 comes in an PDIP 28 pin package and is suitable for use on our 28 pin AVR Development Board
- ✓ It is used to control all the devices in our classroom



3.3. PIR (Passive Infra Rated) Sensor

The PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.



3.4.DS1307 RTC(Real Time Control)

This Panel-mount Digital Timer series can be operated in 4 separate power supplies, this ranges from 240 V ac to 12Vdc. Output format can be produced to be volts-free or voltaic-output. Batteries of Lithium CR2032 or rechargeable V80H available for potion which is for option which is retaining the programming during Timer's operating power disconnected. This Digital Timer



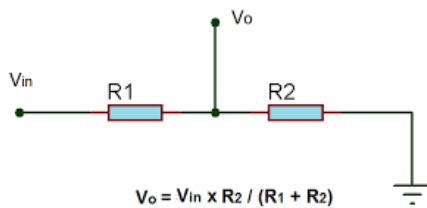
is accurate to the minute, designed with either 6 or 8 ON/OFF (event) per day.



3.5. Voltage Sensor

It can measure analog DC voltages from 0 to 5 Volts via its analog to digital converter. Voltage divider consists of two resistors (R1 & R2). The output voltage (Vo) can be calculated by the following formula:

$$V_o = V_{in} \times R_2 / (R_1 + R_2)$$



3.6. Battery

The Fan and Lighting System was made independent of the Electricity mains. Calculating the consumption of the Fan and Light and placing allowances for an uninterrupted supply for 24 hrs, a 12W 7Ah battery was installed. A lead acid battery was chosen for its well known efficient characteristics.



3.7. LCD Display

LCD is the display which use for the showing status of equipment, time, date, etc. A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light

modulating properties of liquid crystals. Liquid crystals do not emit light directly.

Feature:

- ✓ 5*8 dots with cursor
- ✓ 16 characters * 2 lines display
- ✓ 4 bit or 8 bit MPU interfaces
- ✓ Display mode and backlight variation
- ✓ Low power operation support: 2.7 to 5.5V
- ✓ Pin function compatibility with HD44780S
- ✓ Internal oscillator with external resistor

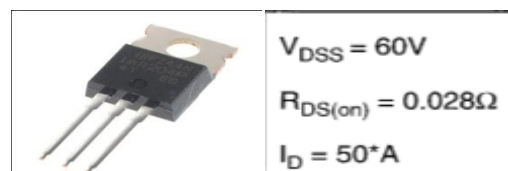


3.8. MOSFET(Metal Oxide Semiconductor Field Effect Transistor)

The MOSFET will still conduct through the body diode so the device will receive a small voltage.

Features:

- ✓ Dynamic dv/dt rating
- ✓ 175°C operating temperature
- ✓ Fast switching
- ✓ Ease of paralleling
- ✓ Simple drive requirements



4.WORKING

The entire circuit operation of the proposed system is divided into four parts.

4.1Input Section

At the Input side, PIR sensor is used to sense presence of any person in Classroom if there is no one in classroom then there will be No output signalling from sensor to Microcontroller therefore, light will be in off position. As soon as, the presence of any person occurs in classroom, it will be automatically detected by PIR sensors. Then all sensors are interfaced with the Microcontroller then by the controlling action light will turn ON.



4.2 Controlling Section

In the controlling section, the Microcontroller will act as a main controlling unit where the output from PIR sensors is given as input to Microcontroller. Microcontroller is a powerful tool used in device to automate any system it has capability to control devices in accordance to logic build in memory of Microcontroller. In the Microcontroller, the desired programming is burned. Then, according to programming, the Microcontroller will take action.

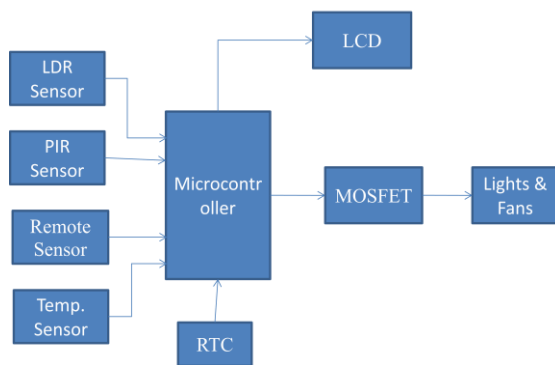


Figure. Control Section

4.3 Output Section

The output section mainly consists of MOSFET. It consists of switching transistors. The controlling output from Microcontroller is given to the base of specific transistor which will activate corresponding MOSFET than that MOSFET will switch ON or OFF the particular light and fan.

4.4 Power Supply Section

The 230 volt AC supply is given to Switch mode power supplies (SMPS) are an extraordinary array of high frequency alternative. These are the Switching Regulators offers higher efficiency than linear regulators. In addition the Power Supply SMPS can step-up. Down and invert the input voltage. This SMPS power supply will down convert the 230v AC supply which is used to supply power to various components in the circuit.

5. FLOW CHART

- ✓ When Solar Energy Available it is use for load and to charge battery
- ✓ When solar energy not available and battery is available load run on battery
- ✓ In a case when battery is not fully charged we use main supply running load.

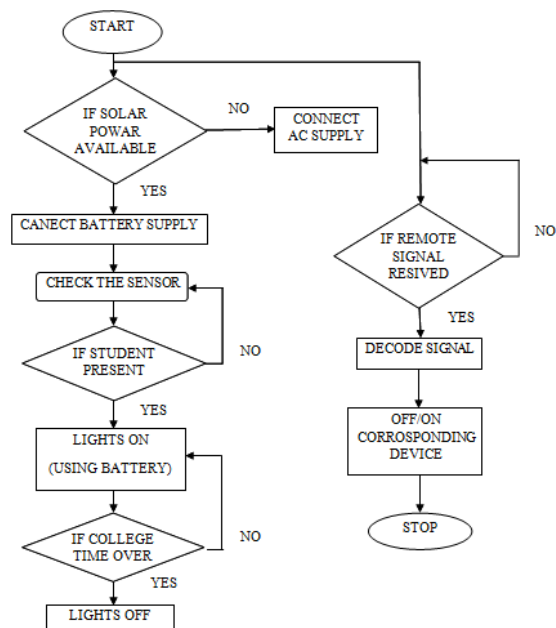


Figure. Flow Chart

6. CONCLUSION

In this study, appropriate Microcontroller with the program to control and monitor the system from a central point was realized. This system can effectively work in areas where electricity is excessively used especially, during day time in Classroom or corridors of hostels, hospitals etc. The proposed Microcontroller based system will remain OFF when there is no presence of human being and will activate upon the arrival of human being in specified area. This presence will be detected by sensor at input side. One of the biggest utility concerns is the fact that by detecting the presence of person whenever enters in the area of corridor of premises, the light and fan will remain in ON state, otherwise it will remain OFF. The proposed model will surely help to reduce the extra use of electricity and prevent the adverse effect of extra uses due to which we suffers a lot.

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