DESIGN AND CONSTRUCTION OF A SOLAR-POWERED AUTOMATIC SECURITY LIGHTING SYSTEM USING GSM MODULE

BY

UGBODAGA AYOMIDE JOHN

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A PROJECT SUBMITED TO THE DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING, FEDERAL UNIVERSITY OYE EKITI IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF ENGINEERING (B.ENG) DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

SUPERVISOR: ENGR K. O. OLUSUYI

FEBRUARY, 2019.

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This project work titled "Solar-powered automatic security lighting system using GSM module" by Ugbodaga Ayomide John, meets the requirements for the award of Bachelor of Engineering (B.Eng.) degree in Electrical and Electronics Engineering Department, Federal University Oye-Ekiti.

ENGR K. O. OLUSUYI **DATE**

PROJECT SUPERVISOR

ENGR. DR. J. Y. ORICHA **DATE**

HOD

EXTERNAL EXAMINER **DATE**

DEDICATION

This report is dedicated to the ruler of the universe the custodian of great wisdom and the giver of knowledge Almighty God, for his love, guidance and blessing through my stay at the university, to my dearest parents MR and MRS UGBODAGA who made my academic succession a reality through their financial support.

ACKNOWLEDGEMENT

I acknowledge Almighty God, for giving me the strength and wisdom to complete my course. Sincere gratitude, appreciation and thanks go to my Parents and Siblings for their love, care, moral and financial support. I also thank my able supervisor Engr. K. O. Olusuyi for his perusal, suggestion and encouragement during the writing of this report.

My immense gratitude also goes to my Head of Department, Engr. Dr. Oricha, the departmental project coordinator, Engr. G. K. Ijemaru, Engr Prof Akinsami Engr. Babarinde, Engr Ezea, and Engr. Sanni and the entire staff of Electrical and Electronics Engineering.

Finally, my profound gratitude goes to my course mates for their pieces of advice and bearing attitude towards the compilation of this report.

ABSTRACT

This project presents a solar-powered automatic security lighting system using GSM module for its working operation. The PIR acting as a sensor senses human close to the building during the day and triggers an alarm and during night fall triggers alarm and switch ON the security light by the help of the LDR. This project is however programmed in such a way that the house owner receives an SMS alert whenever someone comes close to the building in case of theft. Thus, the aim and objective of the project is achieved.

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LIST OF ABBREVATIONS

1. LDR – LIGHT DEPENDENT RESISTOR
2. GSM- GLOBAL SYSTEM FOR MOBILE
3. SIM- SUBSCRIBER IDENTITY MODULE
4. PIR- PASSIVE INFRARED SENSOR
5. WSN- WIRELESS SENSOR NETWORK

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CHAPTER ONE

1.0 INTRODUCTION

Security lighting system is very important in everyday community for the safety of occupant within the community. From human beings to domestic insects, from technology to science, nothing seems to maximize its existence without the availability of light. (Garg HP, 2000) Even the human eye requires some amount of light to function well at night. (Perlin, 1999). Light gotten from sun is called sunlight, this sunlight can serve as a source of solar power which is converted to electric power for both house hold and industrialization.

1.1 BACKGROUND OF THE PROJECT

In the world of today security light is very crucial and due to the busy schedule of occupants within a particular community switching operations of security light are most times either not carried out on time or not carried out at all. Most times if these security light are on peradventure it might not be switched off as at when due and these result to wastage of electricity i.e. even during the day the light is still on, but development in the field of electronics has contributed to the automatic switching ON and OFF of this security light so as to reduce man made error and make live more comfortable and also reduce theft. Electronics component such as relay, light dependent resistor, PIR sensors, GSM module, embedded system and a solar inverter therefore plays important role in helping towards the achievement of this project.

1.2 STATEMENT OF PROBLEM

Insecurity has become a hydra headed monster which security agents in the world appear incapable of handling. National Bureau of Statistics in 2016 listed BURGLARY being the second most committed crime across top 10 states with security challenges whereby the design and construction of automatic security light control system using solar inverter will

lead to automatic switching ON of security light at the sensing of a person by the PIR sensor, this in turn will help locate suspicious act of a thief at night within the environment. Nevertheless, the problem of security in Nigeria has affected the economy of the country in one way or the other which this project has been introduced to minimize and these include:

1. Reducing Energy waste even if one forgets to switch off the security lightning system of a house in the morning before going to out hence the PHCN bill will be reduced
2. Reducing man power operation in the switching ON and OFF of the security light as at when due.
3. To minimize the cost of electricity since it can also be charged by solar and this will make it independent on PHCN light.
4. It would automatically control the ON and OFF state of the output light when a shadow is upon or off it with the aid of the LDR and turn ON the light when someone approaches the building.

1.3 MOTIVATION

With the increase in the insecurity of lives and property within the community and some places in Nigeria it is evident that there is need for us to start developing a way we can help security guards and agency by making their work easy. This will aid in the identification of a thief or anyone standing to pose security threats to lives and property within the environment as the light comes ON at night. With this project the security challenges of the country will be reduced to some extent as armed robbers most times operate at night in the dark. The reduction of security threats to my community kola has being the major motivation for this project.

four explains the construction and testing of the whole project then chapter five concludes the whole work with limitations and recommendations for future work.

CHAPTER TWO

2.1 REVIEW OF RELATED LITERATURES

Lately, the governments of developing countries have improved the security challenges within the country with the aid of innovations in technology. Security light is particularly concern for public authority in the developing countries for economic stability. A poor security lightning system creates an unsafe environment for industries and occupants residing within the environment. An automatic security lightning control system enables the automation, power consumption and cost effectiveness. The automatic system helps in reducing man power in the switching ON and OFF of the security light by interconnection of embedded control system. So many related researches have been done in lieu of an automatic security light control system using solar inverter project, a very relevant ones are discussed below:

1. A research designed carried out on PIR sensor based security system in this design, a PIR based security system which saves the power consumption and the memory space of the recording system has been proposed. Passive Infrared Radiation(PIR) sensor detects the change in infrared radiation of warm blooded moving object in its detection range. According to the change in infrared radiation, there will be a change in the voltages generated which was amplified and used to turn ON the webcam and lighting system through relay. Software was developed and installed in the computer to capture and record the video when the webcam gets turned ON. When an intruder comes in the detection range of the PIR sensor, it actuates the lighting system and the webcam. The software detects the webcam connection; it will start to record and save the video. Once the intruder moves out of detection range of the sensor, the webcam and light gets turn OFF. The software repeats the process. Thus the saves power consumption and the memory space of the recording system as the lamp and webcam

will only get turned ON when PIR sensors detects an object. Consequently, the system starts recording only when the webcam is turned ON; hence saving memory space. (Pema Chodon, Passive Infrared (PIR) Sensor Based Security system, 2013)

2. This research is a GSM based street light automation, the creeping interests in the wireless and GSM based projects, made the researcher came up with this idea of developing a simpler, multipurpose, cost-effective design to control the on-off street lights via short message service (SMS), Commands are sent to street light for night lighting Applications system through user' mobile as data through SMS (Short Service Messages) providing a cost effective, reliable far reaching access to the user. The coded SMS is sent to the light relay system to base station controller that receives the messages, decodes the messages, initiates required automation operations and responds to the successful initiations by a reply to the user. The Hardware for the implementation of Auto light intensity and Auto switching system control for Smart Street lighting system is used AT COMMAND for functionally of street light just like server used. By sending a SMS onto microcontroller by the help of mobile they read it and match by itself if microcontroller is accepting them then, street light is ON vice versa for OFF also used was contractor against to relay to protect and control of maintained of supply. There is inbuilt circuit are here power supply are given to module therefore by the help of ac capacitor we reduce the ripple and then convert into dc by the help of bridge rectifier further by using antenna they transmit the MSG to micro controller the read and accept if they match with at command after then MSG should be received led light emitted and unit of street light 1or unit 2 or unit 3.all of them should be open. Vice versa they should be OFF. (M. Shariz Ansari1, 2015)

3. In this project the author was able to design a GSM based smart street light monitoring and control system, the GSM based street light monitoring & control system is an automated system designed to increase the efficiency and accuracy of an industry by automatically timed controlled Switching of street lights. This project describes a new economical solution of street light control systems. The control system consists of a GSM Modem, and control circuitry and the electrical devices. This also includes client server mechanism where user can directly interact with web based application to control the Street light of any place from single position. Base server will be running a Java Web Application which will maintain complete street light recode of City/State/Country. When we want to switch ON/OFF any particular street light, server will send a GSM SMS to that street controller to take necessary action. Street light controller will receive that SMS and will decode it and finds the particular street light which needs to put ON/OFF using relay circuit. Here the street controller 89C51 is connected to GSM modem through its UART port (Serial Ports). 89C51 cannot talk to GSM modem directly due to mismatch. in voltage levels. So GSM modem is connected through voltage level convertor MAX 232. Only 2 lines RX & TX are connected to the MAX 232.The MAX232 is connected to GSM modem via RS 232 cable [1]. An oscillator circuit of 4 MHz is connected to the 89C51. One of the port of 89C51 is connected to relay driver circuit which will help 89C51 to switch power ON/OFF of the street lights.89C51 will continuously reading the serial port after every second for new SMS. Ones the SMS came it will try to fetch that SMS from GSM modem using AT commands. It will then decode the will decode it and finds the particular street light which needs to put ON/OFF using relay circuit. The entire street light lamps are connected to relay driver circuit. Base server will be running a Java application which will maintain complete street lighting details of the

city. When we want to switch ON/OFF any particular street light, server will send a GSM SMS to that street controller to take necessary action. Further, with the rapid development of mobile communication technology, mobile phone not only can be used to call or send short messages, but also as a smart tool, through which one can browse the web pages, send and receive e-mails, can view notifications and alerts via android applications and connectivity facilities. This system provides its users a very flexible and portable facility of viewing the notifications with the help of their android devices having basic connectivity feature. (Prof. S.A.Chavan, 2013)

4. A study carried out on automatic switch using PIR sensor, in this study The Arduino PRO mini board which contains ATmega328 microcontroller was used, it is 8-bit microcontroller, which is used to control the system. The PIR sensor detect the presence of a human in the area and send signal to Arduino PRO Mini, Arduino will turn on the lights, fans or electrical appliances, after every 40 seconds Arduino check the output of the sensor and if output is high then it will not switch off the electrical appliances and if output is low then it will turn off the electrical appliances. The device repeats this pattern continuously. Range of the PIR sensor is nearly 6 meters. (1Abhishek N Vaghela, 2017)
5. This research main objective is to develop a motion sensor alarm based on a Passive Infra-Red (PIR). This project is aim to build a sensor system which is transmit and receive the signal. This project is about the motion detection using Infra-Red sensor in wirelessly. Besides that, it also acted as an auto power switching system. When the sensor is triggered, the signal will transmit wirelessly to take further action. For this project, we relate this sensor system with an auto power light switching system. Which mean when the sensor is triggered, light in a room will automatically switch ON. In order to transmit signal wirelessly, this project used radio frequency module to

transmit the signal. For the controller circuit part, this project will use Programmable Interface Controller (PIC) to control the circuit, because it is cheaper and easier to program. The objective of this project is tending to switch ON the light automatically and fan based on the temperature. Besides that, signal transmit wirelessly can avoid the circuit malfunction because of wire broken also in this work Current temperature will shows on a LCD display. (Ajay Kumar Tiwari, 2016)

6. A research study carried out on the design and implementation of automatic street light control system using Light dependent resistor, the project basically emphasizes on developing a cost efficient and highly reliable automatic streetlight control system. The main drawback of present conventional switching and timer switching system is wastage of power. Here the prime concern is to design and fabricate a highly reliable automatic streetlight controller. ATmega8 microcontroller is the brain of the entire controlling circuit. The control circuit requires 5V DC to operate which is obtained from the rectifier circuit which also includes a step-down transformer and a voltage regulator. The light dependent resistor used as a light sensing device senses light intensity and sends analogue signals to the microcontroller. The timer concept is employed along with light dependent resistor. The real time, ON time and OFF time settings is done using the four button keyboard and liquid crystal display. A tolerance of one hour is provided for the efficient operation of the streetlight. In order to turn ON/OFF the streetlight, two conditions have to be satisfied. One of the condition is light intensity sensing of the light dependent resistor and the other being the timers in the microcontroller. Once both of these conditions are satisfied the microcontroller generates control signals to energize and de-energize the relay for the streetlight to turn ON and turn OFF. The Analog signals from the LDR are processed in Analog to digital converter (ADC) of the ATmega8 Microcontroller. The real time and On/Off

time is set, a tolerance of one hour is pre-set using codes written in C language and the program is dumped into the microcontroller. The operation of Relay switch is controlled by the ATmega8 microcontroller. In this research the bulb glows when the LDR senses a drop in light intensity and when the set ON time is matched, hence both of the above condition are satisfied. (Gouthami. C #1, 2016)

7. In this project the author was able to design and construct a solar power based lightning system The design is such that the solar panel will be installed on the galvanized pole considering some specifications like angle of tilt and direction of sunlight. The 12V dc battery that will power the LED bulbs will be connected to the solar panel via the charge controller for charging purpose. The pole was constructed such that it will be able to hold the LED bulb or lamp. The solar tracker in the solar panel tracks the sunlight and the light detected is converted to electric power using the photovoltaic effect. The electric power is used to charge the battery and the charger controller embedded in the street light system is used to prevent the overcharging of the battery. The photocells detect if light is needed. Photocells are light sensitive sensors that respond to the amount of light detected. When the light is too low, such as at dusk or under heavy overcast skies, the sensor tells the switching circuit within the street light system to activate the flow of electricity and the electricity is sent through high-intensity discharge lamps. When the sensor detects too much light, the sensor will deactivate the street light e.g at dawn. (Oke A. O.*1, 2013)
8. These research designed an electronic street light using solar power and LED The circuit of the project research consists of microcontroller, LDR, PIR sensor and RTC. This system controls the street lights using LDR and PIR sensor. Street lights are switched on depending on the intensity of the Sun light on LDR. If the intensity of Sunlight on LDR is low, its resistance value is high. When it is completely in dark this

value increases and then becomes high. This resistance value decides when the street lights are required to switch ON. The resistance of LDR in dark is in ohms and in dark its resistance is in mega ohms. When the resistance value is maximum in midnights, real time clock (RTC) comes into the play. When there is no traffic the microcontroller checks peak time and switch OFF the lights. When there is any vehicle passes on the road, it is detected by the PIR sensor. Whenever PIR sensor is detected it just indicates the microcontroller to switch on the street lights. Then lights are switched on for 2 to 3minutes and then automatically switched off. LCD is also used for displaying time. Time from RTC is read and displayed on the LCD. a sensor to help in the automatic switching, PIR sensors can be used for "automatic street lightening" whose operations are based on body or vehicle movement near the street light. The equipment was fabricated along with a switching circuit which activates and deactivates the system as well as a charge controller unit that prevents the battery from overcharging. The system was also built to conserve energy with the use of a LED lamp to replace other lamps such as the fluorescent lamp which might reduce the efficiency of the battery. The power consumption of LED is very less which helps to save electricity. In the solar panel DC supply necessary to charge the battery without the need for a conversion to an AC so there is no need of inverter. (Shruti lohiya, 2015)

9. The project is aimed at designing and construction of an automatic security light control system with open circuit detector the research project work involves the application of the light department resistor (LDR) technology to sense darkness and light and of course to automatically initiate the switching process of security lights in our homes and offices without human intervention. An open circuit detector which helps to alert occupants (by switching on an alarm and LED used as indicator)

whenever a security light / bulb is bad or removed, is incorporated into the design to ensure close monitoring of the security light even while asleep. (ADEIZA, 2008)

10. This research is a solar based inverter and charger This system is designed for outdoor application in un-electrified remote rural areas. This system is an ideal application for house or village street lighting. The system is provided with battery storage backup sufficient to operate the light for 7-8 hours daily. The project is about to develop and fabricate the circuit that can charge the lead acid battery during day time by using solar as the source. To control the circuit for charging, the researcher used the circuit charging that can implement the condition of the charging whether it's in charging condition of in float condition. The design consists of a PV array, a 12-volts lead acid battery, a control section that uses the PIC16F72 microcontroller. The control section obtains the information from the PV array through microcontroller's Analog and Digital (A/D) ports and hence to perform the pulse width modulation (PWM) to the converter through its D/A ports. Battery's state of charge is also controlled by the microcontroller to protect the battery from over charged. When charging condition, red LED will turn on until the battery reach the full charge state that is in floating condition and green LED will turn on. The PIC16F72 will determine whether it is daytime or night time by using sensing circuit. The light will automatically ON when the sensor circuit give the input to the PIC and PIC will give the output to the relay to switch on the light. When night change to the day, sensing circuit detect the ray from the sun, PIC will give the output to off the lamp and the charging circuit will continue charge the battery for the day. (P.H.Patil#, 2013)
11. This project helped in the design and implementation of smart LED lightning system using a self-adaptive weighted data fusion algorithm, the project work aims to develop a smart LED lighting system, which is remotely controlled by Android apps

via handheld devices, e.g., smartphones, tablets, and so forth. The status of energy use is reflected by readings displayed on a handheld device, and it is treated as a criterion in the lighting mode design of a system. A multimeter, a wireless light dimmer, an IR learning remote module, *etc.* are connected to a server by means of RS 232/485 and a human computer interface on a touch screen. The wireless data communication is designed to operate in compliance with the ZigBee standard, and signal processing on sensed data is made through a self-adaptive weighted data fusion algorithm. A low variation in data fusion together with a high stability is experimentally demonstrated in this work. The wireless light dimmer as well as the IR learning remote module can be instructed directly by command given on the human computer interface, and the reading on a multimeter can be displayed thereon via the server. This proposed smart LED lighting system can be remotely controlled and self-learning mode can be enabled by a single handheld device via Wi-Fi transmission. (Lin, 2013)

12. In this project, a PIR based security system which saves the power consumption and the memory space of the recording system was designed. Passive Infrared Radiation (PIR) sensor detects the change in infrared radiation of warm blooded moving object in its detection range. According to the change in infrared radiation, there will be a change in the voltages generated which was amplified and used to turn ON the webcam and lighting system through relay. Software was developed and installed in the computer to capture and record the video when the webcam gets turned ON. When an intruder comes in the detection range of the PIR sensor, it actuates the lighting system and the webcam. The software detects the webcam connection; it will start to record and save the video. Once the intruder moves out of detection range of the sensor, the webcam and light gets turn OFF. The software repeats the process. Thus the saves power consumption and the memory space of the recording system as

the lamp and webcam will only get turned ON when PIR sensors detects an object. Consequently the system starts recording only when the webcam is turned ON; hence saving memory space (Pema Chodon, Passive Infrared (PIR) Sensor Based Security System, 2013).

13. This paper GSM Based Autonomous Street Illumination System for Efficient Power Management efficiently defines the control of street lightning system and thereby saving electricity which is a major concern worldwide. It also describes the use of wireless sensor networks using GSM for streetlight monitoring and control. This system provides a remote access for streetlight maintenance and control. It also discusses an intelligent system that takes automatic decisions for luminous control (ON/OFF/DIMMING) considering surrounding light intensity and time of the day both at the same moment. The system also senses various parameters like surrounding temperature, fog, carbon emissions, and noise intensities and suggests corrective measures. Power theft control is also integrated in the same system. The efficiency of the system is designed such that it can be readily installed in present on road conditions with extra cost of only a single controlling computer. The system is compatible to solar cell installation (Chaitanya Amin, 2013) .
14. The researcher designed a motion sensor for security light using PIR sensor. The main motive of this project is for designing a security system in those places where no person is allowed to enter. If any movement occurs in that particular place, then the bulb will glow up or they can use buzzer in place of bulb so that the buzzer will get on. Basically this project works with the PIR sensor. The main function of PIR sensor is here to detect the Human body movement, whenever there is any body movement the temperature of infrared will get vary and from that a signal is generated so as to bring into switching mode by using transistor to switch. For switching they used 555

timers to increase the time duration of glowing the bulb. When they got the signal the bulb has to be set ON to 2 or 3 seconds. The output signal of the IC 555 is to be given to ULN 2308 IC and that from ULN to relay so as to drive the signal (Santosh kr. Mallick1, 2017).

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microcontroller checks peak time and switch OFF the lights. When there is any vehicle passes on the road, it is detected by the PIR sensor. Whenever PIR sensor is detected it just indicates the microcontroller to switch on the street lights. Then lights are switched on for 2 to 3minutes and then automatically switched off. LCD is also used for displaying time. Time from RTC is read and displayed on the LCD. a sensor to help in the automatic switching, PIR sensors can be used for "automatic street lightening" whose operations are based on body or vehicle movement near the street light. The equipment was fabricated along with a switching circuit which activates and deactivates the system as well as a charge controller unit that prevents the battery from overcharging. The system was also built to conserve energy with the use of a LED lamp to replace other lamps such as the fluorescent lamp which might reduce the efficiency of the battery. The power consumption of LED is very less which helps to save electricity. In the solar panel DC supply necessary to charge the battery without the need for a conversion to an AC so there is no need of inverter. (Shruti lohiya, 2015)

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21. A research designed carried out on PIR sensor based security system in this design, a PIR based security system which saves the power consumption and the memory space

of the recording system has been proposed. Passive Infrared Radiation(PIR) sensor detects the change in infrared radiation of warm blooded moving object in its detection range. According to the change in infrared radiation, there will be a change in the voltages generated which was amplified and used to turn ON the webcam and lighting system through relay. Software was developed and installed in the computer to capture and record the video when the webcam gets turned ON. When an intruder comes in the detection range of the PIR sensor, it actuates the lighting system and the webcam. The software detects the webcam connection; it will start to record and save the video. Once the intruder moves out of detection range of the sensor, the webcam and light gets turn OFF. The software repeats the process. Thus the saves power consumption and the memory space of the recording system as the lamp and webcam will only get turned ON when PIR sensors detects an object. Consequently, the system starts recording only when the webcam is turned ON; hence saving memory space. (Pema Chodon, Passive Infrared (PIR) Sensor Based Security system, 2013)

22. This research main objective is to develop a motion sensor alarm based on a Passive Infra-Red (PIR). This project is aim to build a sensor system which is transmit and receive the signal. This project is about the motion detection using Infra-Red sensor in wirelessly. Besides that, it also acted as an auto power switching system. When the sensor is triggered, the signal will transmit wirelessly to take further action. For this project, we relate this sensor system with an auto power light switching system. Which mean when the sensor is triggered, light in a room will automatically switch ON. In order to transmit signal wirelessly, this project used radio frequency module to transmit the signal. For the controller circuit part, this project will use Programmable Interface Controller (PIC) to control the circuit, because it is cheaper and easier to program. The objective of this project is tending to switch ON the light automatically

and fan based on the temperature. Besides that, signal transmit wirelessly can avoid the circuit malfunction because of wire broken also in this work Current temperature will shows on a LCD display. (Ajay Kumar Tiwari, 2016)

23. In this project the author was able to design and construct a solar power based lightning system The design is such that the solar panel will be installed on the galvanized pole considering some specifications like angle of tilt and direction of sunlight. The 12V dc battery that will power the LED bulbs will be connected to the solar panel via the charge controller for charging purpose. The pole was constructed such that it will be able to hold the LED bulb or lamp. The solar tracker in the solar panel tracks the sunlight and the light detected is converted to electric power using the photovoltaic effect. The electric power is used to charge the battery and the charger controller embedded in the street light system is used to prevent the overcharging of the battery. The photocells detect if light is needed. Photocells are light sensitive sensors that respond to the amount of light detected. When the light is too low, such as at dusk or under heavy overcast skies, the sensor tells the switching circuit within the street light system to activate the flow of electricity and the electricity is sent through high-intensity discharge lamps. When the sensor detects too much light, the sensor will deactivate the street light e.g at dawn. (Oke A. O.*1, 2013)
24. The project is aimed at designing and construction of an automatic security light control system with open circuit detector the research project work involves the application of the light department resistor (LDR) technology to sense darkness and light and of course to automatically initiate the switching process of security lights in our homes and offices without human intervention. An open circuit detector which helps to alert occupants (by switching on an alarm and LED used as indicator)

whenever a security light / bulb is bad or removed, is incorporated into the design to ensure close monitoring of the security light even while asleep. (ADEIZA, 2008)

25. This research is a solar based inverter and charger This system is designed for outdoor application in un-electrified remote rural areas. This system is an ideal application for house or village street lighting. The system is provided with battery storage backup sufficient to operate the light for 7-8 hours daily. The project is about to develop and fabricate the circuit that can charge the lead acid battery during day time by using solar as the source. To control the circuit for charging, the researcher used the circuit charging that can implement the condition of the charging whether it's in charging condition of in float condition. The design consists of a PV array, a 12-volts lead acid battery, a control section that uses the PIC16F72 microcontroller. The control section obtains the information from the PV array through microcontroller's Analog and Digital (A/D) ports and hence to perform the pulse width modulation (PWM) to the converter through its D/A ports. Battery's state of charge is also controlled by the microcontroller to protect the battery from over charged. When charging condition, red LED will turn on until the battery reach the full charge state that is in floating condition and green LED will turn on. The PIC16F72 will determine whether it is daytime or night time by using sensing circuit. The light will automatically ON when the sensor circuit give the input to the PIC and PIC will give the output to the relay to switch on the light. When night change to the day, sensing circuit detect the ray from the sun, PIC will give the output to off the lamp and the charging circuit will continue charge the battery for the day. (P.H.Patil#, 2013)
26. This project helped in the design and implementation of smart LED lightning system using a self-adaptive weighted data fusion algorithm, the project work aims to develop a smart LED lighting system, which is remotely controlled by Android apps

via handheld devices, e.g., smartphones, tablets, and so forth. The status of energy use is reflected by readings displayed on a handheld device, and it is treated as a criterion in the lighting mode design of a system. A multimeter, a wireless light dimmer, an IR learning remote module, *etc.* are connected to a server by means of RS 232/485 and a human computer interface on a touch screen. The wireless data communication is designed to operate in compliance with the ZigBee standard, and signal processing on sensed data is made through a self-adaptive weighted data fusion algorithm. A low variation in data fusion together with a high stability is experimentally demonstrated in this work. The wireless light dimmer as well as the IR learning remote module can be instructed directly by command given on the human computer interface, and the reading on a multimeter can be displayed thereon via the server. This proposed smart LED lighting system can be remotely controlled and self-learning mode can be enabled by a single handheld device via WiFi transmission. (Lin, 2013)

27. In this project, a PIR based security system which saves the power consumption and the memory space of the recording system was designed. Passive Infrared Radiation (PIR) sensor detects the change in infrared radiation of warm blooded moving object in its detection range. According to the change in infrared radiation, there will be a change in the voltages generated which was amplified and used to turn ON the webcam and lighting system through relay. Software was developed and installed in the computer to capture and record the video when the webcam gets turned ON. When an intruder comes in the detection range of the PIR sensor, it actuates the lighting system and the webcam. The software detects the webcam connection; it will start to record and save the video. Once the intruder moves out of detection range of the sensor, the webcam and light gets turn OFF. The software repeats the process. Thus the saves power consumption and the memory space of the recording system as

the lamp and webcam will only get turned ON when PIR sensors detects an object. Consequently the system starts recording only when the webcam is turned ON;hence saving memory space (Pema Chodon, Passive Infrared (PIR) Sensor Based Security System, 2013).

28. This paper GSM Based Autonomous Street Illumination System for Efficient Power Management efficiently defines the control of street lightning system and thereby saving electricity which is a major concern worldwide. It also describes the use of wireless sensor networks using GSM for streetlight monitoring and control. This system provides a remote access for streetlight maintenance and control. It also discusses an intelligent system that takes automatic decisions for luminous control (ON/OFF/DIMMING) considering surrounding light intensity and time of the day both at the same moment. The system also senses various parameters like surrounding temperature, fog, carbon emissions, and noise intensities and suggests corrective measures. Power theft control is also integrated in the same system. The efficiency of the system is designed such that it can be readily installed in present on road conditions with extra cost of only a single controlling computer. The system is compatible to solar cell installation (Chaitanya Amin, 2013) .
29. The researcher designed a motion sensor for security light using PIR sensor. The main motive of this project is for designing a security system in those places where no person is allowed to enter. If any movement occurs in that particular place, then the bulb will glow up or they can use buzzer in place of bulb so that the buzzer will get on. Basically this project works with the PIR sensor. The main function of PIR sensor is here to detect the Human body movement, whenever there is any body movement the temperature of infrared will get vary and from that a signal is generated so as to bring into switching mode by using transistor to switch. For switching they used 555

timers to increase the time duration of glowing the bulb. When they got the signal the bulb has to be set ON to 2 or 3 seconds. The output signal of the IC 555 is to be given to ULN 2308 IC and that from ULN to relay so as to drive the signal (Santosh kr. Mallick1, 2017).

2.2 FUNDAMENTAL CONCEPTS

From the review of related literatures, it can be deduced that the design and construction of an automatic security lightning control system can be implemented and achieved using different methods, not only LDR can be used to sense darkness and light but PIR sensors can be used as motion detector to switch on the light when someone come close to the building and still achieve similar goals. When comparing and contrasting different author with the project been worked on their major aims are to design and construct an automatic security lightning control system but different methodology has been applied to getting the desired aim.

2.3 SENSORS

According to Wikipedia sensor is a device or subsystem whose purpose is to detect events or changes in its environment and sends the information to other electronics, frequently a component. Processing a sensor is always used with other electronics whether as simple as a light or as compound as a computer. A sensors sensitivity indicates how much the sensor's output changes when the input quantity being measured changes. Sensors are used in everyday objects such as touch-sensitive elevator buttons and lamps which dim or brighten by touching the base, besides innumerable applications of which most people are never aware. With advances into technology and easy to use microcontroller platforms, the uses of sensors have expanded beyond the traditional fields of temperature, moreover analogue sensor such as potentiometers and force sensing resistors are still widely used. Applications

include automatic control switch, robotics and many other aspects of our day to day life. Sensors are sophisticated devices that are frequently used to detect and respond to electrical or optical signals. A sensor converts the physical parameters (for e.g. temperature, blood pressure, humidity, speed, etc.) into a signal which can be measured electrically. (Shruti lohiya, 2015)

Figure 2.1 Various Kind of Sensor

2.3.1 LIGHT DEPENDENT RESISTOR SENSOR

Light dependent resistors also known as a photo resistor are light sensitive device used to indicate day or night time or to measure the light intensity. In the dark their resistant is very high, sometimes up to 1mega ohms but when the LDR sensor is exposed to light, the resistance drops dramatically even down to fewer ohms depending on the light intensity. Practically LDRs are the light dependent resistors available in the market which are used for practical implications in various electronic circuits. Practical LDRs are available in variety of sizes and package styles, the most popular size is having a face diameter of roughly 10mm.

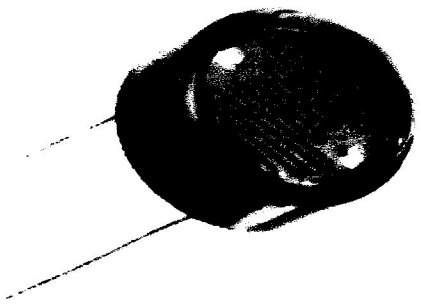


Figure 2.2: LDR

Features of LDR

1. High reliability
2. Light weight
3. Wide spectral response
4. Wide ambient temperature range

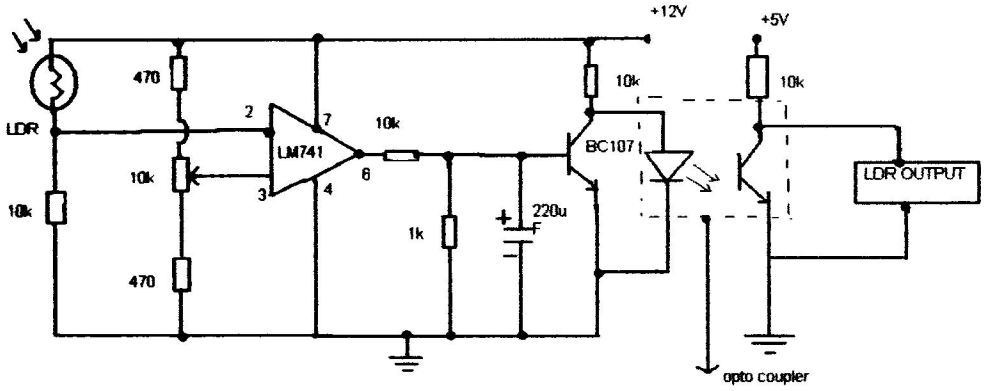


Figure 2.3: LDR Circuit diagram

2.3.2 PIR SENSORS

A PIR detector is a motion detector that senses the heat emitted by a living body. These are often fitted to security lights so that they will switch on automatically if approached. They are very effective in enhancing home security systems. The sensor is passive because, instead of emitting a beam of light or microwave energy that must be interrupted by a passing person in order to sense that person, the PIR is simply sensitive to the infrared energy emitted by every

living thing. When an intruder walks into the detector 's field of vision, the detector sees a sharp increase in infrared energy.

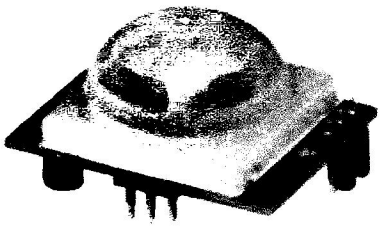


Figure 2.4: PIR Sensor

2.4 MICROCONTROLLER

Microcontrollers are very prominent in our modern society. They are found in automobiles, airplanes, toys, kitchen appliances, computers, TVs and VCDs, mobile phones space telescopes, and practically every electronic digital device that incorporate an independent functionality to its user. A microcontroller (sometimes called an MCU) is actually a computer on a chip (Julio, 2007). Essentially it is a control device and its design places emphasis on being self-sufficient and inexpensive. The typical microcontroller contains all the components and features necessary to perform its functions, such as a central processor, input/out-put facilities, timers, RAM memory for storing program data and executable code, and a clock or oscillator that provides a timing beat. In addition, some microcontrollers include a variety of additional modules and circuits. Some common ones are serial and parallel communications, analog-to-digital converters, real-time clocks, and flash memory.

2.4.1 THE ARDUINO UNO MICROCONTROLLER BOARD

The Arduino microcontroller is an easy to use yet powerful single board computer that has gained considerable publicity recently. The Arduino is open-source, which means hardware is reasonably priced and development software is free. Arduino is essentially a tiny computer that can connect to electrical circuits. The Arduino Uno is powered by an ATmega328P chip which can easily be programmed and reprogrammed through a computer, with the simplified C-programming language. The top row of the Arduino has 14 digital pins, labelled 0-13. These pins can act as either inputs or outputs, which can be connected to circuits to turn them on or off. It has an input for 5v Vcc (input voltage) and ground, another input and output labelled TX and Rx for data transmission and reception respectively (aduino.cc).

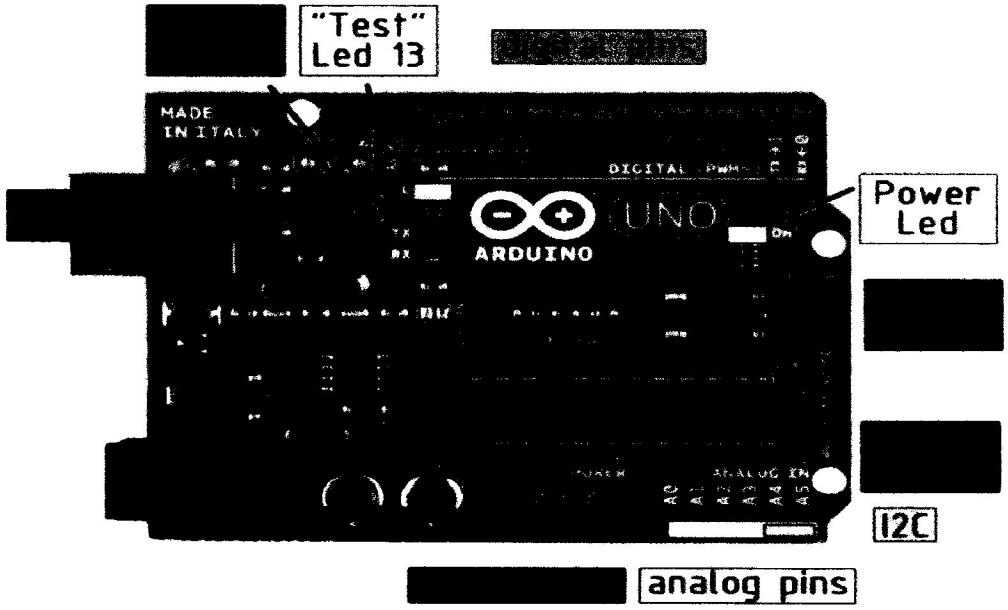


Figure 2.5 Arduino Uno Microcontroller Board

2.6 GSM MODEM TECHNOLOGY

GSM is a mobile communication modem; it stands for global system for mobile communication. The idea of GSM was developed at Bell laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular

technology used for transmitting mobile voices and data services operates at the 805MHz, 1800MHz and 1900Mhz frequency band. GSM system was developed as a digital system using time division multiple access technique for communicating purpose. A GSM digitizes and reduces the data, then sends it through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120Mbps of data rates. A GSM module is a device which can either be a mobile phone or a modem device which can be used to make a computer or other microprocessor communicates over a network. A GSM module requires a SIM card to be operated and operates over a network range subscribed by the network.

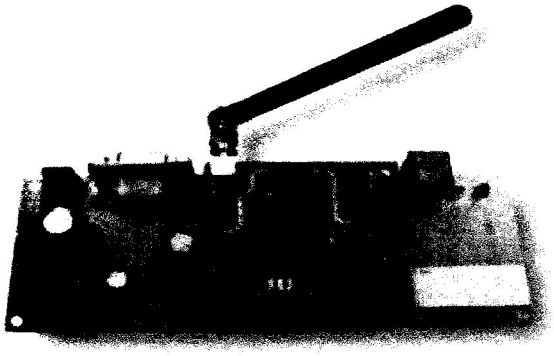


Figure 2.6 GSM Module

2.7 BUZZER

According Wikipedia a buzzer or a beeper is an audio signaling device which may be mechanical, electromechanical or piezoelectric. a buzzer is used as an alarm device, timers and confirmation of user input such as mouse click or keystroke.

Figure 2.7: Buzzer

2.6 SOLAR INVERTER

A solar inverter, or converter or PV inverter, converts the variable direct current output of a photovoltaic solar panel into a utility frequency alternating current that can be fed into a commercial electrical grid or used by a local, off-grid electrical network. It is a critical balance of system component in a photovoltaic system, allowing the use of ordinary AC-powered equipment. Solar power inverters have special functions adapted for use with photovoltaic arrays, including maximum power point tracking and anti-islanding protection.

Classification of solar inverters- They can be classified into three board types which are **stand-alone inverter, grid tie inverter, battery backup inverter.** But in this project the backup battery inverter will be used.

1. **Battery backup inverters**- are special inverters which are designed to draw energy from a battery, manage the battery charge via an onboard charger, and export excess energy to the utility grid. These inverters are capable of supplying AC energy to selected loads during a utility outage, and are required to have anti-islanding protection.

2.7 JUMPER WIRE

Jumper wire is an electrical wire or group of them in a cable with a connector or pin at each end, which is normally used to interconnect various sensors, microcontroller and components of a bread board or other test circuit without soldering.

Figure 2.8 Jumper wires

2.8 BATTERY

A Battery is an electric cell or a device that converts chemical energy into electricity. It consists of two or more cells connected in series or parallel, but the term is also used for single cells. All cells consist of a liquid, paste, or solid electrolyte and a positive electrode, and a negative electrode. The electrolyte is an ionic conductor; one of the electrodes will react, producing electrons, while the other will accept electrons. When the electrodes are connected to a device to be powered, called a load, an electrical current flows. In this project a battery is used to power the circuit and it is being charged by PHCN power supply but this project designed a solar inverter to serve as back up charge to the battery at the absence of NEPA light.

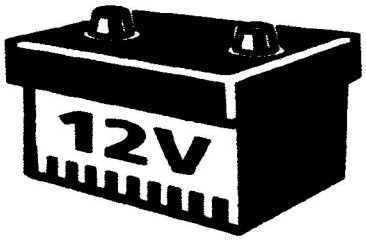


Figure 2.9: Battery

CHAPTER THREE

3.1 DESIGN METHODOLOGY

The hardware component of the project includes ATMEGA 328 microcontroller, light dependent resistor, PIR Sensor, GSM module, solar panel, buzzer and a battery. The construction techniques of this automatic security lighting control system involve the use of both passive components i.e. resistors, capacitors, and active components i.e. diode, transistors, integrated circuit. The automatic security lightning control system with the interconnection of components is designed in a way that when someone comes close to the building at day time it initiates the buzzer to give an alarm then sends an SMS alert to the house owner for notification and during the night period when the PIR sensor also senses someone close to the building it also initiates the buzzer to give an alarm then sends an SMS alert to the house owner and turns ON the security light should in case of theft or the person within the building tends to pose a security challenge the person can be seen. The project also adopts a remote control to help turn off the microcontroller during the day so as not to keep sending message often when the owner of the house comes in and out of the building within shorter period of time as security threats most times occurs at night. The system is designed in such a way that when there is PHCN light it charges the battery but in the absence of power supply the solar panel charges the battery as backup to power the project.

3.2 FUNDAMENTAL CIRCUIT DIAGRAM

1. The project involves the interconnections of components.

2. The LDR is a device that senses night and day time and it controls the security light because they are switched on depending on the intensity of the sun light on the LDR.

3. The PIR sensor senses heat emitted by a living body close to the building

3. The Microcontroller used is the Arduino Uno board which contains the ATMEGA328 Chip is primarily the one that controls the other components; it stores the code which describes the output of the LDR and PIR sensor behavior and serial data output for the GSM module.

4. The solar panel is connected in such a way that it charges the battery from sunlight when there is no PHCN light to charge it.

5. The SIM 800 GSM module is connected to the microcontroller reading or outputting the data contained and wirelessly transmitting the data via the GSM

6. The buzzer and security light is connected to the microcontroller to trigger an alarm and turn ON the bulb when necessary

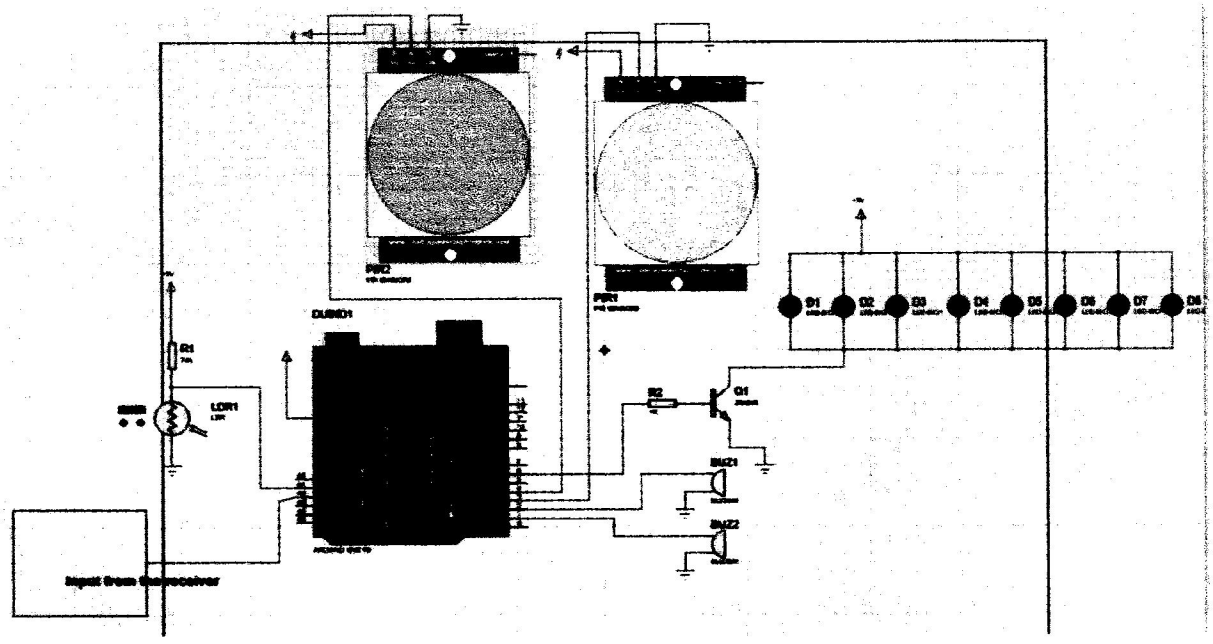


Figure 3.1 Circuit diagram of the design hardware

3.3 WORKING PRINCIPLE OF THE DESIGN OPERATION

This project is all about the design and construction of a solar powered automatic security lighting system and it is powered by a DC battery charged by either PHCN light or solar panel. The system consists of both the hardware which includes the GSM module, buzzer, solar panel, battery, microcontroller, PIR sensor, LDR sensor, a remote and the software which includes program code of the microcontroller which serves as a brain behind the whole design.

3.3.1 OPERATION OF THE PIR SENSOR

A few mechanisms have been used to focus the distant infrared energy onto the sensor surface. The window may have Fresnel lenses molded into it. Alternatively, sometimes PIR sensors are used with plastic segmented parabolic mirrors to focus the infrared energy; when mirrors are used, the plastic window cover has no Fresnel lenses molded into it. A filtering window (or lens) may be used to limit the wavelengths to 8-14 micrometers, which is most sensitive to human infrared radiation (9.4 micrometers being the strongest). The PIR device can be thought of as a kind of infrared _camera ', which remembers the amount of infrared energy focused on its surface. Once power is applied to the PIR the electronics in the PIR shortly settle into a quiescent state and energize a small relay. This relay controls a set of electrical contacts, which are usually connected to the detection input of an alarm control panel. If the amount of infrared energy focused on the sensor changes within a configured time period, the device will switch the state of the alarm output relay. The alarm output relay is typically a normally closed relay also known as form B. A person entering the monitored area is detected when the infrared energy emitted from the intruder's body is focused by a Fresnel lens or a mirror segment and overlaps section on the chip, which had previously been looking at some much cooler part of the protected area. That portion of the chip is now much warmer than when the intruder was not there.

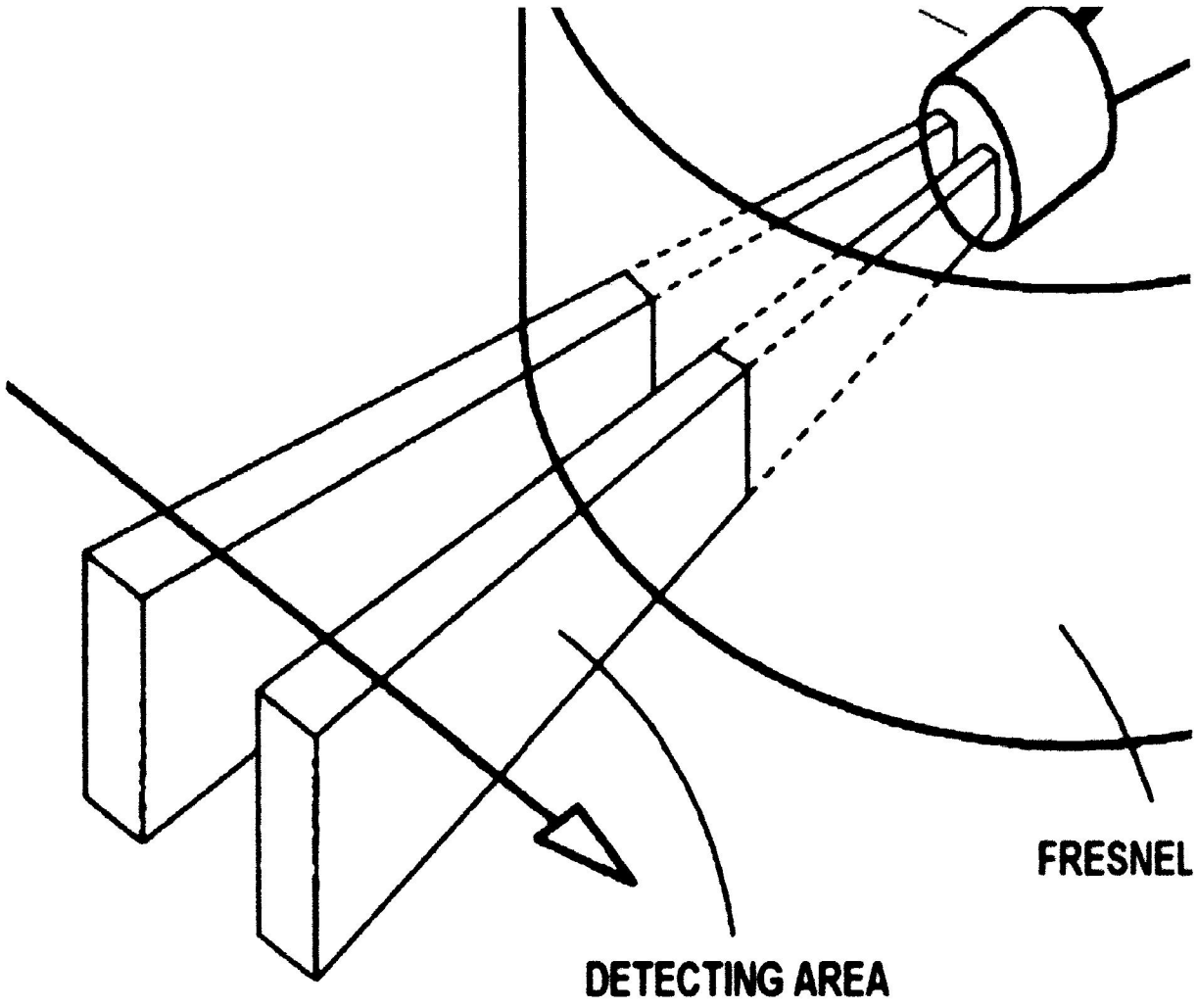


Figure 3.2: Operation of PIR Sensor

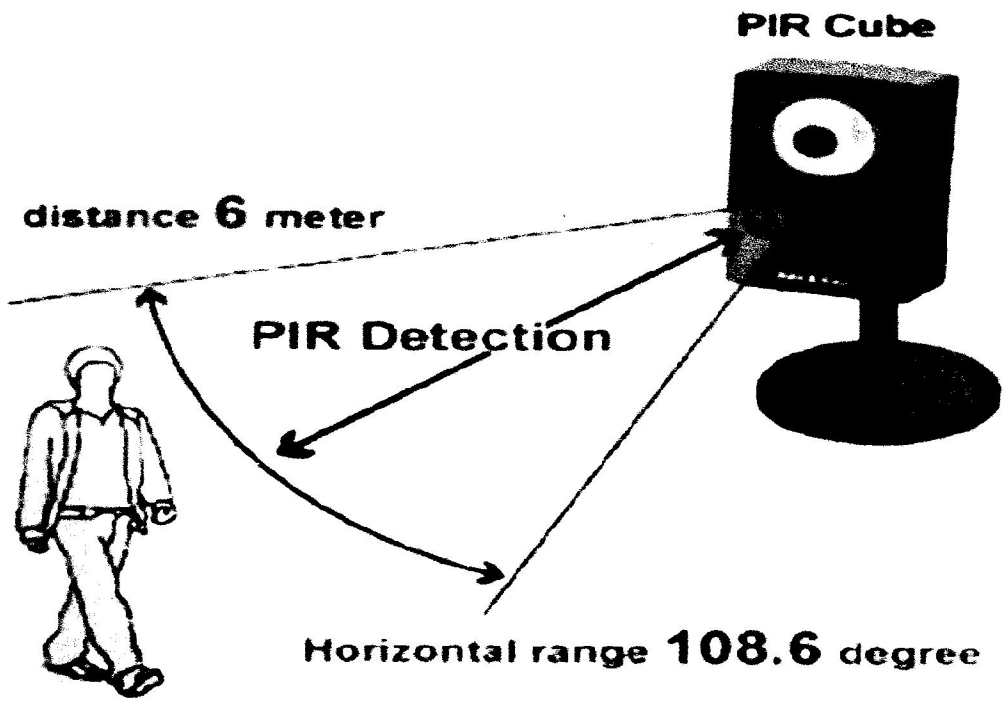


Figure 3.3: Showing PIR detection

3.4 DESIGN CALCULATIONS

The value of current flowing through the circuit when the light dependent resistor is prevented from illumination (when in darkness) could be calculated as follows: From ohm's law, which states that, "the amount of current passing/flowing through a conducting material at constant temperature is directly proportional to the potential difference across it.

V = IR Where I = V/R, I = current, V = voltage, R Resistance. Remember that, R_1 and R_3 are parallel to each other. For the value of resistance passing across R_1 and R_3, since they are in parallel,

$$1/R_T = I/R_1 + I/R_2$$

$$\frac{1}{R_T} = \frac{R_{13} + R_1}{R_1 R_3}$$

$$\therefore \text{RT} = \frac{R_1 R_3}{R_3 + R_1}$$

The value of R1 used in the design and construction is 22kΩ = and R_3 = 15kΩ

To find R_T using R_1R_3/R_3+R_1

$R_T = (22 \times 10^3) \times 15$

$(22 \times 10^3) + 15 \times 10^3$

$R = 330 \times 10^6 = 8918.95\Omega = 8.9 \times 10^2$

Value of supply voltage to the system = 1 2v: current passing through the resistors is:

From I = V/R = 12v/8.9kΩ = 1.3 x 10_3A

The voltage at the junction $R_1$and R_2 is: -

From V = IR, where I = 1.3 x 10^{-3}A, R = 8.9kΩ

V = 1.3 x 10^3 x 8.9kΩ, V = 11.57. The voltage at the junction of R_1 and R_2 should not be less than 3v and not more than 30v.

3.4.1 OVERALL SELECTION OF MATERIALS

The PIR sensors, LDR and microcontroller used are low power type requiring between 3.3V and 5V. below is an overall selection of the components

1. Battery ➔ 12V

2. Microcontroller ➔5-12 v

3. PIR Sensor = 5v

4. LDR =5v

5. Capacitor ➔ 1000μf

5. Resistors = 2.2k, 1k, 3.3k

3.5 SOLDERING AND INSTALLATION TECHNIQUES

When soldering, the use of the correct tool, materials and techniques is essential and care must be taken to avoid risk of burns, fire, electrical shock and to avoid damage to the components. During the soldering on the Vero board, it was ensured that the surfaces to be soldered are clean, bright and free from grease. Some were tinned where necessary. To avoid damaging the components, the joints were made rapidly. Heat shunt was used to avoid over heating the component. The work was arranged so that the joint is easily accessible with no risk of burning adjacent components. It was ensured that the soldering iron is at the correct temperature. Soldering irons take 2 to 1 0 minutes to heat up fully depending on the size. The solder melted to a shiny surface, the flux did not char, but gave off a little white smoke.

The fiat of the bit (of the iron) was used to press the solder on to the joint. As the solder melts, more solder was fed in until the joint was completely covered. The soldering iron was removed as soon as the joint was made care was taken not to move the components until the solder solidified. A good joint has a very low electrical resistance. A bad joint may initially have a low resistance but this may not be maintained. This automatic security lighting control system has to be powered with a small voltage of 12volts from PHCN power supply. The light dependent resistor (LDR) should be water tight and placed in the direction of light illumination

3.6 MATERIALS USED

1. Light dependent resistor LDR
2. PIR sensor

3. Remote
4. Battery
5. Microcontroller
6. Buzzer
7. Transistor
8. Resistors
9. Capacitor
10. Switch

3.7 BLOCK DIAGRAM

The block diagram of the design consists of some major components used in making the circuit working.

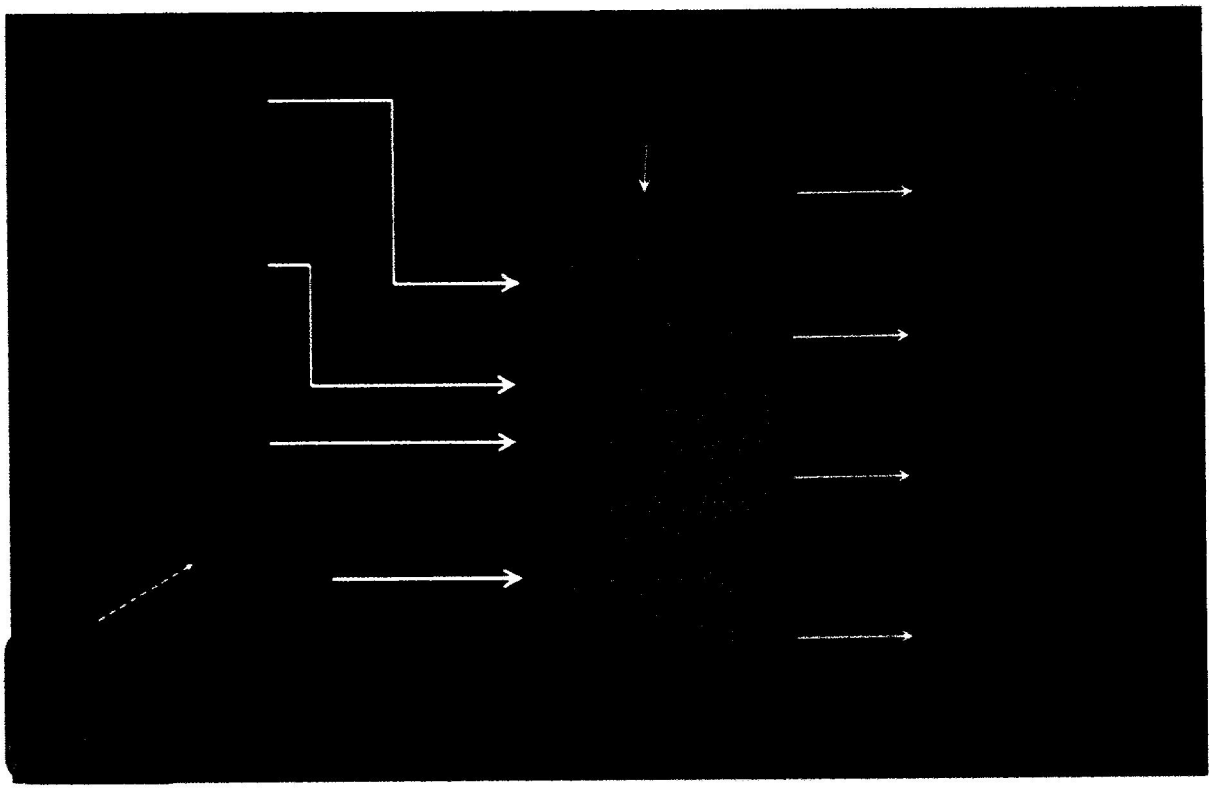


Figure 3.2: Block diagram

CHAPTER FOUR

CONSTRUCTION AND TESTING

4.1 CONSTRUCTION

First step when constructing an electronic circuit is circuit design, after then follow the steps below

1. Simulation of the circuit which required picking and dropping of components, then interconnected as shown in the figure below. Afterwards, the design code was uploaded, and the design runs. Below is the detailed Proteus design.

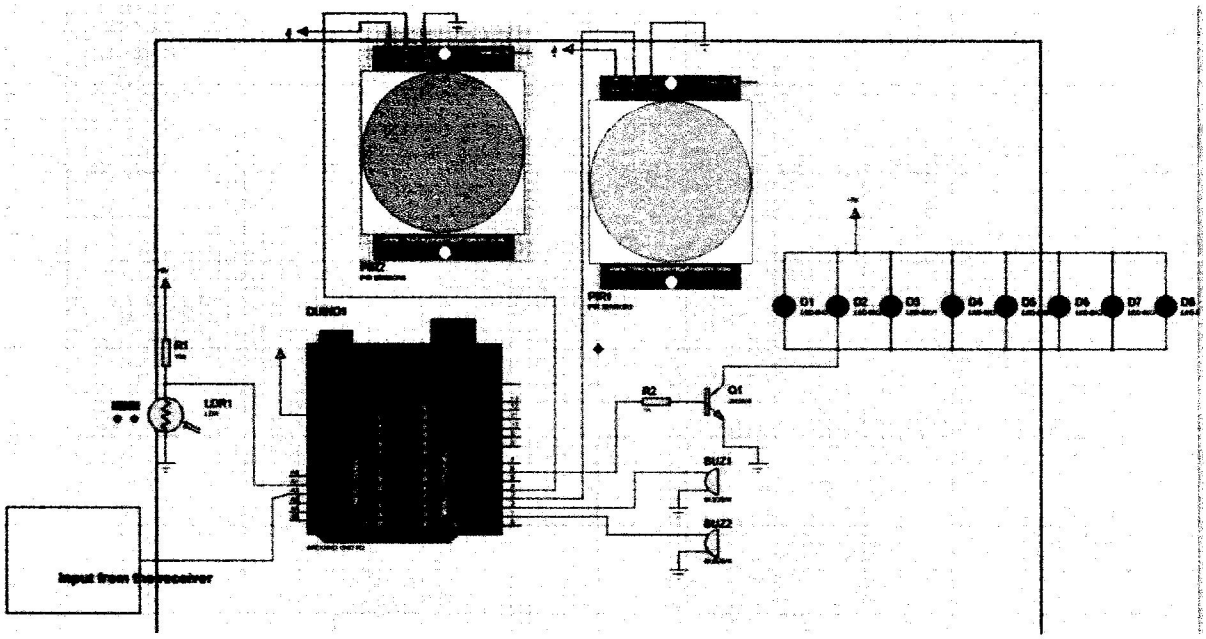


Figure 4.1: Simulation of the Circuit

2. Assemble all the components on the Vero board based on circuit diagram. TX and RX pins of the GSM module to the appropriate pins and insert a valid SIM in the GSM modem.

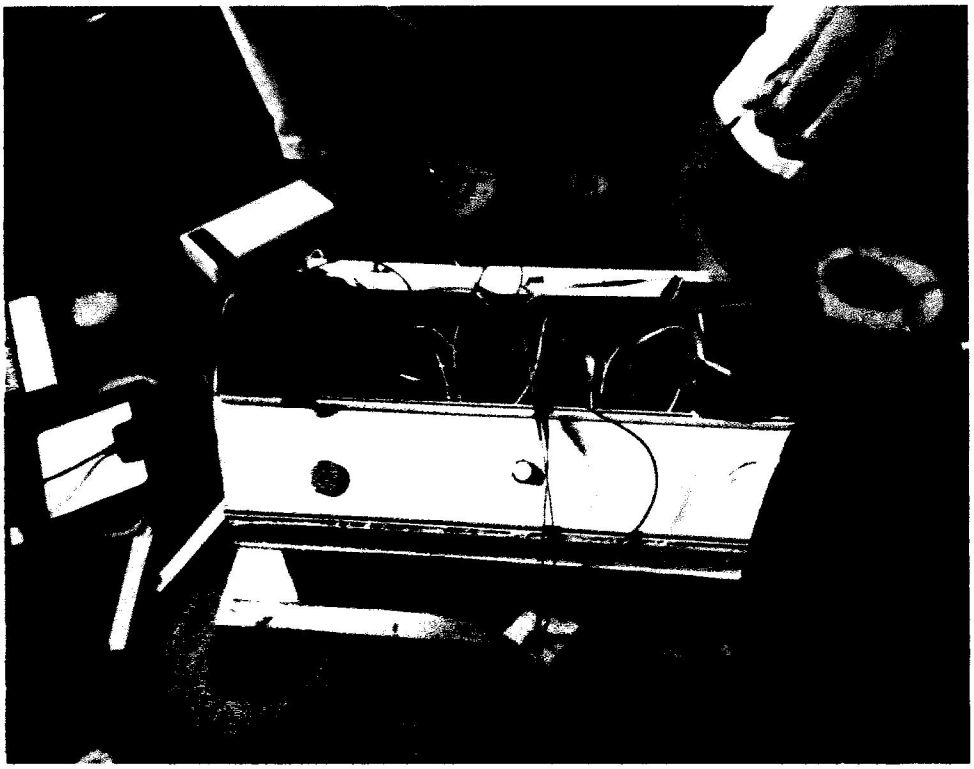


Figure 4.2 Interconnection of components

3. Connect the GSM module according to circuit diagram, it serially communicates with the microcontroller through the transmitter and receiver pinon the terminal of the Arduino board.

4. Implementation and testing of the project which was done in the Lab

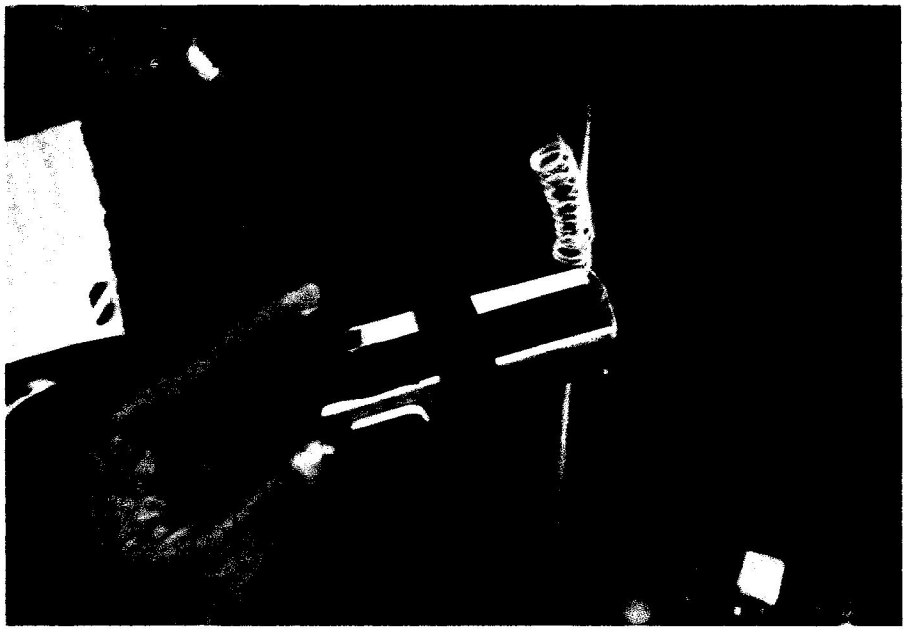


Figure 4.3: Project testing

5. Casing of the project. The circuit was enclosed in plastic casing of about 15cm x 15cm in dimension the location of the LDR is important, since it is undesirable to have the circuit revert to its original state when the cell is illuminated by the light from the bulb.

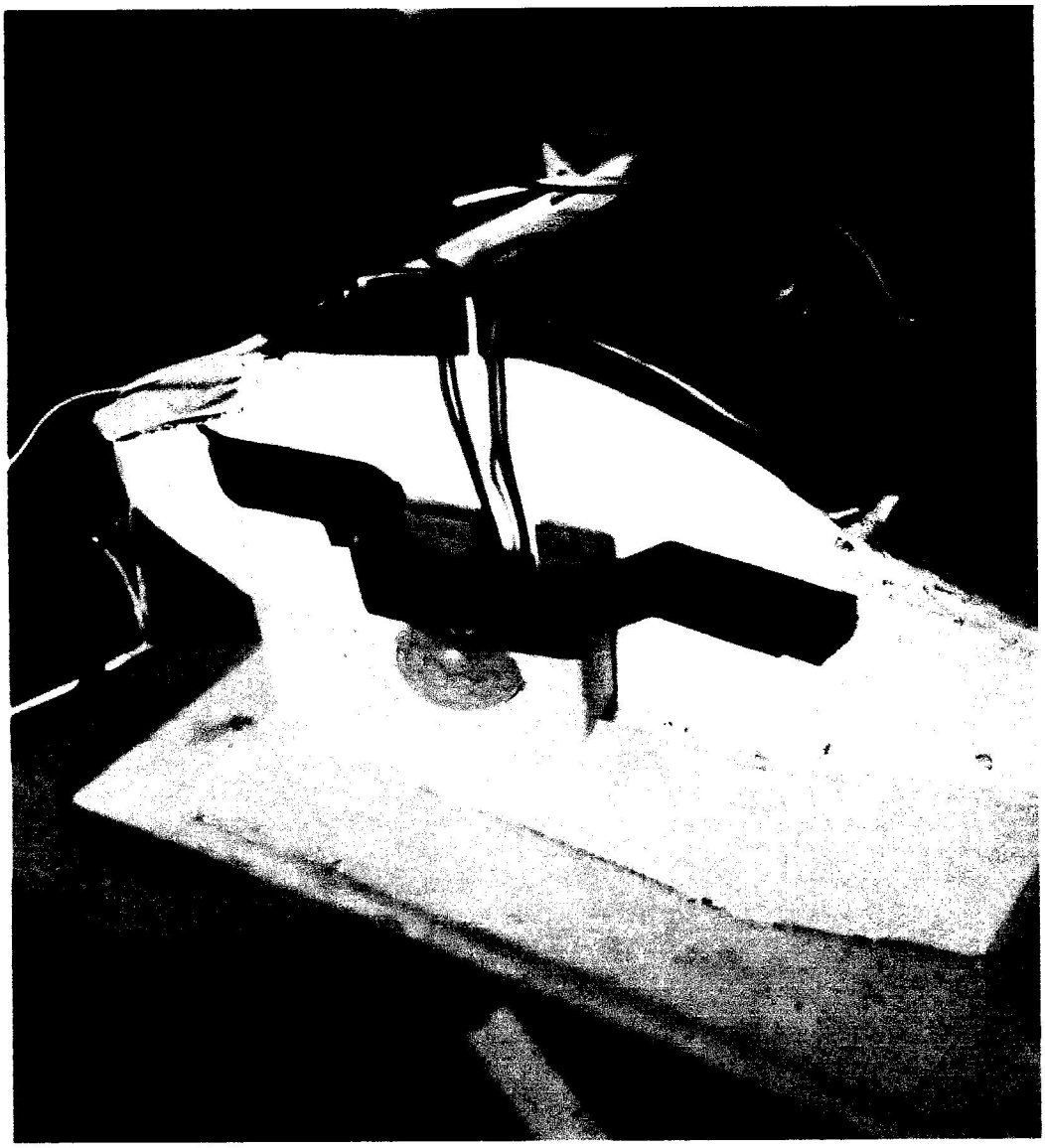


Figure 4.4 Casing of the project

4.2 DISCUSSION AND RESULT

The system is powered by a backup battery of 5V and the circuit uses light dependent resistor (LDR) as a sensor which is connected to switch S_1 via R_1 and R_2 connected in parallel. This switch S_1 is mounted outside just to make or break contact when shadow falls

on the light dependent resistor by switching ON the light and going out immediately the light dependent resistor is exposed to day light, hence it switches OFF the light. Therefore, the voltage measured at the junction of R_1 and R_2 is not less than 3v and not more than 30v. The resistance of light dependent resistor used in the circuit is based on the fact that when light falls on it, its resistance is extremely low but when it is prevented from illumination or shadow falls on it, its resistance increases to infinity.

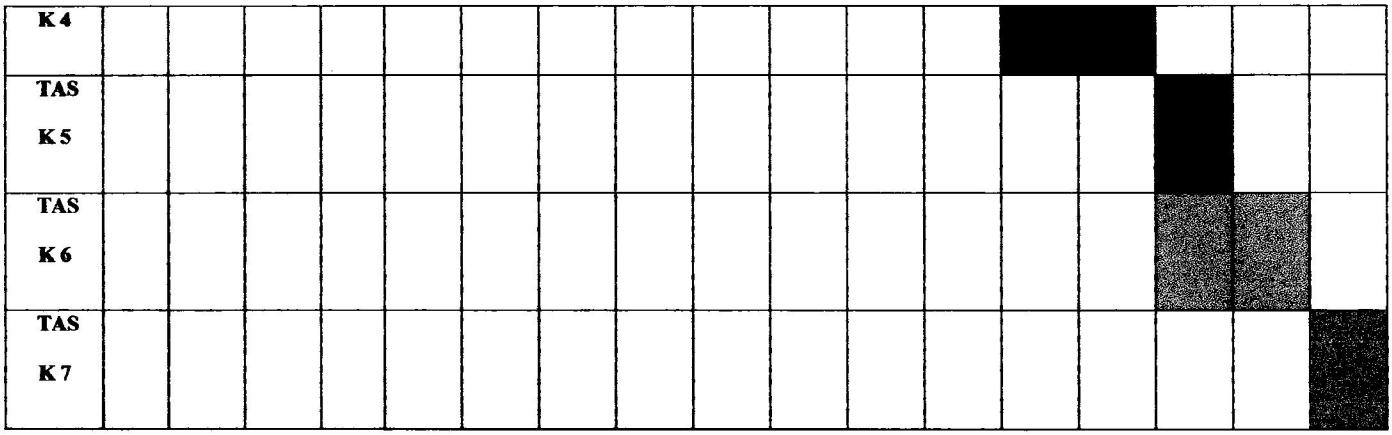
4.3 PROJECT MANAGEMENT

The project was not achieved in a day, it had various tasks that were carried from commencement to completion. A Gantt chart was developed to keep track of project progress. Project tasks were listed against their estimated start and completion times to accurately complete the project within the estimated time. However, there were delays in the implementation of the project due to the fact that the required GSM module was not readily available in the local market and had to be imported which took a long time almost a month. The Gantt chart used was as below:

4.4 GANTT CHART

Table 4.1: Gantt chart illustrating project activities and duration.

		WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8	WK 9	WK 10	WK 11	WK 12	WK 13	WK 14	WK 15	WK 16	WK 17
TASK 1																	
TASK 2																	
TASK 3																	
TASK																	



Task 1- Project research work

Task 2- Design of project circuit prototype

Task 3- source code development

Task 4- purchase of components and tools needed for the project

Task 5- construction of circuit on a bread board

Task 6- permanent soldering on a Vero board

Task 7- project packaging and performance review

4.5 SYSTEM FLOW CHAT

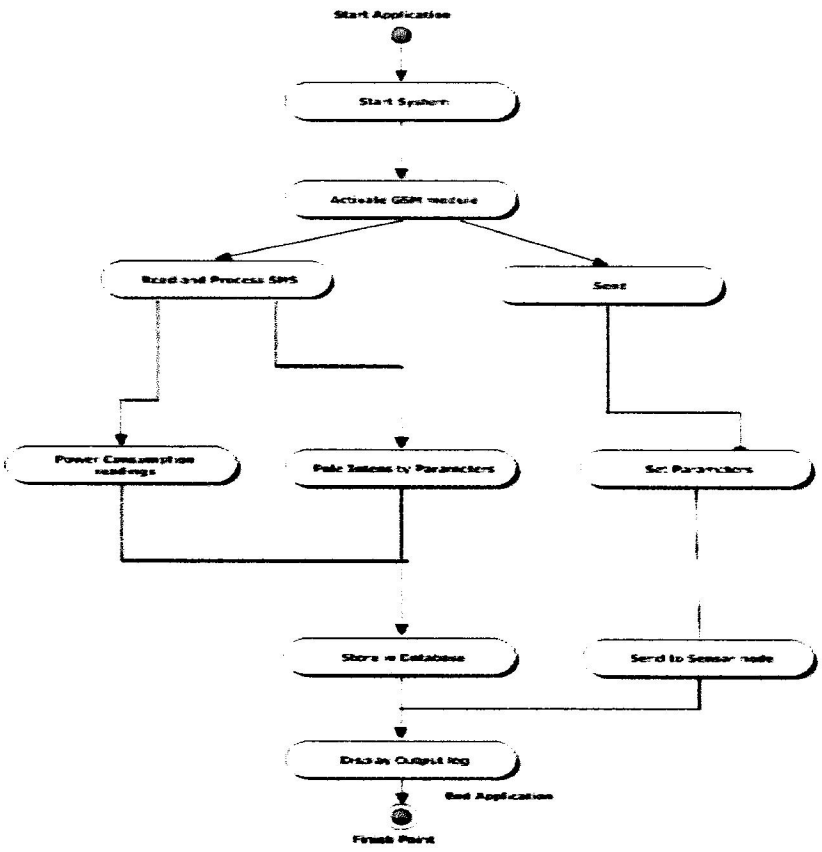


Figure 4.5 System flow chat

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

The solar powered automatic security lighting control system using a GSM module was designed and found working. The circuit is a very simple circuit, requires very little current to operate (mA), reliable, cheap, affordable, portable and serves security purposes. It can be used at homes, car parking light, automatic outdoor lighting control, automatic curtain operator and burglary sensor. The major aim and objectives of this project was fully achieved, in this project work we have studied and implemented a complete working model using Arduino microcontroller. The programming and interfering of the microcontroller has been mastered during the implementation.

5.2 LIMITATIONS

Upon the completion of this project I realized some limitations which are discussed below

1. Due to the effect of poor GSM Network coverage, the design of GSM module becomes an issue because this can lead to delay of the expected SMS when someone comes close to the building.
2. Every occurrence of SMS alert and buzzer alarm could course disturbance to the inhabitants of the house should in case the children have to move close to the PIR sensor often.

5.3 FUTURE WORK

After having implemented this Intelligent System, what remains is the scope for improvements

1. Fingerprint senor instead of PIR sensor can be used, so that only authorized personals will be able to access the main building

2. Other sensors can also be implemented in the same model. For example, wind speed sensor or seismometer can be implemented so that warning during a calamity can be sounded.

3. A web cam should be added so as to recognize any one that comes close to the building in case of robbery.

5.4 RECOMMENDATIONS

This electronic device is recommended to be used at homes and offices in the preventive and collective measures against intrusions or other criminal activity on a physical piece of property. The solar powered, PIR and GSM module-based security system is recommended for residential properties for efficiency and effectiveness of home surveillance. Some shortcomings of the system, however, are related to the sensitivity of the PIR sensors. More work is required in the determination of the right materials for use in the manufacture PIR sensors to increase its ability to detect any kind of human movement across or along its path.

Most surveillance systems require the use of power for its operations. Further studies should be carried out on the potential use of PIR-based home surveillance system in remote areas with no access to any source of power. For example, this research has been able to conduct the use of solar powered PIR based security systems.

Jeonghwan Hwang, C. s. (2010). agricultural environment monitoring server system using wireless sensor networks. *IEE*, 200.

Joseph, A. (2016). *design and construction of wireless environmental monitoring system for agricultural process.* akure: unpublished yet.

Kaewmard, N. (2014). sensor data collection and irrigation on vegetable crop using smart phone and wireless networks for smart farm. *IEE*, 653.

Lin, W.-T. S.-S. (2013). Design and Implementation of a Smart LED Lighting System Using a Self Adaptive Weighted Data Fusion Algorithm. *open access article*, 16915.

M. Shariz Ansari1, T. S. (2015). GSM Based Street Light Automation. *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering*, 4415.

Monnit. (2013). *Temperature, humidity and light monitoring for agriculture.* Matt moulton: www.monnit.com.

Nashwa El-Bendary, M. M. (2013). Smart Environmental monitoring using wireless sensor. In M. M. Nashwa El-Bendary, *Smart Environmental monitoring using wireless sensor* (pp. 741-743).

Oke A. O.*1, A. A. (2013). Design and Construction of Solar Power-Based Lighting System. *INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY*, 2280-2290.

Oke, Awokola, & Amusan. (2017). Development of a GSM-Based Environmental Monitoring System. *International Journal of Research Studies in Computer Science and Engineering (IJRSCSE)*, 13.

P.H.Patil#, P. U. (2013). Solar Based Inverter and Charger. *International Journal of Scientific & Engineering Research,*, 79-80.

Pema Chodon, D. M. (2013). Passive Infrared (PIR) Sensor Based Security system. *International Journal of Electrical, Electronics and Computer Systems.*

Pema Chodon, D. M. (2013). Passive Infrared (PIR) Sensor Based Security System. *International Journal of Electrical, Electronics and Computer Systems.*, 1.

Perlin. (1999). *From space to earth : the story of solar electricity, a.* USA: Aatec publisher.

prof Chavan C. H, M. K. (2014). Wireless monitoring of soil moisture, temperature and humidity using zigbee in agriculture. *international journal of engineering trands and technology*, 493.

Prof. S.A.Chavan, O. N. (2013). GSM Based Smart Street Light Monitoring and Control System. *International Journal on Computer Science and Engineering*, 187.

Pujar, R. (2015). Difference between sim 800 and sim 900 GSM module. In R. Pujar, *Difference between sim 800 and sim 900 GSM module.*

Purnima, R. S. (2012). Design of remote monitoring and control system with automatic irrigation system using GSM-Bluetooth. *international journal of computer applications*, 12.

Santosh kr. Mallick1, A. k. (2017). MOTION SENSOR FOR SECURITY LIGHT USING PIR SENSOR. *IJMTER*, 143.

Shruti lohiya, V. l. (2015). Electronic Street Light Using Solar Power and Led. *Journal of Management Engineering and Information Technology (JMEIT)*, 13-15.

Sneha Mahalingayya, N. (2016). In combination of WSN and GSM for long Distance sensor monitoring and parameter control. *International journal on recent and innovation trends in computing and communications*, 236-238.

technologies, m. (2015, january 5). *sms based weather report information system.* Retrieved from www.projectsof8051.com: http://www.projectof8051.com/sms-based-weather-report-information-system/

APPENDIX I

COST EVALUATION OF THE WHOLE PROJECT

S/N	COMPONENT /ITEM	QUANTITY	AMOUNT	TOTAL AMOUNT
1	12V Battery	1	5000	5000
2	LDR	1	2000	2000
3	Solar Panel	1	5000	5000
4	SIM-800 GSM Module	1	5000	5000
5	PIR Sensor	2	2000	4000
6	Microcontroller	1	3500	3500
7	Vero Board	1	100	100
8	Casing	1	12000	12000
9	Connecting Wire(set)	1	500	500
10	Buzzer	2	100	200
11	Resistor	4	50	200
12	Capacitor	2	100	200
13	Diode	1	100	100
14	Transistor	2	100	200
15	RF Transmitter/receiver	1	1000	1000
	Grand Total			39000

APPENDIX II

PROGRAM CODE

```
#include <TimerOne.h>
        #include <Sim800L.h>
        #include <SoftwareSerial.h>

        #define RX  10
        #define TX  11
        Sim800L phone(RX, TX, 7);
        char* text;
        char* number;
        bool check;


        int pir1 = 3, pir2 = 4;
        int buz1 = 8, buz2 = 9;
        int securityLights = 12, securityEnableLED = 13;
        int ldr = A1;
        int remoteCtrl = 2;
        volatile byte securityState = LOW, ldrCheck = HIGH;
        volatile int countSeconds = 20, value = 0;
        bool timerSet = false;

        void setup() {
         //////////////////////////
         pinMode(pir1, OUTPUT);
         pinMode(pir2, OUTPUT);
         pinMode(buz1, OUTPUT);
         pinMode(buz2, OUTPUT);  pinMode(securityLights, OUTPUT);
         pinMode(securityEnableLED, OUTPUT);
         ////////////////////////////////////////////////////////////////
```

```
attachInterrupt(digitalPinToInterrupt(remoteCtrl), securityCtrl, RISING);

 //all outputs should be initially turned off
 digitalWrite(buz1, LOW);
 digitalWrite(buz2, LOW);
 digitalWrite(securityLights, LOW);
 digitalWrite(securityEnableLED, securityState);

 // setting up the phone module 4 action
 phone.begin(4800);
 text = "Warning: Security Alert!!!"; //text for the message.
 number = "+2348167626525"; //change to a valid
number.+2349070725380

}

void loop() {

 check4Night(); //automatically turn on in the Night until use use the remote
to turn it off

 switch (securityState) {
  case LOW:
   digitalWrite(buz1, LOW);
   digitalWrite(buz2, LOW);
   digitalWrite(securityLights, LOW);
   break;

  case HIGH:
   ////////////////////////////////////////////////
   pinMode(pir1, INPUT);
   pinMode(pir2, INPUT);
   if ( (digitalRead(pir1) == HIGH) || (digitalRead(pir2) == HIGH) ) {
```

```
      delayMicroseconds(1);
      check = phone.sendSms(number, text);
      while (check == true) {
       check = phone.sendSms(number, text);
      }

      digitalWrite(buz1, HIGH);
      digitalWrite(buz2, HIGH);
      if (digitalRead(ldr) == HIGH)
       digitalWrite(securityLights, HIGH);
      else
       digitalWrite(securityLights, LOW);
      while ( (digitalRead(pir1) == HIGH) || (digitalRead(pir2) == HIGH) );
//note that this works well for the pir in repetitive mode
      digitalWrite(buz1, LOW);
      digitalWrite(buz2, LOW);
      digitalWrite(securityLights, LOW);
      pinMode(pir1, OUTPUT);
      // pinMode(pir2, OUTPUT);

     }
     else {
      digitalWrite(buz1, LOW);
      digitalWrite(buz2, LOW);
      digitalWrite(securityLights, LOW);
     }
     break;
  }

}

void securityCtrl() {
 if ( digitalRead(ldr) == LOW ) {
```

```
    securityState = !securityState;
    digitalWrite(securityEnableLED, securityState);
    ldrCheck = HIGH;
    pinMode(pir1, OUTPUT);
    pinMode(pir2, OUTPUT);
   }
   else {
    securityState = !securityState;
    digitalWrite(securityEnableLED, securityState);
    ldrCheck = LOW;
    Timer1.detachInterrupt();
    Timer1.initialize(0);
    timerSet = false;
    pinMode(pir1, OUTPUT);
    pinMode(pir2, OUTPUT);
   }
}


void check4Night() {
 if ( (digitalRead(ldr) == HIGH) && (ldrCheck == HIGH) ) {
   securityState = HIGH;
   digitalWrite(securityEnableLED, securityState);
 }
 else if ( (digitalRead(ldr) == HIGH) && (ldrCheck == LOW) ) {
   securityState = securityState;
   digitalWrite(securityEnableLED, securityState);
   ////////////////////////////////////////////////////
   if (timerSet == false) {
    Timer1.initialize(1000000); // 1 seconds
    Timer1.attachInterrupt(backupOn);
    timerSet = true;
   }
```

```
  }
  else if ( digitalRead(ldr) == LOW ) {
    ldrCheck = HIGH;
  }
}

void backupOn() {
  if (value >= countSeconds) {
    Timer1.detachInterrupt();
    Timer1.initialize(0);
    ldrCheck = HIGH;
    timerSet = false;
    value = 0;
  }
  else {
    value = value + 1;
  }
}
```