AUTO LIGHT AND WATER SAVING SYSTEM BY USING MICROCONTROLLER

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DAFFODIL INTERNATIONAL UNIVERSITY

Letter of Transmittal

Date: 27/11/2018

To

Dr.Md. Rezwanul Ahsan

Assistance professor

Department of Electrical & Electronic Engineering

Daffodil International University

Subject: Submission of Project Report.

Dear Sir,

We are pleased to submit the project report on **"Auto Light And Water Saving System By Using Microcontroller"**. It was a great pleasure to work on such an important topic. This project has been done as per instruction of your supervision and according to the requirements of the Daffodil International University (DIU).

We are expect that the project will be accepted by the concerned authority. We will remain happy to further explanation that you may feel necessary in this regard.

Thank You

Sincerely yours,

Suvo Kumar Das

ID#151-33-2312

Md. Shaminur Rahman

ID#151-33-2467

DECLARATION

We do hereby solemnly declare that, the work presented here in this project report has been carried out by us and has not been previously submitted to any University/ /College/ Organization for award of any degree. We hereby ensure that the works that has been presented here does not breach any existing copyright.

We further undertake to indemnify the university against any loss or damage arising from breach of the foregoing obligation.

Signature of Supervisor

RAhsan 26/12/18

Dr. Rezwanul Ahsan
Assistant Professor
Department of EEE

Signature of candidates

26.12.18

Suvo Kumar Das

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26/12/18

Md. Shaminur Rahman

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DAFFODIL INTERNATIONAL UNIVERSITY

CERTIFICATE

This is to certify that the project report on **"Auto Light And Water Saving System By Using Microcontroller"** is the bona-fide record of project work done by Suvo Kumar Das (ID#151-33-2312) and Md. Shaminur Rahman (ID#151-33-2467) for partial fulfillment of the requirement for the award of the degree of Bachelor of Science in Electrical and Electronic Engineering from Daffodil International University.

This report has been carried out under my guidance and is a record of bona-fide work carried out successfully.

I wish them every success in the future.

Supervisor

RAhsan 26/12/18

Dr.Md. Rezwanul Ahsan

Assistance professor

Department of Electrical & Electronic Engineering (EEE)

Daffodil International University (DIU)

Dhaka, Bangladesh

ACKNOWLEDGEMENT

First of all We are grateful to almighty Allah for giving us such an opportunity to bring this report into light successfully.

This project is accomplished under the supervision of Dr.Md. Rezwanul Ahsan, Assistance professor, Department of Electrical and Electronic Engineering, Daffodil International University. It is a great pleasure to acknowledge our profound gratitude and respect to our supervisor for this consistent guidance, encouragement, helpful suggestions, constructive criticism and endless patience throughout the progress of this work. The successful completion of this project would not have been possible without his persistent motivation and continuous guidance.

We are also grateful to honorable Vice Chancellor Professor Dr. Yousuf Mahbubul Islam, Pro-Vice Chancellor Professor M. Shahjahan Mina and Prof. Dr. Md. Shahid Ullah, Head of the department of EEE and all respected teachers of the Electrical and Electronic Engineering department for their co-operation and significant help for completing the project work successfully. We are grateful to our family members and other well wishers for their support and encouragement during the preparation of our report and throughout our life.

Thank you all

Suvo Kumar Das

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EXECUTIVE SUMMARY

We are now living the 21st century .Now a days we are mostly dependent on technology. We cannot think ourselves without technology for a single moment. Now computer technology have developed enormously. Now most of technology is basically dependent on the computer technology. We are now using technology to make ourselves automated. People are now using automated technology of their day to day life. Microcontroller based automatic system are getting more popular. Various sensors are being used with the microcontroller. Our study is basically a small attempt to promote a simple home automation. We used PIR Infrared Motion Sensor, IR sensor, Temperature sensor. We have built a prototype for our project including two room, one water basin, and a fire alarm in the home .For two room we used two PIR sensor which basically perform automatic switching of light. PIR sensor used the movement of any object. Then the IR sensor basically controlling the motor. IR sensor detects the object by using the infrared ray. Finally temperature sensor works to detect the high temperature and then fire alarm get started.

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CHAPTER 1

INTRODUCTION

1.1 Background

In the present world microcontroller and sensor based automation are getting more popular. People are thinking about their comfort. There are various kind of sensors which is basically run by the microcontroller. Microcontroller is a small processor. Accordingly mostly home automation sensors and microcontroller has been using for a long time.

A microcontroller is a digital device that can be programmed to make decisions and alter outputs based on its inputs. It is traditionally a digital system but is often interfaced to the analog world. These microcontrollers use a program that executes in a loop to complete a task. Our dishwasher and washing machine along with our remote control and our cell phone are all controlled by a microcontroller. It can be thought of as a mini computer all on a chip. Home automation gives us access to control devices in our home from a mobile device anywhere in the world. The term may be used for isolated programmable devices, like thermostats and sprinkler systems, but home automation more accurately describes homes in which nearly everything — lights, appliances, electrical outlets, heating and cooling systems — are hooked up to a remotely controllable network. From a home security perspective, this also includes your alarm system, and all of the doors, windows, locks, smoke detectors, surveillance cameras and any other sensors that are linked to it.

Our study is basically autoing light and water saving and security alarm system when temperature will increase. People are sometimes needed more comfort and need more technology to get it. Auto light on off system is very effective for any home automation. But using motion sensor named PIR is very effective and also quite interesting sensor than any other sensor. Another sensor is called IR sensor which perform saving the water. Sometimes when we use basin we are not aware about the water falling after our work done. If we use automatic water saving system by using IR sensor (Infrared ray sensor). It helps to save water.

When any object detects by the sensor then the motor will automatically on. When hands out from its way then the motor automatically off. This operation basically saves the water. Sometimes home affected by fire from kitchen or electrical short circuit. To

minimize the problem temperature detectors sensor can be very effective. When temperature exceeds a minimum level temperature sensor detects the temperature and gives a signal to the fire warning alarm. Having set that all of the sensor are only for human comfort.

1.2 Objectives

- This project's aim is auto basin and light control system.
- To know about the microcontroller how it performs.
- To know about sensors like PIR sensor, IR sensor and temperature sensor.
- To make the prototype of our projects by using all of these sensors.
- To save water and also to make the home under light automated system.

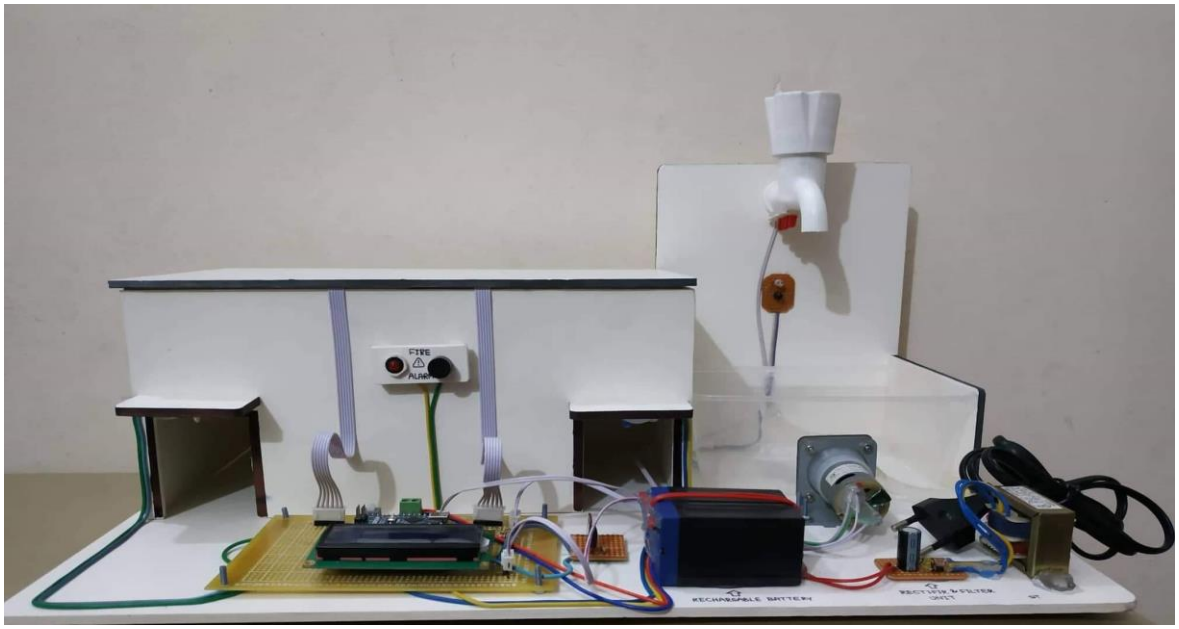
1.3 Methodology

- Creating an idea for light and water saving system for Home
- Designing a block diagram to know which components need to construct it.
- Designing a schematic for creating the circuit board.
- Programming for the microcontroller (ATMEGA328P) to controlled the system.
- Setting all the components in a PCB board and soldering.
- Making the prototype home including rooms, kitchen, and basin.
- Turn on the device experimental.
- And finally, run the prototype system..

CHAPTER 2

PROJECT ARCHITECTURE

2.1 Project Picture



2.2 Block Diagram

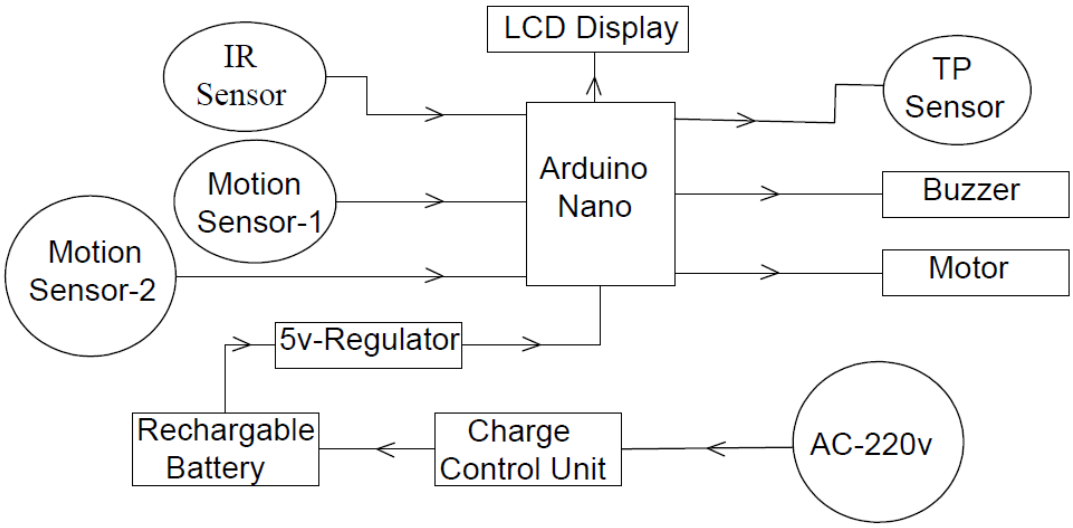


Figure 2.1: Block diagram of Auto Light And Water Saving System

2.3 Circuit Diagram

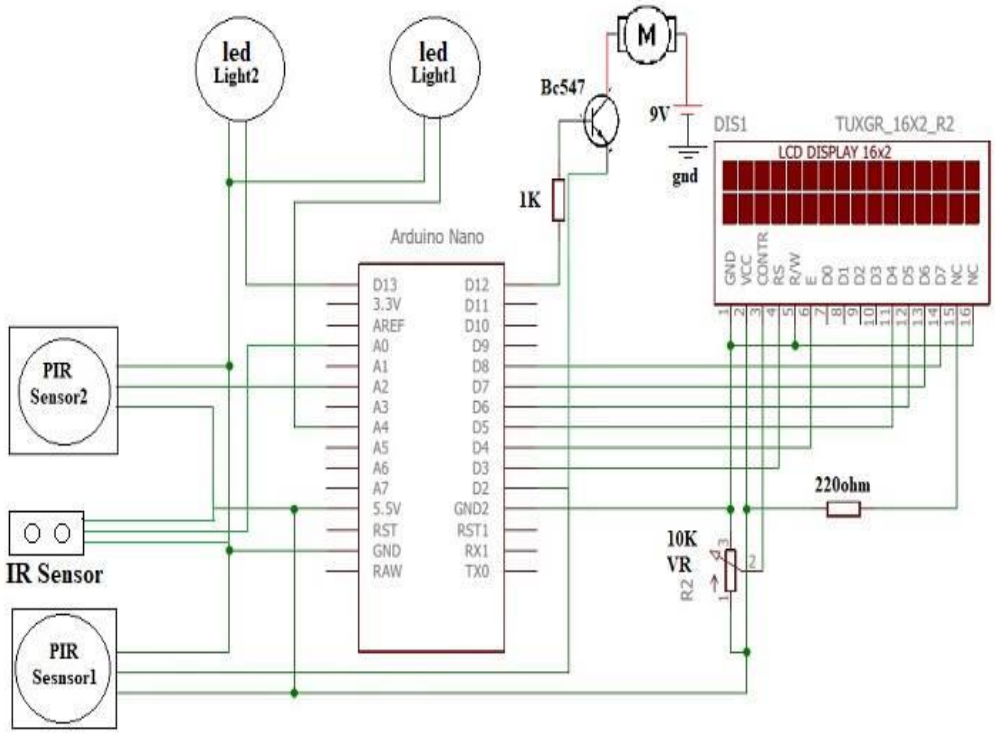


Figure 2.2: Circuit Diagram of Auto Light And Water Saving System

2.4 Working Principle

2.4.1 Structure

From circuit diagram, we can see that the Arduino Nano has 30 pins, PIR sensor has 3 pins, IR sensor has 3 pins and LED has 2 pins. To complete this project here used Arduino Nano, 2 pieces LED light, 2 pieces PIR sensor, 1 pieces IR sensor, a Transformer, a Battery, a LCD display 16×2, Diode, Capacitor, Resistances etc.

- First a common wire from LED light 1 & 2, PIR sensor 1 & 2 and IR sensor are connected to GND pin of Arduino Nano.

- The other wire of LED light 1 is connected with the pin A4 and LED light 2 is connected with the pin D13.
- A common wire from another pin of PIR sensor 1 & 2 and IR sensor is connected with the Arduino's 5.5V pin.
- Another pin of PIR sensor 2 is connected with the pin of A2.
- Last pin of IR sensor is connected with A0 pin.
- The wire of PIR sensor 2 and IR sensor which is connected to the Arduino's pin 5.5V is short with the other wire of PIR sensor 1. And this wire is directly connected the LCD display's pin 2 which define the VCC. Also this wire is short with LCD's pin 15 which define NC by a 220 ohm resistor. Another wire from LCD's pin 1 is short with this wire by a 10K VR and directly connected to the Arduino's pin GND 2.
- The LCD's pin 1 (GND), 5 (R/W) and 16 (NC) are short and the other pins are connected to the Arduino's pins as shown in circuit diagram.

2.4.2 Operation

To run this project PIR sensor 1 & 2 respectively control the LED light 1 & 2. Basically PIR sensor work with the movement of any kind of moving thing. If PIR sensor sense any movement near of it, it send signal to the microcontroller to process and command to switch on the LED light. If there aren't any movement, the light will be off in a few seconds/minutes.

The IR sensor have 2 led . One of them radiate signal and another one is receive the signal. When any signal radiate from the sender and if any obstacle get appear in front of it then the signal reflected and the receiver start working with receive that reflected signal. By receiving the reflected signal IR sensor send a command to Arduino to run the motor. When motor start working, the water is flowing to tap with a pipe and start to fall down. Also there are a temperature sensor which can sense the temperature and a fire alarm for safety. If temperature raised up to 50 degree centigrade, then the fire alarm automatic start to ring.

2.5 List of Components with Price

Table 2.4.1: Components with Price

Name	**Quantity**	**Unit Price/Tk.**	**Total (Tk.)**
Arduino Nano	1	700	700
Water pump	1	200	200
4V Rechargeable battery	2	40	80
Transformer	1	130	130
ON/OFF switch	1	30	30
Connector	5	5	25
Resistor, Capacitor	5	50	50
Motion Sensor	2	50	100
IR LED	1	20	20
IR Sensor	1	20	20
Mini submersible motor pump	1	150	150
Temperature Sensor	1	20	20
Buzzer	1	20	20
Transistor	1	10	10
Others	--	500	500
		Total cost	**1855/-**
		Market price	**10,000/-**

Table 2.4.2: Comparisons price list of various company

Company Name	**Feature**	**Price (Tk.)**
Palson	Project Model	11000
Philips	Project Model	15000
Panasonic	Project Model	12000
Hitachi	Project Model	15000

2.6 Applications

- This Automation can be used in Restaurant.
- It can be used on the upper surface of commercial building, home, Washroom.

2.7 Advantages

- Auto basin can save energy And human power.
- Easy to use.
- Easier to clean.
- Compact size and portable.

CHAPTER 3

MICROCONTROLLER

3.1 Introduction

Arduino is an open-source electronics prototyping entresol based on flexible, easy-to-use hardware and software. It's intended for artists, hobbyists, designers and anyone interested in creating interactive objects or circumstance. Aurduino can sense the circumstance by receiving input from a variety of sensors and can affect its surroundings by controlling motors, lights and other actuators.

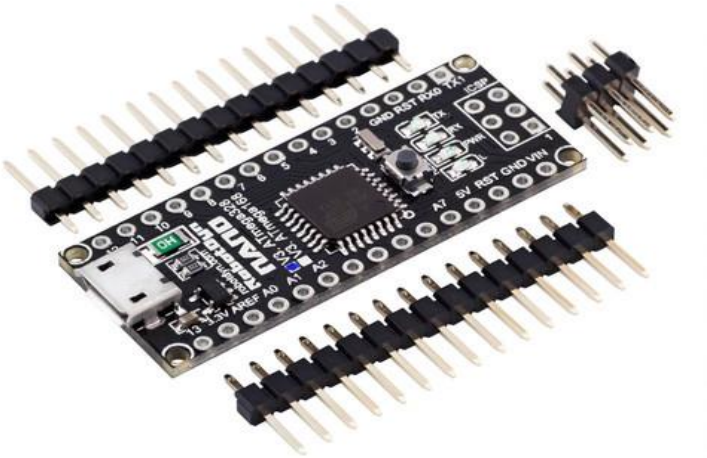


Figure 3.1: Arduino Nano

The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development circumstance (based on Processing). Arduino projects can be stand-alone or they can communicate with software on running on a computer or digital device (e.g. Flash, Processing, MaxMSP).

Arduino Nano is a surface mount breadboard interwoven version with integrated USB. It is a complete, smallest and breadboard friendly. It has everything that Diecimila/Duemilanove has (electrically) with more analog input pins and onboard +5V AREF jumper. Generally, it is missing power jack. The Nano is automatically sense and switch to the higher potential power source.

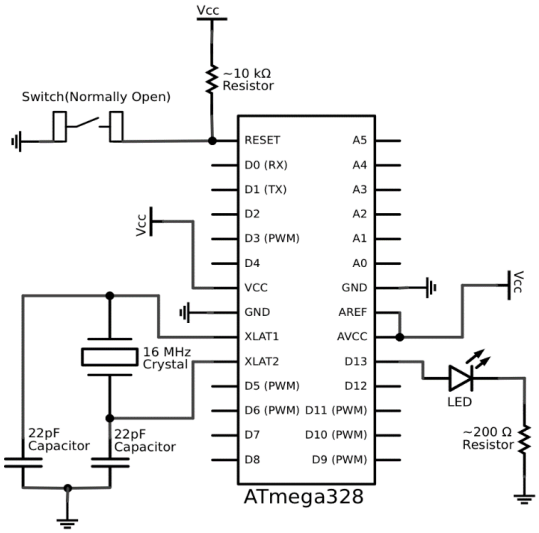


Figure 3.2: Arduino schematic diagram

Nano's got the breadboard-ability of the Boarduino and the Mini+USB with smaller footprint than either, so users have more breadboard space. It's got a pin layout that works well with the Mini or the Basic Stamp (TX, RX, ATN, GND on one top, power and ground on the other). This new version 3.0 comes with ATMEGA328P which offer more programming and data memory space. It is two layers. That make it easier to hack and more affordable.[1]

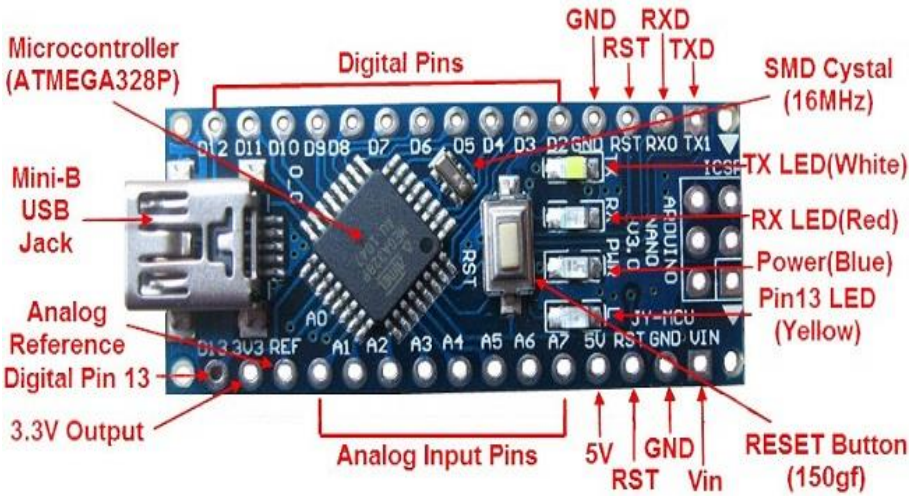


Figure 3.3: Section of Arduino Nano

3.2 Specifications

- Microcontroller: ATMEGA328P.
- Input Voltage (recommended): 7-12 V.
- Input Voltage (limits): 6-20 V.
- Operating Voltage (logic level): 5 V.
- Digital I/O Pins: 14 (of which 6 provide PWM output).
- Analog Input Pins: 8.
- DC Current per I/O Pin: 40 mA.
- SRAM: 2 KB.
- EEPROM: 1 KB.
- Flash Memory: 32 KB (of which 2KB used by boot loader).
- Clock Speed: 16 MHz.
- Dimensions: 0.70" x 1.70".

3.3 Features

- Automatic reset during Program Download.
- ICSP header for direct program download.
- Power OK blue LED.
- Green (TX), red (RX) and orange (L) LED.
- Standard 0.1 spacing DIP (breadboard friendly).
- Manual reset switch .

3.4 Microcontroller IC ATmega328P

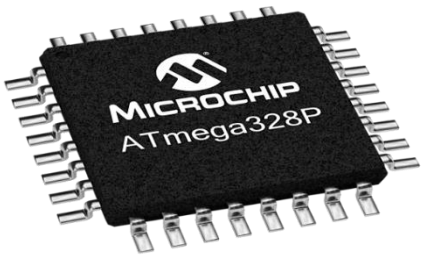


Figure 3.4: Microcontroller IC ATmega328P

The high-performance Microchip Pico power 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write pertinence, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By acting powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.[2]

3.5 Voltage specifications

VCC is the voltage that it needs for its own internal operation 5V, L293D will not use this voltage for driving the motor. For driving the motors, it has a separate provision to provide motor supply VSS. L293d will use this to drive the motor. It means if you want to operate a motor at 9V then you need to provide a Supply of 9V across VSS motor supply.

The maximum voltage for VSS motor supply is 36V. It can supply a max current of 600mA per channel. Since it can drive motors up to 36v hence can drive pretty big motors with this L293D.

3.6 PIR Infrared Motion Sensor

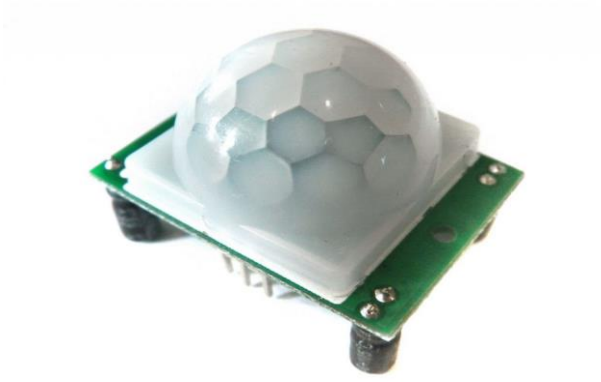
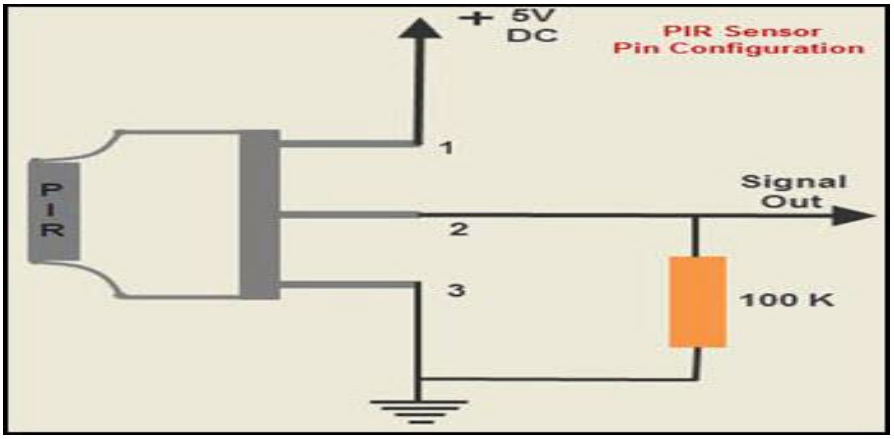


Figure 3.5: PIR Infrared Motion Sensor



3.6 Figure: Circuit Diagram of PIR Sensor.

PIR sensors, often referred to as, "Passive Infrared" or "IR motion" sensors, enable you to sense motion. Everything emits a small amount of infrared radiation (IR), and the hotter something is, the more radiation it emits. PIR sensors are able to detect a change in average IR levels of their detection zone (e.g. when a human enters a room, that room will increase in temperature slightly) and hence sense motion.

This one's great, as it can be powered via the Raspberry Pi's 5V output, and be read directly from the Raspberry Pi's GPIO input (as the sensor has a digital 3.3V output!)

This PIR includes an adjustable delay before firing (approx 0.5 - 200 seconds), has adjustable sensitivity and two M2 mounting holes! It runs on 4.5V-20V power (or 3V by bypassing the regulator with a bit of soldering) and has a digital signal output (3.3V) high, 0V low. Its sensing range is up to 7 meters in a 100 degree cone.

The HC-SR501 Infrared Motion Sensor Features:

Input Voltage: 4.5V - 20V

Current Draw: <50µA

Digital Output: 3.3V (High)

Digital Output: 0V (Low)

Working Temperature: -15°C to 70°C

Delay Time: 0.5 - 200 Seconds

Sensing Angle: 100° Cone

Range 5m - 7m

Dimensions

Sensor Lens Diameter: 23mm

Length: 24.03mm

Width: 32.34mm

Height (with lens): 24.66mm

Centre screw hole distance: 28mm

Screw hole diameter: 2mm (M2)

3.6.1 Advantages of PIR sensor

PIR sensor is used as occupancy sensor. PIR sensor is passive sensor as it senses infrared signal emitted by various objects including human body. They are used as alternative to microwave sensors.

PIR sensor houses pyro-electric sensor as shown in the figure-2. PIR sensor generates energy when exposed to heat. Human or animal body radiates energy in the form of infrared radiation. Hence when human/animal come in the range of PIR motion sensor, it receives thermal energy and hence motion is detected by the sensor.

3.6.2 Benefits or advantages of PIR sensor

Following are the benefits or advantages of PIR sensor:

➡Detects motion reliably in indoors as well as in day or dark.

➡It consumes less energy (0.8W to 1.0W) compare to microwave sensor.

➡They are cheaper compare to microwave sensors.

➡They are good for electrical applications used in smaller and compact premises.

3.6.3 Drawbacks or disadvantages of PIR sensor

Following are the drawbacks or disadvantages of PIR sensor:

➡They have lower sensitivity and less coverage compare to microwave sensors.

➡It does not operate greater than 35 degree C.

➡It works effectively in LOS (Line of Sight) and will have problems in the corner regions.

➡It is insensitive to very slow motion of the objects.

➡Since PIR sensors sense heat signatures in room, they are not very sensitive if the room itself is warm. Hence PIR sensors are not able to detect human beings in the summer in some countries like INDIA.

➡Snoozing is another problem with PIR sensors. PIR sensors may turn off even if there is very little movement in occupied floors.

➡Thieves may find it easy to fool PIR detection range as they have slotted detection zone and not continuous one like microwave sensor.

3.7 IR Sensor Module

Figure 3.7 : IR Sensor Module

3.7.1 Circuit diagram Of IR Module

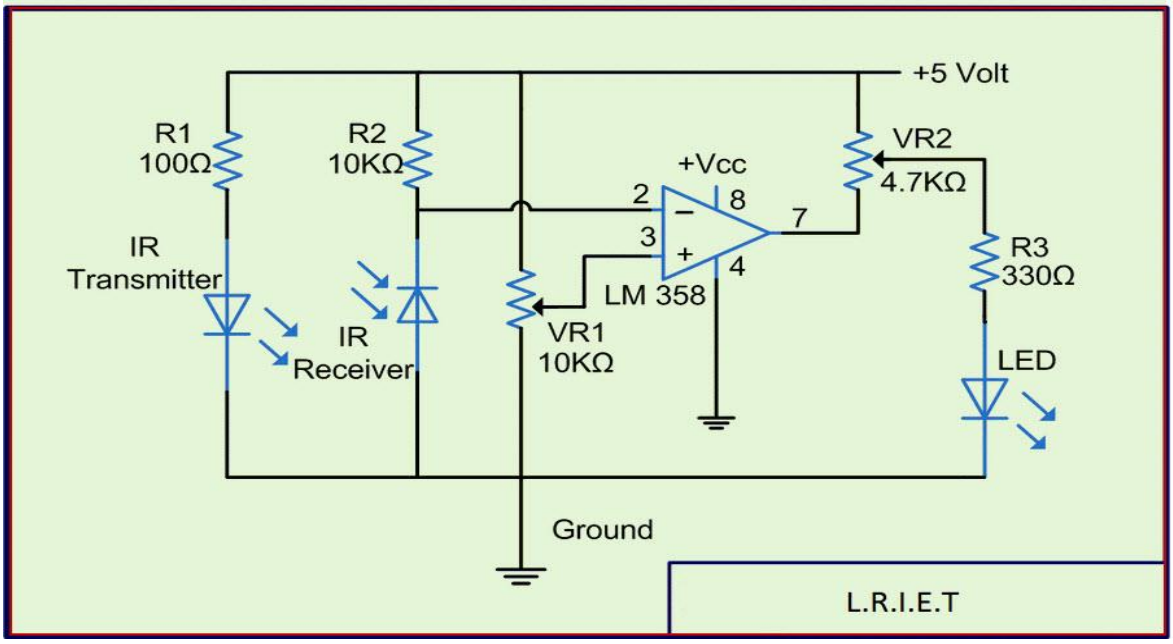


Figure 3.8 : Circuit diagram Of IR Module

Infrared sensor is an electronic device, It emits in order to sense some form of the surroundings. IR sensor can measure the heat of any substance as well as detects the motion. This types of sensors can measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the substance radiate some form of thermal radiations. This types of radiations are invisible. Also our eyes can't see it. It can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode. IR photodiode is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.

3.8 Temperature Sensor

Figure 3.9 : Temperature Sensor

Temperature sensor is a device which can measure the temperature of human being, metal alloy, moisture and etc. The temperature sensor is that the temperature is converted into a usable output letter by using the physical properties of the material with the change of temperature Number.

There are four main types of temperature sensor: thermocouple, thermistor, resistance temperature detector (RTD) and IC temperature sensor. The IC temperature sensor has two types of: output and digital output.

CHAPTER 4

Mini Submersible Water Pump

4.1 Introduction

Mini submersible water pump is a low cost, small size submersible water pump which can be operated from a 2.5V-6V power supply. It can take up to 120 liters per hour with very low current consumption of 220mA. Just connect tube pipe to the motor outlet, submerge it in water and power it.

4.2 Description

A submersible pump or sub pump, (electric submersible pump (ESP)) is a device which has a hermetically sealed motor close-coupled link to the pump body. The total assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevents pump cavitation. A problem associated with a high mount difference between pump and the fluid surface. Submersible pumps push fluid to the surface as opposed to jet pumps having to pull fluids. Submersibles are more efficient than jet pumps. This mini submersible pump 2.5V-6V is great for experiment, aquarium, and fount etc. It is compatible for varieties of water such as city water, ground water and sea water.

Figure: 4.1: Water pump

4.3 Working principle

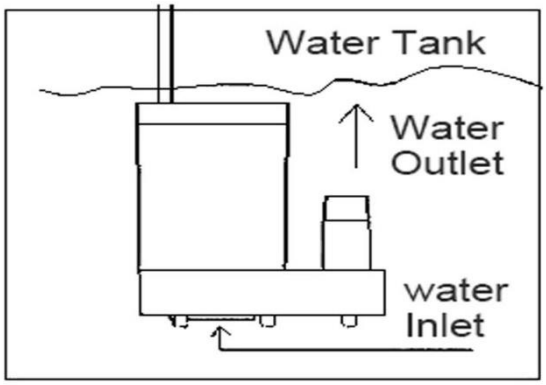


Figure 4.2: Working principal of mini submersible water pump

Electric submersible pumps are multistage eccentric pumps operating in a vertical position. Liquids, swifted by the impeller, lose their kinetic energy in the diffuser where a conversion of kinetic to pressure energy takes place. This is the main operational mechanism of long-range and mixed flow pumps.

Figure 4.3: Working system of mini submersible water pump

The pump shaft is connected to the gas separator or the protector by a mechanical coupling at the bottom of the pump. Fluids enter the pump through an intake screen and are lifted by the pump stages. Other parts include the radial bearings (bushings) distributed along the length of the shaft providing radial support to the pump shaft. An optional thrust bearing takes up part of the axial forces arising in the pump but most of those forces are absorbed by the protector's thrust bearing.

4.4 Applications

- Submersible pumps are found in many applications.
- Single stage pumps are used for drainage, sewage pumping, general industrial pumping and slurry pumping.
- They are also popular with pond filters.
- Most typically used for residential, commercial, municipal and industrial water extraction (abstraction), water wells and in oil wells.
- Other uses for submersible pumps include sewage treatment plants, seawater handling, fire-fighting.

4.5 Specifications

- Operating voltage: 2.5V-6V
- Operating current: 130mA-220mA
- Flow rate: 80L/H-120 L/H
- Maximum lift: 40mm-110 mm
- Continuous working life: 500 hours.
- Driving mode: DC, Magnetic driving.
- Material: Plastic + Electronic components.
- Outlet outside diameter: 7.5 mm
- Outlet inside diameter: 5 mm
- Style: Vertical, Horizontal (Optional)
- Power: 3W
- Water temperature: -20°C - +50°C
- Collection bag pore size in micron.
- Outlet filter life and pore size in micron.
- Motor capacity.
- The weight of the equipment.
- Movability and easy handling facility.

- Self-cleaning feature.
- Accessories like painter tool, adsorbent, cord spring.
- Less noise generation during cleaning.

4.6 DC motor speed controller

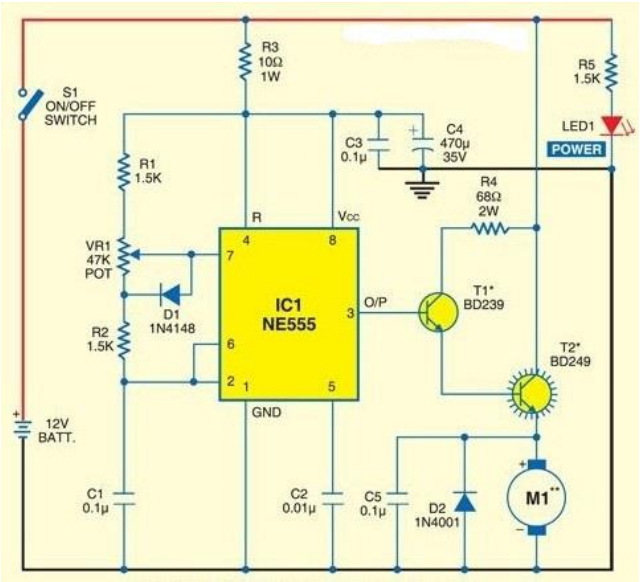


Figure 4.4: DC motor speed controller circuit

Here IC_1 is wired as a low-frequency, free-running Astable Multivibrator with pulse-width modulation (PWM) controlled output. The R-C components like R_1, VR_1, R_2 and C_1 determine the frequency of oscillations. Potentiometer VR_1 works as the master speed controller for the motor. Components R_3, C_3 and C_4 decouple the DC supply of the oscillator. A blinking-type red LED (LED1) is used for visual indication of power 'ON'.

When the wiper arm of Potentiometer VR_1 is in top position, capacitor C_1 charges through R_1, R_2 and D_1 and produces a pulse train at the output of IC_1 with long negative and short positive pulse widths. Therefore the motor speed is slow. On the other hand, when the wiper arm of VR_1 is at the bottom position, C_1 charges through R_1, R_2 and VR_1 and discharges via R_2. The resulting pulse train has long positive and short negative pulse widths. Now the motor rotates at a high speed. The output at pin 3 of IC_1 is fed to transistor T_1, which, in turn, drives the DC motor through high power switching transistor T_2 at the selected speed. Resistor R_4 limits the base current of transistor T_2. Diode D_2, connected in antiparallel with the

DC motor, limits the back E.M.F. generated by the rotation of the motor. Capacitor C_5 suppresses parasitic oscillations.

4.7 Features

- It operates from a wide range of power supplies ranging from +5V to +18V supply voltage.
- Sinking or sourcing 200 mA of load current.
- The external components should be selected properly so that the timing intervals can be made into several minutes along with the frequencies exceeding several hundred kilohertz.
- The output of a 555 timer can drive a Transistor-Transistor Logic (TTL) due to its high current output.
- It has a temperature stability of 50 parts per million (ppm) per degree Celsius change in temperature, or equivalently 0.005%/°C.

CHAPTER 5

COMPONENTS

5.1 Capacitor

When potential difference occure across the conductors (e.g., when a capacitor is attached across a battery), an electric field develops across the dielectric, causing positive charge (+Q) to collect on one plate and negative charge (-Q) to collect on the other plate. If a battery has been associated to a capacitor for a sufficient amount of time, no current can flow via the capacitor. However, if an accelerating or alternating voltage is employed across the leads of the capacitor, a displacement current can flow.

Figure 5.1: Capacitor

An ideal capacitor is distinguished by a single constant value for its capacitance. Capacitance is expressed as the ratio of the electric charge (Q) on each conductor to the potential difference (V). The SI unit of capacitance is the farad (F), which is equal to one coulomb per volt (1 C/V). Typical capacitance values range from about 1 pF (10^{-12} F) to about 1 mF (10^{-3} F).The capacitance is larger when there is a narrower breakage between conductors and when the conductors have a larger surface area. In practice, the dielectric between the plates passes a small amount of leakage current and also has an electric field strength limit, known as the breakdown voltage. The conductors and leads introduce an undesired resistance and inductance. Capacitors are widely used in electronic circuits for hindering direct current while allowing alternating

current to pass. In analog filter networks, they smooth the output of power supplies. In resonant circuits they tune radios to particular frequencies. In electric power transmission systems they ballast voltage and power flow.

5.2 Resistor

A resistor is a inactive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the sometime, act to lower voltage levels into circuits. Resistors may have fixed resistances or variable resistances, such as those founding thermostats, visitors, trimmers, photo resistors, hamsters and potentiometers. The current through a resistor is in direct proportion to the voltage across the resistor's terminals. This relationship is represented by Ohm's law

Figure 5.2: Resistor

5.3 Theory of operation

The behavior of an ideal resistor is dictated by the relationship specified by Ohm’s law: $V = I \times R$

Ohm's law states that the voltage (V) across a resistor is proportional to the current (I), where the constant of proportionality is the resistance (R).

Equivalently, Ohm's law can be stated:

$$I = \frac{V}{R}$$

This formulation states that the current (I) is proportional to the voltage (V) and inversely proportional to the resistance (R). This is directly used in practical computations. For example, if a 300Ω resistor is attached across the terminals

of a 12 volt battery, then a current of 12/300 = 0.04 amperes flows through that resistor.

Table 5.1 : The Resistor color code

Color	Code	Multiplier	Tolerance
Black	0	10^0	--
Brown	1	10^1	±2 %
Red	2	10^2	±2 %
Orange	3	10^3	--
Yellow	4	10^4	--
Green	5	105	±0.5%
Blue	6	10^6	±0.25 %
Violet	7	10^7	±0.1%
Grey	8	10^8	±0.05%
White	9	10^9	--
Gold	--	10^{-1}	±5 %
Silver	--	10^{-2}	±10 %

5.4 LED

5.4.1 Introduction

A light Emitting Diode (LED) is a two-lead semiconductor light source. It is a P–N junction diode that emits light when incite. When a compatible current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light is ascertained by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm^2) and integrated optical components may be used to shape the radiation pattern.

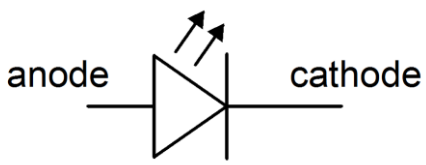


Figure 5.3 : Symbol of LED

Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared light. Infrared LEDs are still frequently used as transmitting elements in remote-control circuits, such as those in remote controls for a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Modern LEDs are available across the visible, ultraviolet, and infrared wavelengths, with very high brightness.

5.4.2 Overview

Figure 5.4: LED

Early LEDs were often used as determinative lamps for electronic devices, replacing small luminous bulbs. They were soon packaged into numeric readouts in the form of seven-segment displays and were commonly seen in digital clocks. Recent developments have produced LEDs suitable for environmental and task lighting. LEDs have led to new displays and sensors, while their high switching rates are useful in advanced communications technology.

LEDs have many advantages over luminous light sources, including lower energy consumption, longer lifetime, improved physical toughness, faster switching and smaller size. LED's are used in applications as diverse as aviation lighting, automotive headlamps, advertising, general lighting, traffic signals, camera flashes, lighted wallpaper and medical devices. They are also significantly more energy efficient and, conceivably, have fewer environmental concerns associated to their disposal.

Unlike a laser, the color of light emitted from an LED is neither coherent nor monochromatic, but the spectrum is parochial with respect to human vision, and for

most purposes the light from a simple diode element can be take into consideration as functionally monochromatic.

5.4.3 Working principle

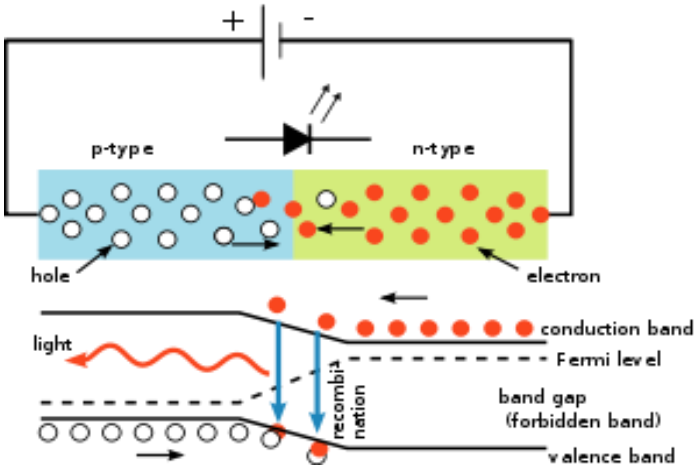


Figure 5.5: Circuit of LED

A p-n junction can convert submerged light energy into a proportional electric current. The same process is turn over here (i.e. the p-n junction emits light when electrical energy is applied to it). This phenomenon is generally called electroluminescence, which can be defined as the emission of light from a semiconductor under the influence of an electric field. The charge carriers recombine in a forward-biased p-n junction as the electrons cross from the n-region and recombine with the holes existing in the p-region. Free electrons are in the conduction band of energy levels, while holes are in the valence energy band. Thus the energy level of the holes is less than the energy levels of the electrons. Some section of the energy must be diminished to recombine the electrons and the holes. This energy is emitted in the form of light and heat.

The electrons dissipate energy in the form of heat for silicon and germanium diodes but in gallium arsenide phosphide (GaAsP) and gallium phosphide (GaP) semiconductors, the electrons dissipate energy by emitting photons. If the semiconductor is diaphanous, the junction becomes the source of light as it is emitted, thus becoming a LED. However, when the junction is reverse biased, the

LED produces no light and if the potential is great enough, the device is depreciated.

5.4.4 Advantages

- Efficiency: LEDs emit more lumens per watt than incandescent light bulbs.
- Size: LEDs can be very small in size (smaller than 2 mm^2) and are easily associated to printed circuit boards.
- Color: LEDs can emit light of an designed color without using any color filters as traditional lighting methods need. This is more efficient and can lower initial costs.
- Dimming: LEDs can very easily be dimmed either by pulse-width modulation or lowering the forward current.
- Cool light: In contrast to most light sources, LEDs radiate very little heat in the form of IR that can cause damage to sensitive objects or fabrics.
- Cycling: LEDs are ideal for uses subject to frequent on-off cycling.
- Warm up time: LEDs light up very quickly. LEDs used in communications devices can have even faster response times.
- Lifetime: LEDs can have a relatively long useful life.
- Shock resistance: LEDs, being solid-state components, are difficult to damage with external shock.
- Focus: The solid package of the LED can be designed to focus its light.

5.4.5 Disadvantages

- Color rendition: Most cool-white LEDs have spectra that differ significantly from a black body radiator like the sun or an incandescent light.
- Impact on insects: LEDs are much more attractive to insects than sodium-vapor lights, so much so that there has been speculative concern about the possibility of disruption to food webs.
- Temperature dependence: LED performance largely depends on the ambient temperature of the operating environment.
- Efficiency droop: The efficiency of LEDs decreases as the electric current increases.

- Voltage sensitivity: LEDs must be supplied with a voltage above their threshold voltage and a current below their rating.

5.4.6 Applications

- Visual signals where light goes more or less directly from the source to the human eye, to sustain a message or meaning.
- Measuring and interacting with processes involving no human vision.
- Illumination where light is reflected from objects to give visual response of these objects.

5.5 Diode (1N4007)

Diode is an electrical device accommodate current to move via it in one direction with far greater ease than in the other. The most common kind of diode in modern circuit design is the semiconductor diode, although other diode technologies exist. Semiconductor diodes are encapsulate in schematic diagrams such as Figure below.

The term “diode” is thoroughly reserved for small signal devices, $I \leq 1$ A. The term rectifier is used for power devices, $I > 1$ A.

Figure 5.6: Diode (1N4007)

When placed in a simple battery-lamp circuit, the diode will either allow or prevent current through the lamp, recline on the polarity of the applied voltage.

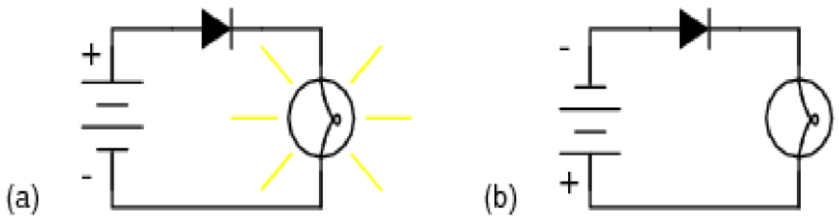


Figure 5.7: (a) Current flow is permitted; the diode is forward biased.

(b) Current flow is prohibited; the diode is reversed biased

When the polarity of the battery is such that electrons are allowed to flow through the diode, the diode is said to be forward-biased. On the other hand, when the battery is "backward" and the diode obstruct current, the diode is said to be reverse-biased. A diode may be thought of as like a switch: "closed" when forward-biased and "open" when reverse-biased.

5.6 Battery

5.6.1 Introduction

A lithium-ion battery or Li-ion battery (abbreviated as LIB) is a type of rechargeable battery in which lithium ions move from the negative electrode to the positive electrode during discharge and back when charging. Li-ion batteries use an intercalated lithium compound as one electrode material, compared to the metallic lithium used in a non-rechargeable lithium battery. The electrolyte, which allows for ionic movement, and the two electrodes are the constituent components of a lithium-ion battery cell.

Lithium-ion batteries are common in home electronics. They are one of the most popular types of rechargeable batteries for portable electronics, with a high energy density, tiny memory effect and low self-discharge. LIBs are also growing in popularity for military, battery electric vehicle and aerospace applications.

5.6.2 Overview

Chemistry, performance, cost and safety characteristics vary across LIB types. Handheld electronics mostly use LIBs based on lithium cobalt oxide ($LiCoO_2$), which offers high energy density but presents safety risks, especially when damaged. Lithium iron phosphate ($LiFePO_4$), lithium ion manganese oxide battery($LiMn_2O_4$, $Li2MnO_3$, or LMO), and lithium nickel manganese cobalt oxide ($LiNiMnCoO_2$ or NMC) offer lower energy density but longer lives and less likelihood of unfortunate events in real-world use (e.g., fire, explosion, etc.).

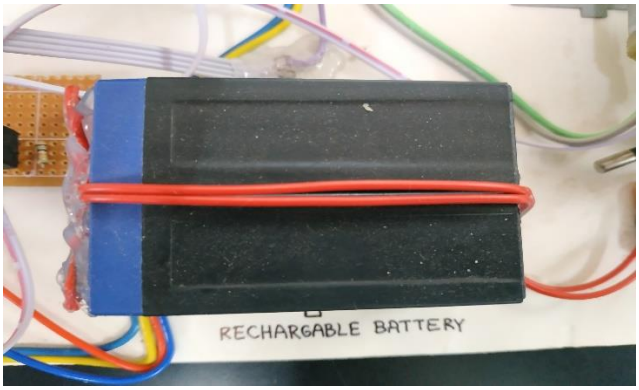


Figure 5.8: Lithium-ion battery

Such batteries are widely used for electric tools, medical equipment, and other roles. NMC in particular is a leading contender for automotive applications. Lithium nickel cobalt aluminum oxide ($LiNiCoAlO_2$ or NCA) and lithium titanate ($Li_4Ti_5O_{12}$ or LTO) are specialty designs aimed at particular niche roles. The newer lithium sulfur batteries promise the highest performance-to-weight ratio.

Lithium-ion batteries can pose unique safety hazards since they contain a flammable electrolyte and may be kept pressurized. A battery cell charged too quickly could cause a short circuit, leading to explosions and fires. Because of these risks, testing standards are more stringent than those for acid-electrolyte batteries, requiring both a broader range of test conditions and additional battery-specific tests. There have been battery-related recalls by some companies, including the 2016 Samsung Galaxy Note 7 recall for battery fires.

5.6.3 Working principle

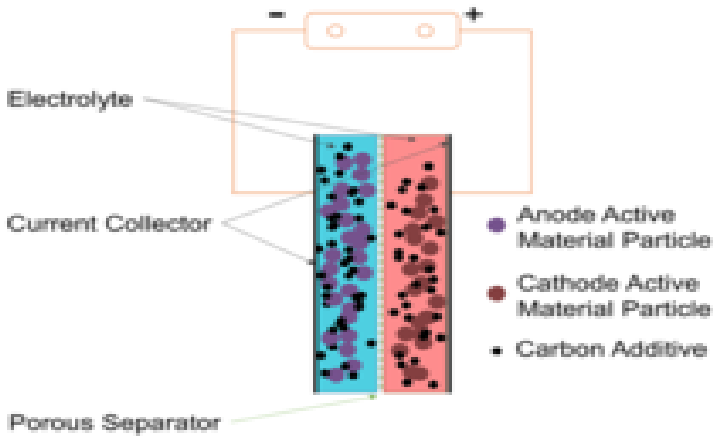


Figure 5.9: Circuit of lithium battery

The reactants in the electrochemical reactions in a lithium-ion battery are the negative and positive electrodes and the electrolyte providing a conductive medium for lithium ions to move between the electrodes. Electrical energy flows out from or in to the battery when electrons flow through an external circuit during discharge or charge, respectively.

During discharge, the lithium ions move from the negative electrode to the positive electrode (cathode) through the electrolyte while the electrons flow through the external circuit in the same direction. When the cell is charging, the reverse occurs with the lithium ions and electrons move back into the negative electrode in a net higher energy state. The following equations exemplify the chemistry.

5.6.4 Charge and discharge Procedure

During discharge, lithium ions (Li^+) carry the current within the battery from the negative to the positive electrode, through the non-aqueous electrolyte and separator diaphragm.

During charging, an external electrical power source (the charging circuit) applies an over-voltage, forcing a charging current to flow within the battery from the positive to the negative electrode, i.e. in the reverse direction of a discharge current under normal condition. The lithium ions then migrate from the positive to the

negative electrode, where they become embedded in the porous electrode material in a process known as intercalation.

The charging procedures for single Li-ion cells, and complete Li-ion batteries, are slightly different.

A single Li-ion cell is charged in two stages

- Constant Voltage (CV)
- Constant Current (CC)

A Li-ion battery is charged in three stages

- Constant Current
- Constant Voltage
- Balance (not required once a battery is balanced)
-

5.6.5 Uses

- Power tools: Li-ion batteries are used in tools for example cordless drills, sanders, saws and a variety of garden equipment including hedge trimmers.

  Portable devices: these include mobile phones and smart phones, digital camera electronic cigarettes, laptops and tablets and torches.

- Electric vehicles: including electric cars, hybrid vehicles, electric bicycles, personal transporters and advanced electric wheelchairs. Also radio-controlled models, model aircraft, aircraft, and the Mars Curiosity rover.

CHAPTER 6

POWER SUPPLY

6.1 Introduction

To operate whole project we need power source, in this project we use DC source because Microcontroller needs DC voltage to operate, In this project we use 220V to 18V step-down converter to reduce voltage level and then a bridge rectifier circuit to convert DC from AC. DC 5V is good enough for operate the Arduino Nano.

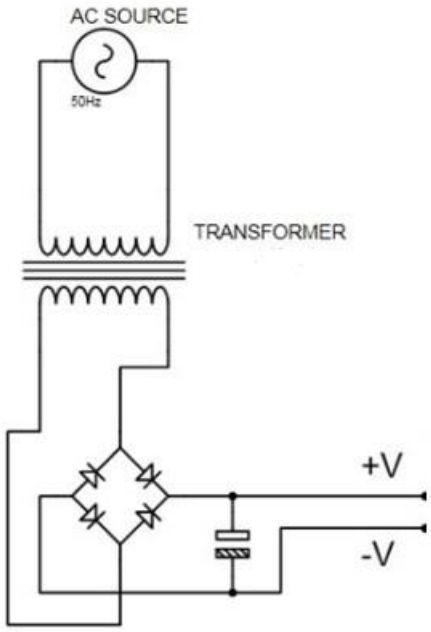


Figure 6.1: 220V AC to 18V DC circuit

6.2 DC 18V 600mA Adapter

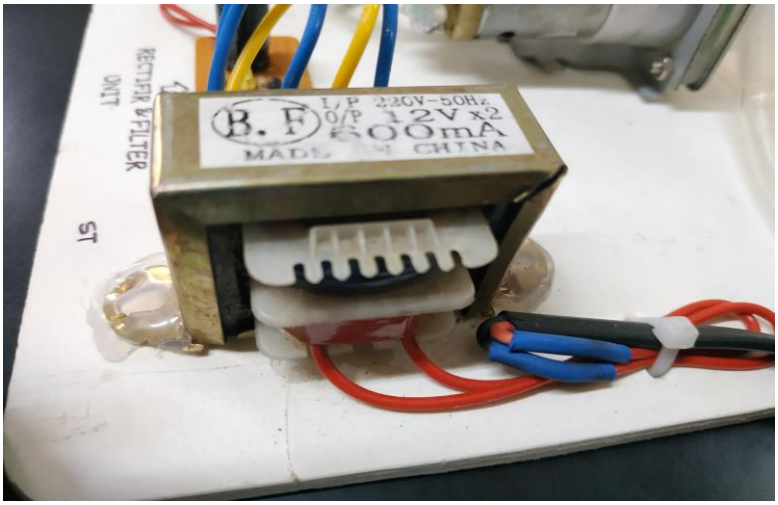


Figure 6.2: 24V DC Voltage Adapter

6.2.1 Features

- This power supply adapter is perfect for led lights strips.
- Also for other electronic products.
- Plug: EU Plug
- Caution: Indoor use only
- Input:100-240V AC 50/60 Hz
- Output: DC 24V, 600mA

6.3 Transistor

6.3.1 Introduction

A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is built of semiconductor material usually with at least three terminals for connection to an external circuit.

Figure 6.3: Transistor

A voltage or current applied to one pair of the transistor's terminals controls the current through another pair of terminals. Because the regulable (output) power can be higher than the regulating (input) power. A transistor can amplify a signal. Today, some transistors are packaged individually, but many more are found embedded in integrated circuits

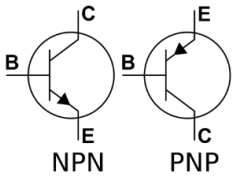


Figure 6.4: Symbol of NPN and PNP transistor

6.3.2 Transistor as a switch

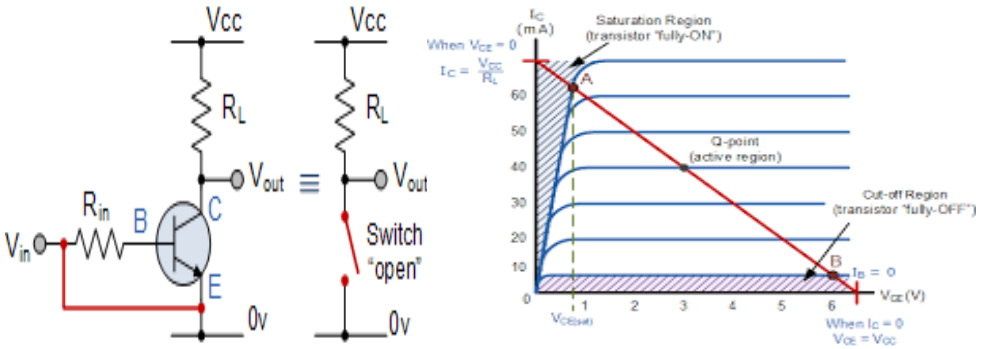


Figure 6.5: Circuit diagram and curve of transistor as a switch

- Cut-off Region

Here the operating conditions of the transistor are zero input base current (I_B), zero output collector current (I_C) and maximum collector voltage (V_{CE}) which results in

a large depletion layer and no current flowing through the device. Therefore the transistor is switched 'Fully-OFF'.

- Saturation Region

  Here the transistor will be biased so that the maximum amount of base current is applied, resulting in maximum collector current resulting in the minimum collector emitter voltage drop which results in the depletion layer being as small as possible and maximum current flowing through the transistor. Therefore the transistor is switched 'Fully-ON'.

- Active region

  Active region is one in which Base emitter junction is forward biased and Base Collector junction will be reverse biased in a transistor.

6.3.3 Transistor as an amplifier

The common-emitter amplifier is designed so that a small change in voltage (V_{in}) changes the small current through the base of the transistor; the transistor's current amplification combined with the properties of the circuit means that small swings in V_{in} produce large changes in V_{out}.

Various configurations of single transistor amplifier are possible, with some providing current gain, some voltage gain, and some both.

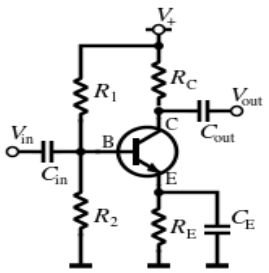


Figure 6.6: Circuit of transistor as an amplifier

From mobile phones to televisions, vast numbers of products include amplifiers for sound reproduction, radio transmission, and signal processing. The first discrete-transistor audio amplifiers barely supplied a few hundred mille watts, but power and audio fidelity gradually increased as better transistors became available and amplifier

6.4 Transformer

6.4.1 Introduction:

A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. Electromagnetic induction produces an electromotive force within a conductor which is exposed to time varying magnetic fields. Transformers are used to increase or decrease the alternating voltages in electric power applications. It is a step down transformer in which the secondary winding is more than primary winding. Due to this windings it can able to step down the voltage. A Transformer changes electricity from high to low voltage or low to high voltage using two properties of electricity.

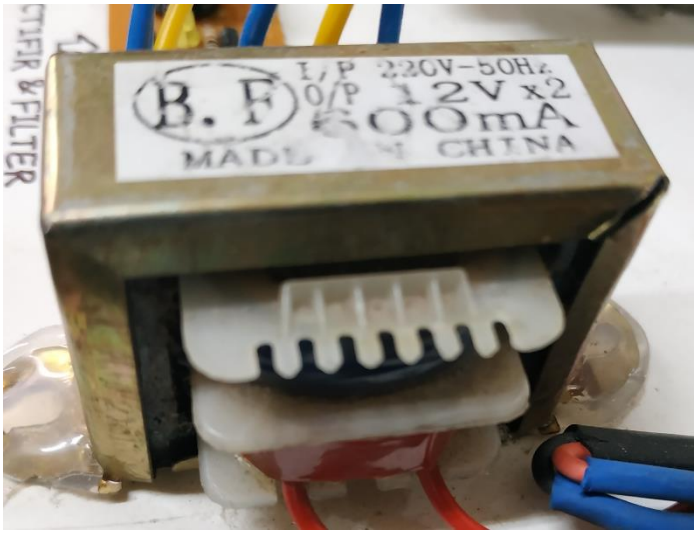


Figure 6.7: 12V×2 step down transformer

It is a general purpose chassis mounting mains transformer. Transformer has 220V primary windings and center tapped secondary winding. The transformer has flying colored insulated connecting leads (Approx. 100 mm long). The Transformer act as step down transformer that reducing 220V AC to 12V×2V AC. Power supplies for all kinds of project & circuit boards. Step down 220V AC to 12V×2 AC with a maximum of 600mA current. In AC circuits, AC voltage, current and waveform can be transformed with the help of Transformers. Transformer plays an important role in electronic equipment. AC and DC voltage in power supply equipment are almost achieved by transformer's transformation and commutation.

6.4.2 Transformer Power Rating

Voltage is measured in volts, current is measured in amps, and the unit of measure for power is watts. Watts is equal to the volts times the amps. There is a little loss of power in a transformer due to the combination of resistance and reactance. Reactance is similar to resistance except it is the resistance to an AC current or more technically, the resistance to change in a change in current due to the change in the field created. This heat is what limits the amount of current or power a transformer can handle. The higher the current, the more heat is produced. When the wires get too hot, the insulation breaks down and shorts with adjacent wires which cause more heat which eventually melts wires and ruins the transformer.

A basic transformer has no additional components and so nothing to protect it from overloading. If you were to connect the two output wires directly together, that will constitute a short circuit and cause far too much current to flow in both the primary and secondary and you will burn out the transformer. In the same way, if you use the transformer to power a hot wire foam cutter and you are using a wire with too little resistance for your foam cutter, you will burn out your transformer if you don't have it protected by a proper value fuse or breaker. You have to make sure that the wire resistance, in other words, the gage or diameter, and the length is correct to limit the amount of current to under the rating of the transformer.

The higher the current, the larger the wires need to be that carry that current. When the wires are larger, there is less resistance and so less heat. The power that is changed to heat and lost can be calculated as $P = I^2R$. That means that if you double the current, the power lost to heat increases by four times. If the transformer is a step down transformer, then there will be more current on the output and so the wire in the secondary windings will be heavier than the primary.

6.4.3 Transformer Configurations

A common configuration is a center tap or CT. The secondary side has three wires out. The middle wire on the output side is attached to the secondary coil, usually at the middle. If the winding ratio is 13 to 1, then with 234V input, you get 18 volts

output on the two outside wires but if it connects an outside wire and the center wire, it get 9 volts.

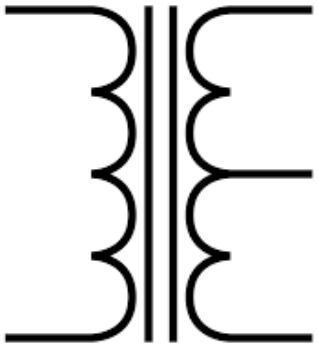


Figure 6.8: Transformer Configurations

If the transformer is rated at 2 amps, it still can only use 2 amps output whether it use 12 volts or 24 volts. Often the center tap is grounded so it then have two 12 volt sources that can be used to make '+' and '-' 12V DC after running through a converter (rectifier and filter).

6.4.4 Features

- Supply voltage: 220V-230V AC
- Output current: 600mA
- Output voltage: 12×2V AC
- 600mA Current drain.
- Soft iron core.

6.4.5 Applications

- Using for battery charger.
- Using for AC to AC converter.
- Using for any electronic applications.
- Step down applications.

CHAPTER 7

DISCUSSION & CONCLUSION

7.1 Introduction:

Our study is basically technical to test the feasibility of the prototype home automation. We have used PIR sensor, IR Sensors and temperature sensor. Our prototype home automation system has showed that how effective it is. Sometimes we are very careless to stop our water basin after using water basin. So our project will help people to make them more aware to save water. Because water is the most important element for environment and it is also limited. It's been a long time automatic light off and on system is more popular. Most of the time people use Bluetooth control on off system or sonar sensor base on off system etc. But PIR is the most interesting and effective solution for on off system. PIR is basically object detective sensor. Another important sensor is temperature sensor. Temperature sensor basically sense the high temperature and give feedback to the fire alarm.

7.2 Scope of this work

- Automatic switching for all appliance in the household.
- Dual mode (Automatic and remote control).
- Voice control dual action all of the electrical appliance
- Wi-Fi connect.
- Robotic control based home automation
- Various other sensor based automation

APPENDIX A

Code of Arduino Nano

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(3, 4, 5, 6, 7, 8);

#define motionPin1 2
#define tempin A5
#define ir1pin A0
#define motionPin2 A2
#define lightPin1 A4
#define lightPin2 13
#define motorPin 12
#define BUZ 11

int sensorValue1 = 0;
int sensorValue2 = 0;
int sensorValue3 = 0;
float tp=26.8;
void setup()
{
 Serial.begin(9600);
 lcd.begin(16, 2);
 pinMode(ir1pin, INPUT);
 pinMode(tempin, INPUT);
 pinMode(motionPin1, INPUT);
 pinMode(motionPin2, INPUT);
 pinMode(lightPin1, OUTPUT);
 pinMode(lightPin2, OUTPUT);
 pinMode(motorPin, OUTPUT);
 pinMode(BUZ, OUTPUT);

 digitalWrite(lightPin1, LOW);
 digitalWrite(lightPin2, LOW);

 digitalWrite(BUZ, HIGH);delay(60);digitalWrite(BUZ, LOW);delay(60);
 digitalWrite(BUZ, HIGH);delay(60);digitalWrite(BUZ, LOW);delay(60);
 digitalWrite(BUZ, HIGH);delay(60);digitalWrite(BUZ, LOW);delay(60);

 lcd.setCursor(0, 0);
 lcd.print("   WELCOME TO   ");

 lcd.setCursor(0, 1);
 lcd.print("     DIU      ");
 delay(2000);
```

```
  lcd.setCursor(0, 0);
  lcd.print(" SUBMITTED BY:  ");

  lcd.setCursor(0, 1);
  lcd.print("               ");
  delay(1500);

  lcd.setCursor(0, 0);
  lcd.print("SUVO KUMAR DAS  ");

  lcd.setCursor(0, 1);
  lcd.print("SHAMINUR RAHMAN ");
  delay(3000);

}



void loop()
{
  motionControl();
  motorControl();
  SENSOR_READ();
  LCD_DISPLAY();

  if(tp >50)
  temp_alarm();
}



void SENSOR_READ()
{
  tp = analogRead(tempin);
  tp = (tp/10);

  sensorValue3 = analogRead(ir1pin);
  sensorValue1 = digitalRead(motionPin1);
  sensorValue2 = digitalRead(motionPin2);

}
void LCD_DISPLAY()
{
  lcd.setCursor(0, 0);
  lcd.print("T:");
  lcd.print(tp);
  lcd.write(223);
  lcd.print("C");
}
```

```
void motorControl()
{
 if (sensorValue3 < 800)
 {
  digitalWrite(motorPin, HIGH);

  //lcd.setCursor(0, 1);
  //lcd.print("m1:ON ");
 }
 else if (sensorValue3 > 800)
 {
  digitalWrite(motorPin, LOW);

  //lcd.setCursor(0, 1);
  //lcd.print("m1:Off ");
 }
}

void motionControl()
{
 if (sensorValue1 == 1)
 {
  digitalWrite(lightPin1, HIGH);
  lcd.setCursor(0, 1);
  lcd.print("L1:ON ");
 }
 else if (sensorValue1 == 0)
 {
  digitalWrite(lightPin1, LOW);
  lcd.setCursor(0, 1);
  lcd.print("L1:OFF ");
 }

 if (sensorValue2 == 1)
 {
  digitalWrite(lightPin2, HIGH);
  lcd.setCursor(9, 1);
  lcd.print("L2:ON ");
 }
 else if (sensorValue2 == 0)
 {
  digitalWrite(lightPin2, LOW);
  lcd.setCursor(9, 1);
  lcd.print("L2:OFF ");
 }
}

void temp_alarm()
{
  int i;
```

```
  for(i=0;i<10;i++)
  {
   lcd.setCursor(0, 0);
   lcd.print("      ALARM     ");

   digitalWrite(BUZ, HIGH);
   lcd.setCursor(0, 1);
   lcd.print("      FIRE      ");
   delay(500);
   lcd.setCursor(0, 0);
   lcd.print("                ");
   digitalWrite(BUZ, LOW);
   delay(500);

  }

}
```

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