

AUTOMATIC STREET LIGHT CONTROL WITH SOLAR PANEL

**A Project and Thesis submitted in partial fulfillment of the requirements
for the Award of Degree of
Bachelor of Science in Electrical and Electronic Engineering**

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**DEPARTMENT OF ELECTRICAL AND ELECTRONIC
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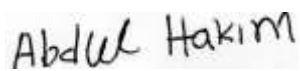
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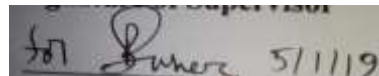
This is to certify that this project and thesis entitled “**Automatic Street light Control With Solar panel**” is done by the following students under my direct supervision and this work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on 20 November 2018.

Signature of the candidates



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Pro.Dr.M.Shamsul Alam

**Dedicated
To
My Parents**

CONTENTS

List of Figures	Vi
List of Tables	Vii
List of Abbreviations	Viii
Acknowledgment	IX
Abstract	X

Chapter 1: INTRODUCTION	1-2
--------------------------------	------------

1.1	Introduction	1
1.2	Objectives	2
1.3	Methodology	2
1.4	Outline of this Report	2

Chapter 2: EQUIPMENT'S	3-47
-------------------------------	-------------

2.1	IR LED (Infrared Light Emitting Diode)	3
2.1.1	Introduction	3
2.1.2	Pin Diagram of IR LED	3
2.1.3	IR sensor	4
2.1.4	Principle of Working	4
2.2	Photodiode	5
2.2.1	Introduction	5
2.2.2	Types of Photodiode	5-6
2.2.3	Working of Photodiode	6
2.2.4	Modes of Operation	6-7

2.2.5	Applications of Photodiode	7
2.3	Resistor	7
2.3.1	Introduction	7-8
2.3.2	Symbol of Resistor	8
2.3.3	Working of Resistor	8
2.3.4	Color Code of Resistor	9
2.3.5	Types of resistors	9-11
2.3.6	Uses of Resistors	11
2.4	Capacitor	11
2.4.1	Introduction	11
2.4.2	Different Types of Capacitors	12-15
2.4.3	Uses of Capacitors	15
2.5	IC 7805	15
2.5.1	7805 IC Rating	16
2.5.2	Pin Details of 7805 IC	16-17
2.6	Light Emitting Diode (LED)	17
2.6.1	Introduction	17
2.6.2	Working Principle of LED	17-18
2.6.3	Types of Light Emitting Diodes	18-19
2.6.4	LED Working Principle	19-20
2.6.5	I-V Characteristics of LED	20
2.6.6	Advantages of LED lights	20-21
2.7	Relay	21
2.7.1	Introduction	21
2.7.2	How Relays Work	21-22
2.7.3	Advantages & Disadvantages of relays	22
2.8	Battery	22-23
2.8.1	Introduction	22-23
2.8.2	Working principle of battery	23-24
2.8.3	Store energy in a battery	24
2.9	Solar panel	24
2.9.1	Introduction	24-25
2.9.2	Theory and Construction	25-26
2.9.3	Working principle of solar panel	26-27

2.9.4	Efficiency	27-28
2.9.5	Performance & Degradation	28
2.9.6	Maintenance	28-29
2.9.7	Electricity Crisis in Bangladesh	29-30
2.9.8	Applications	30
2.10	Diode 1n4007	30
2.10.1	Introduction	30-31
2.10.2	Features	31
2.10.3	Characteristics of 1N4007 diode	31-32
2.10.4	Polarity & Pin out	32
2.11	Arduino Pro min	32
2.11.1	Introduction	32-33
2.11.2	Configuration	34
2.11.3	Programming	34
2.11.4	Input and Output	34-35
2.11.5	Pin Configurations	35-36
2.11.6	Overview	36
2.11.7	Block Diagram	36-38
2.12	Transistor 2n2222A	38
2.12.1	Introduction	39
2.12.2	Specification	39-40
2.12.3	Features	40-41
2.13	Summary	41
Chapter 3: DESIGN AND CONSTRUCTION		42
3.1	Introduction	42
3.2	Block Diagram	42
3.3	Circuit Diagram	43
3.4	Working principle	43-45
3.5	Summary	45
Chapter 4: ADVANTAGE, DISADVANTAGE AND APPLICATION		46
4.1	Advantages	46
4.2	Disadvantages	46
4.3	Application	47
Chapter 5: RESULTS AND COST ANALYSIS		48

5.1	Introduction	48
5.2	Results	48-49
5.3	Cost Allocation	49-50
5.4	Cost Comparison	50-51
5.5	Summary	51
Chapter 6: CONCLUSIONS		52
6.1	Conclusions	52
6.2	Future Scopes of the work	52-53
6.3	Summary	53
Reference		54
Appendix		55-58
Flowchart		59
Cost Comparison		60-62

LIST OF FIGURES

Figure #	Figure Caption	
2.1.1	IR LED	3
2.1.4	Working Principle of IR LED	4
2.2.1	Photodiode	5
2.2.3	PN junction diode	6
2.3.2	Symbol of resistor	8
2.3.4	Color code of resistor	9
2.4.1	Capacitor symbol	11
2.4.2	Electrolytic capacitor	12
2.4.3	Mica capacitor	13
2.4.4	Paper capacitor	13
2.4.5	Film capacitor	14
2.4.6	Non-polarized capacitor	14
2.4.7	Ceramic capacitor	15
2.6.1	Light Emitting Diode	17

2.6.2	Working of LED	18
2.6.4	Working principle of LED	19
2.6.5	I-V Characteristics of LED	20
2.7.1	Circuit symbol of relays	21
2.8.2	Working principle of battery	23
2.9.1	Solar panel	25
2.9.3	Working principle of Fresnel lenses	26
2.10.1	Diode 1n4007	31
2.10.3	Circuit symbol of diode 1n4007	32
2.11.1	Arduino pro mini	33
2.11.5	Block diagram	35
2.12.1	Transistor 2n2222A	39
3.2	Circuit Diagram	43

LIST OF TABLES

Table #	Table Caption	
2	Daily average of bright sunshine hours at Dhaka city	27
2.1	Pin out ATmega48A	35
5.2	Charging value	48
5.2	Discharging value	49
5.3	Cost allocation	49
5.4	Cost Comparison	50

List of Abbreviations

LED	Light Emitting Diode
IR LED	Infrared Light Emitting diode
VCR	Videocassette Recorder
TV	Television
MLCC	Multilayer ceramic capacitor
IC	Integrated Circuit
MPP	Maximum power point
STC	Standard test condition
ICSP	In circuit serial programming
AVR	Alf and vegard's Risc
BJT	Bipolar junction transistor

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ABSTRACT

Nowadays traditionally high intensity high intensity discharge lamps (HID) used for urban street Lights on the highways remain on whole night. A lot energy is wasted when there is no vehicle movement. This project is enhanced to detect the vehicle movement on the highways in order to switch on a block of street lights ahead of the vehicle moving towards them as well as switch off the lights when the vehicle passes away using IR sensor technology to save energy. In this project, we use a microcontroller named Arduino pro min. using 12v solar panel we will charge 8v battery. We convert this voltage to 5v by using a voltage regulator because the system of this microcontroller will operating in 5v. The IR Sensors are placed on the either side of the road to sense the vehicle movement and to send the logic commands to the microcontroller to switch on/off a set of LEDs. The project operates in three modes: complete ON mode, medium mode and dim mode. At 6 pm to 12 pm when more vehicles in the road the street light remain ON mode. At 12am-2am the vehicles are reduce on the road then the lights are on medium mode. And at 2am-6am few vehicles were remaining in the road then the lights are in dim mode. Thus, this system dramatically changes the intensity of the lights to save a lot of energy.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Road lighting is a basic open administration that gives a more secure condition at evening time to workers including walkers. Appropriate utilization of road lighting can be considered as a defensive technique which gives monetary and social advantages to the general population. There is a deficiency of legitimate road lighting offices in numerous territories in creating nations because of absence of money related assets. The absence of sufficient light during the evening has offered ascend to poor living conditions and in that capacity, road violations, and different setbacks are typical. Sparing vitality in road lights is in this way imperative for complete vitality funds. It is realized that road lighting levels are intemperate much of the time. For example, on account of low traffic volumes, the lighting levels are unreasonable and could be decreased with the goal that vitality investment funds can be accomplished. Then again, in explicit circumstances and for traffic security reasons, light dimensions ought to be expanded even on account of low traffic volume. Without a doubt, phenomenal road lighting would not just lessen the quantity of mishaps on the streets, yet they would likewise assist the general population with feeble visual perception. These are the general population who think that it's hard to go outside their homes at evenings. Sun based urban Drove road lighting is one such arrangement. Sun powered Drove lights accompany battery-powered batteries and are fueled by the photovoltaic boards. These photovoltaic boards help in charging the batteries in the day time, and afterward they control the Drove lights to give ideal light in the evenings. An excessive amount of lighting can likewise cause issues. The lights can be tweaked to diminish the danger of mishaps. Yet, before doing that, it is constantly imperative to examine the area and ordinary traffic. Distinctive kind of light innovation utilized in lighting structure with their radiant productivity, Drove is consider a promising answer for current road lighting framework because of it is conduct and preferences As underlined in A section from that, the upsides of Drove are probably going to supplant the conventional road lights, for example, the glowing light, fluorescent light and High weight Sodium light. The sunlight based LEDs are savvy, and they are intended to turn on and off consequently as indicated by the lighting conditions. The lights

are anything but difficult to keep up and exceptionally viable. Driven lights are the fate of lighting, on account of their low vitality utilization and long life they Are quick supplanting regular lights world over henceforth we utilized LEDs to control the power of light. The sun based vitality is principally helpful in sun powered road lights, auto sun based water system framework, traffic intersection flag lighting and so forth.

1.2 Objectives:

1. To reduce the energy as our country faces energy crisis.
2. To compensate the growing energy demand by using renewable energy source as solar.
3. To reduce the energy cost.
4. To light the streets of rural areas where there is so many power cuts occurs.
5. To implement low power consumption, longevity, reliability our product.
6. Solar power industry is constantly advancing and improvement will intensity in the future

1.3 Methodology:

1. Study about the theory of auto Intensity control of LED Street light
2. Study about the solar.
3. Construction and performance of circuit.
4. Study of solar energy forecast.

1.4 Outline of this Report:

This report consists of six chapter. In first chapter, we discussed introduction and importance of solar and auto intensity control of LED street light. Whereas in chapter 2, i discussed equipment of this project. In chapter 3, I discussion design and construction. Chapter 4, I discussion advantage, disadvantage and application to my project. Chapter 5, I discussion Cost analysis and cost comparison and result of my project. Chapter 6, the discussion will be on the project conclusions.

CHAPTER 2

EQUIPMENT'S

2.1 IR LED (Infrared Light Emitting Diode)

2.1.1 Introduction

An Infrared light radiating diode (IR Diode) is an uncommon reason Driven producing infrared beams Running 700 nm to 1 mm wavelength. Diverse IR LEDs may deliver infrared light of contrasting wavelengths, much the same as various LEDs create light of various hues. IR LEDs are normally made of gallium arsenide or aluminum gallium arsenide. In supplement with IR recipients, these are usually utilized as sensors.

2.1.2 Pin Diagram of IR LED

An IR Diode is a sort of diode or straightforward semiconductor. Electric flow is permitted to stream in just a single heading in diodes. As the present streams, electrons tumble from one a player in the diode into gaps on another part. So as to fall into these gaps, the electrons must shed vitality as photons, which deliver light.

It is important to regulate the discharge from IR diode to utilize it in electronic application to counteract fake activating. The monstrous utilization of IR LEDs in remote controls and wellbeing alert frameworks has radically scaled down the valuing of IR diodes in the market.



Figure: 2.1.1 IR LED (Infrared Light Emitting Diode)

2.1.3 IR sensor

An IR sensor is a gadget that recognizes IR radiation falling on it. Closeness sensors (utilized in touchscreen telephones and edge maintaining a strategic distance from robots), differentiate sensors (utilized in line following robots) and block counters/sensors (utilized for including merchandise and thief cautions) are a few applications including IR sensors.

2.1.4 Principle of Working

An IR sensor comprises of two sections, the producer circuit and the beneficiary circuit. This is by and large known as a photograph coupler or a pick coupler. The producer is an IR Driven and the locator is an IR photodiode. The IR photodiode is delicate to the IR light radiated by an IR Drove. The photograph diode's opposition and yield voltage change in extent to the IR light got. This is the fundamental working guideline of the IR sensor. In backhanded occurrence, both the diodes are set next to each other with a misty article before the sensor. The light from the IR Drove hits the dark surface and reflects back to the photodiode.

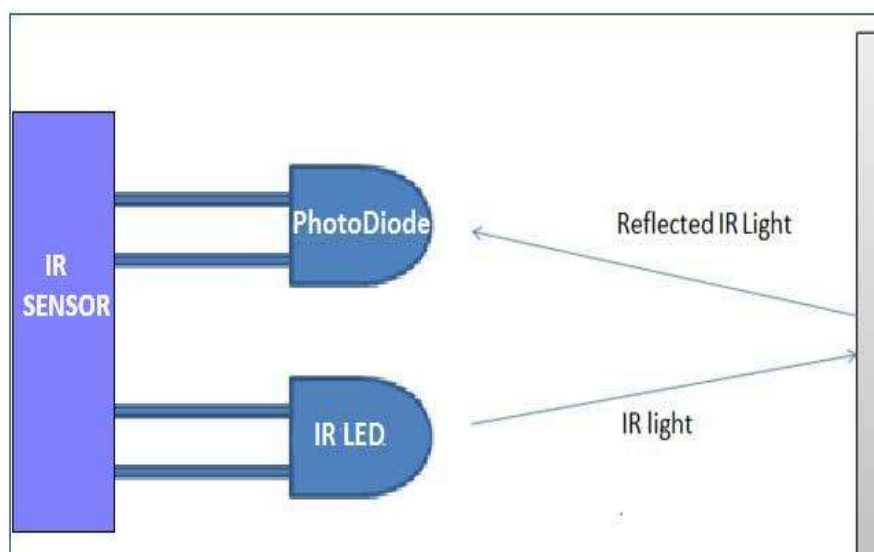


Figure: 2.1.4 working principle of IR LED.

2.2 Photodiode:

2.2.1 Introduction

A photodiode is one sort of light identifier, used to change over the light into current or voltage dependent on the method of activity of the gadget. It contains optical channels, worked in focal points and furthermore surface territories. These diodes have a moderate reaction time when the surface zone of the photodiode increments. Photodiodes are indistinguishable to normal semiconductor diodes, yet that they might be either noticeable to let light achieve the sensitive piece of the gadget. A few diodes expected for use precisely as a photodiode will likewise utilize a Stick intersection to some degree than the standard PN intersection.



Figure: 2.2.1 Photodiode

2.2.2 Types of Photodiode

In spite of the fact that there are various kinds of photodiode accessible in the market and They All deals with a similar fundamental standards, however some are enhanced by different impacts. The working of various kinds of photodiodes work in a marginally unique manner, however the essential activity of these diodes continues as before. The sorts of the photodiodes can be ordered dependent on its development and capacities as pursues.

- PN Photodiode
- Scotty Photograph Diode
- PIN Photodiode
- Avalanche Photodiode

2.2.3 Working of Photodiode

The working principle of a photodiode is, when a photon of ample energy strikes the diode, it makes a couple of an electron-hole. This mechanism is also called as the inner photoelectric effect. If the absorption arises in the depletion region junction, then the carriers are removed from the junction by the inbuilt electric field of the depletion region. Therefore, holes in the region move toward the anode, and electrons move toward the cathode, and a photocurrent will be generated. The entire current through the diode is the sum of the absence of light and the photocurrent. So the absent current must be reduced to maximize the sensitivity of the device.

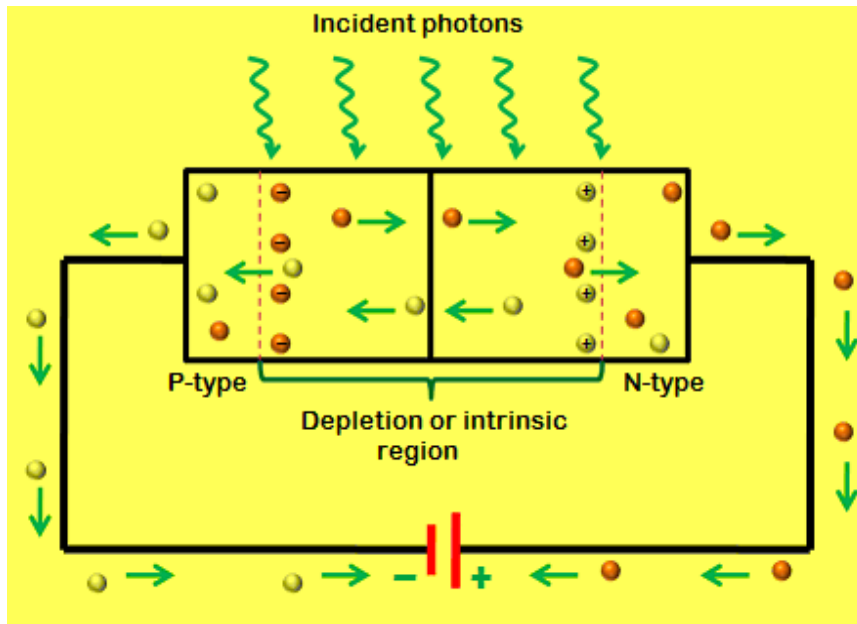


Figure: 2.2.3 PN junction diode

2.2.4 Modes of Operation

The working methods of the photodiode incorporate three modes, to be specific Photovoltaic mode, Photoconductive mode and torrential slide diode mode.

Photovoltaic Mode: This mode is otherwise called zero inclination mode, in which a voltage is delivered by the helped photodiode. It gives a little unique range and non-direct need of the voltage framed.

Photoconductive Mode: The photodiode utilized in this photoconductive mode is all the more normally turn around one-sided. The invert voltage application will expand the consumption layer's width, which thus diminishes the reaction time and the intersection capacitance. This mode is excessively quick and showcases electronic clamor.

Torrential slide Diode Mode: Torrential slide diodes work in a high turn around inclination condition, which licenses duplication of a torrential slide breakdown to every photograph created electron-opening pair. This result in an inside gain in the photodiode, which gradually builds the gadget reaction.

2.2.5 Applications of Photodiode

The uses of photodiodes include in comparative utilizations of photograph indicators like charge-coupled gadgets, photoconductors, and photomultiplier tubes.

These diodes are utilized in customer hardware gadgets like smoke identifiers, reduced circle players, and TVs and remote controls in VCRs.

In other customer gadgets like clock radios, camera light meters, and road lights, photoconductors are more as often as possible utilized instead of photodiodes.

Photodiodes are much of the time utilized for correct estimation of the force of light in science and industry. By and large, they have an upgraded, straighter reaction than photoconductors.

Photodiodes are additionally generally utilized in various therapeutic applications like instruments to investigate tests, indicators for processed tomography and furthermore utilized in blood gas screens.

These diodes are a lot quicker and more intricate than ordinary PN intersection diodes and thus are every now and again utilized for lighting control and in optical interchanges.

2.3 Resistor

2.3.1 Introduction

Resistor is electrical or electronic parts which oppose the stream of flow over the resistor gadget. The protection from current stream results in a voltage drop over the resistor gadget. Resistors are utilized broadly all through electrical and electronic circuits.

Resistor gadgets may give a settled, variable, or movable estimation of obstruction. Movable resistors are alludes to as rheostats, or potentiometers. Resistor esteems are communicated in Ohms, the electric obstruction unit. Resistors are fused inside an electrical or electronic circuits make a realized voltage drop or flow to voltage relationship.

2.3.2 Symbol of Resistor

Resistor is a 2 terminal passive device. The symbol is given below.



Figure 2.3.2: Symbol of resistor

2.3.3 Working of Resistor

Electric or electronic circuits to do specific occupations regularly need to present exact measures of obstruction. They can do that by including modest segments called resistors. A resistor is a little bundle of obstruction: wire it into a circuit and you diminish the current by an exact sum.

A resistor like this is depicted as wire-wound. The quantity of copper turns controls the opposition absolutely: the more copper turns, and the more slender the copper, the higher the obstruction. In littler esteem resistors, intended for lower-control circuits, the copper winding is supplanted by a winding example of carbon. Resistors like this are a lot less expensive to make and are called carbon-film. By and large, wire-wound resistors are progressively exact and increasingly stable at higher working temperatures.

The working of a resistor can be clarified with the likeness of water coursing through a pipe. Consider a pipe through which water is permitted to stream. In the event that the measurement of the pipe is diminished, the water stream will be decreased.

In this model, the power connected to the water is like the ebb and flow moving through the opposition. The weight connected can be looked like to the voltage.

2.3.4 Color Code of Resistor

Black	0	0	0	1	-
Brown	1	1	1	10	±1%
Red	2	2	2	100	±2%
Orange	3	3	3	1000	-
Yellow	4	4	4	10 000	-
Green	5	5	5	100 000	±0.5%
Blue	6	6	6	1 000 000	±0.25%
Violet	7	7	7	10 000 000	±0.1%
Gray	8	8	8	100 000 000	±0.05%
White	9	9	9	1000 000 000	-
Gold				0.1	±5%
Silver				0.01	±10%
None					±20%

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Figure 2.3.3: Color Code of Resistor

2.3.5 Types of resistors

The most regularly utilized resistors all appear to be identical. They resemble a little worm with hued stripes as an afterthought. There are numerous sorts of resistors accessible.

1. Wire-wound Resistors:

Comprise of a tube shaped center which is wrapped or twisted with wire. The round and hollow center is commonly produced using an artistic, plastic, or fiberglass center material. The wire is a sort of obstruction wire, for example, nickel chromium. Wire wound resistors are a kind of intensity resistor and are exact. Wire wound resistors are accessible as settled, or flexible to be utilized as a rheostat or potentiometer.

Regular applications for wire wound resistors incorporate gadget requiring high current taking care of capacity, warm dissemination and obstruction dependability and exactness.

2. Carbon Film Resistors:

A general class depiction for barrel shaped resistors made by saving a carbon film on the outside of a middle center protector.

3. Thin Film Resistors:

A kind of surface-mount film resistor with a generally thin resistive component, estimated in angstroms (millionths of an inch). Thin film resistors are made by sputtering a resistive material, for example, nickel chromium or tantalum nitride, onto the outside of a substrate.

4. Thick Film Resistor:

Uncommonly constructed surface-mount film resistor that conveys high power for the part estimate. For thick film resistors, a ruthenium oxide film or metal coating film is connected utilizing customary screen-printing innovation. These resistor film can be astounding high-voltage or high-control gadgets.

5. Carbon Structure Resistors:

A sort of resistor that comprises of an earth, alumina, and carbon blend that has been mixed and pressurized into a resistive center and after that secured with a formed external protecting center.

6. Metal Film Resistors:

This sort of resistor is made by covering with nickel chromium [Ni,Cr]. The way toward making this resistor is like that of thin film resistors. The distinction will be in the mixes utilized.

7. Settled Resistors:

A settled resistor is one in which the estimation of its opposition can't change.

8. Non-Direct Resistors:

A non-direct resistor is a resistor that has protections that differ fundamentally with connected voltage, Temperature or light. Sorts of non-direct resistors are visitors, thermistors and photograph resistors.

2.3.6 Uses of Resistors

In spite of the fact that resistors can cause wastage of power, it has a great deal of points of interest and applications in our everyday life.

- Resistance is one of the principle fixing in the working of a light. At the point when power goes through the fiber of the knob, it consumes brilliant as it turns amazingly hot because of its littler size. The light utilized these days are exceptionally effective than the more established radiant lights.
- The comparative fiber working is the primary fixing in the working of a portion of our standard family stuffs like electric pots, electric radiators, electric showers, espresso creators, toasters, etc.
- The utilization of variable opposition is likewise useful to us. Our TV's, radios, boisterous speakers, etc. take a shot at this rule.

2.4 Capacitor

2.4.1 Introduction

The capacitor is an aloof segment and it stores the electrical vitality into an electrical field. The impact of the capacitor is known as a capacitance. It is comprised of two close conduits and isolated by the dielectric material. In the event that the plates are associated with the power, the plates amass the electric charge. One plate collects the positive charge and another plate aggregates the negative charge. The electric image of the capacitor is appeared as follows.

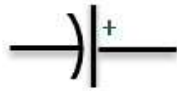


Figure 2.4.1: Capacitor Symbol

2.4.2 Different Types of Capacitors

1. Electrolytic Capacitor:

For the most part, the electrolyte capacitors are utilized when the substantial capacitor esteems are required. The thin metal film layer is utilized for one anode and for the second terminal (cathode) a semi-fluid electrolyte arrangement which is in jam or glue is utilized. The dielectric plate is a thin layer of oxide, it is created electrochemically underway with the thickness of the film and it is not exactly the ten microns.

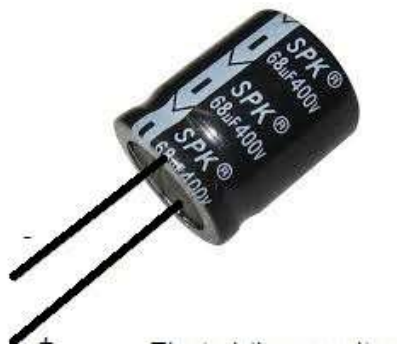


Figure 2.4.2: Electrolytic Capacitor

This protecting layer is thin, it is conceivable to make capacitors with a substantial estimation of capacitance for a physical size, which is in little and the separation between the two plates is little. The sorts of capacitors in the dominant part of electrolytic are captivated, which is DC voltage is connected to the capacitor terminal and they should be right extremity. In the event that the positive to the positive terminal and the negative to the negative terminal as an off base polarization will break the protecting oxide layer and there will be changeless harm.

2. Mica Capacitor:

This capacitor is a gathering of normal minerals and the silver mica capacitors utilize the dielectric. There are two sorts of mica capacitors which are braced capacitors and silver mica capacitor. Braced mica capacitors are considered as an old in view of their substandard trademark. The silver mica capacitors are set up by sandwiching mica sheet covered with metal on the two sides and this get together is then encased in epoxy to ensure the earth. The mica capacitors are utilized in the plan calls for steady, solid capacitor of generally little.



Figure 2.4.3: Mica Capacitor

The mica capacitors are the low misfortune capacitors, utilized at high frequencies and this capacitor is truly steady artificially, electrically, and mechanically, as a result of its particular crystalline structure restricting and it is an ordinarily layered structure. The most widely recognized utilized are Muscovite and phlogopite mica. The Muscovite mica is better in the electrical properties and the other Mica has a high-temperature obstruction.

3. Paper Capacitor:

The development of paper capacitor is between the two tin thwart sheet and they are isolated from the paper, or, oiled paper and thin waxed. The sandwich of the thin thwarts and papers at that point folded into the barrel shaped shape and after that it is encased into the plastic case. The two thin thwarts of the paper capacitors connect to the outer load.



Figure 2.4.4: Paper Capacitor

In the underlying stage if the capacitors the paper was utilized in the middle of the two foils of the capacitor, the capacitance scope of the paper capacitor is from 0.001 to 2.000micro farad and the voltage is high which is dependent upon 2000V.

4. Film Capacitor:

The film capacitors are likewise capacitors and they utilize a thin plastic as the dielectric. The film capacitor is arranged incredibly thin utilizing the modern film drawing process. In the event that the film is produced, it might be metalized rely upon the properties of a capacitor.

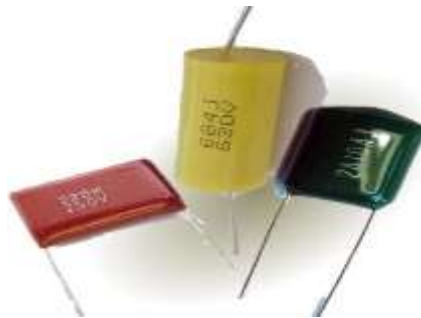


Figure 2.4.5: Film Capacitor

There are diverse sorts of film capacitors are accessible like polyester film, metallized film, polypropylene film, PTE film and polystyrene film.

5. Non-Polarized Capacitors:

The non-captivated capacitors are grouped into two kind's plastic thwart capacitor and the other one is the electrolytic non-spellbound capacitor.

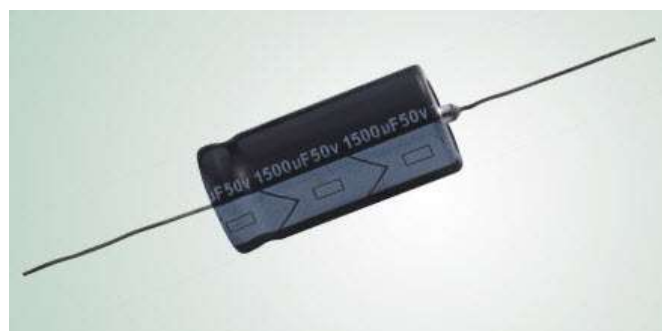


Figure 2.4.6: Non-Polarized Capacitors

The precedents are the speaker hybrid channels and power factor redress arrange. In these two applications, an expansive air conditioning voltage flag is connected over the capacitor.

6. Ceramic Capacitor:

The clay capacitors are the capacitors and utilize the artistic material as a dielectric. The earthenware production are one of the primary materials to use in the generation of capacitors as an encasing.

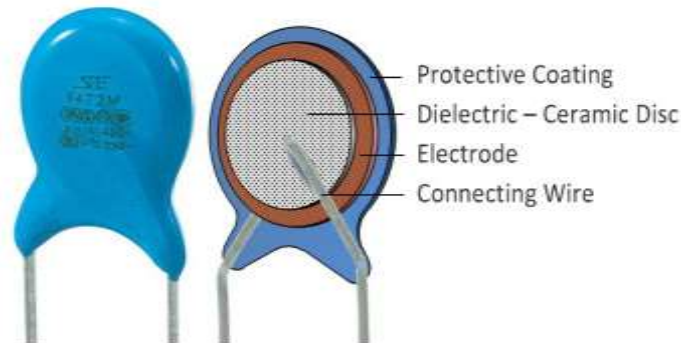


Figure 2.4.7: Ceramic Capacitor

There are numerous geometries are utilized in the earthenware capacitors and some of them are the artistic rounded capacitor, boundary layer capacitors are out of date in view of their size, parasitic impacts or electrical attributes. The two regular kinds of clay capacitors are multilayer artistic capacitor (MLCC) and fired plate capacitor.

2.4.3 Uses of Capacitors

Capacitors are utilized regularly and valuable as an electronic part in the cutting edge circuits and gadgets. The capacitor has a long history and use with over 250 years back the capacitors are the most seasoned electronic part being examined, structured, created and utilized. With further innovation, the capacitors are concocted diverse sorts dependent on their components.

In this article, we are talking about the most well known and most valuable kinds of capacitors. The capacitor is a segment and it can store vitality as electrical charge creates the electrical distinction over its plates and it resembles a little battery-powered battery.

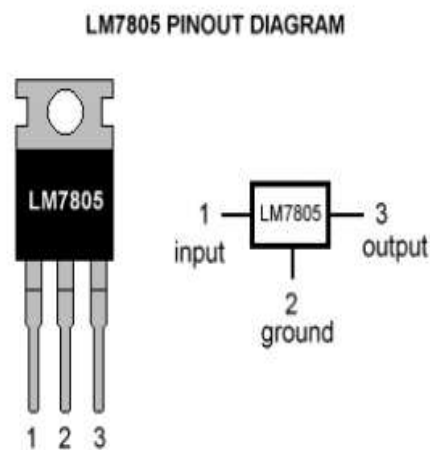
2.5 IC 7805

Voltage sources in a circuit may have changes bringing about not giving settled voltage yields. Voltage controller IC keeps up the yield voltage at a consistent esteem. 7805 IC, a voltage

controller incorporated circuit (IC) is an individual from 78xx arrangement of settled straight voltage controller ICs used to keep up such variances.

The xx in 78xx demonstrates the settled yield voltage it gives. 7805 IC furnishes +5 volts controlled power supply with arrangements to include warm sink also. How about we investigate a portion of the essential appraisals to get a review.

2.5.1 7805 IC Rating



- Input voltage range 7V- 35V
- Current rating $I_c = 1A$
- Output voltage range $V_{Max}=5.2V$, $V_{Min}=4.8V$

2.5.2 Pin Details of 7805 IC

Stick 1-Info

The capacity of this stick is to give the info voltage. It ought to be in the scope of 7V to 35V. The unregulated voltage is given to this stick for control. For 7.2V info, greatest effectiveness can be accomplished.

Stick 2-GROUND

The ground is given to this stick. For yield and information, this stick is similarly unbiased (0V).

Stick 3-Yield

This stick is utilized to take the directed yield. It will be 5V (4.8V-5.2V) the distinction between the info and yield voltage shows up as warmth. The more noteworthy the distinction between the info and yield voltage, the more warmth is produced. On the off chance that an excess of warmth is created, through high information voltage, the controller can overheat.

In the event that the controller does not have a warmth sink to disperse this warmth, it tends to be decimated and glitch. Subsequently, it is fitting to restrict the voltage to a limit of 2-3 volts higher than the yield voltage. So the two choices are, plan your circuit so the info voltage going into the controller is constrained to 2-3 volts over the yield directed voltage or place a suitable warmth sink that can productively disseminate warm.

2.6 Light Emitting Diode (LED)

2.6.1 Introduction

The lighting emanating diode is a p-n intersection diode. It is an uncommonly doped diode and made up of an extraordinary kind of semiconductors. At the point when the light radiates in the forward one-sided, at that point it is called as a light discharging diode.

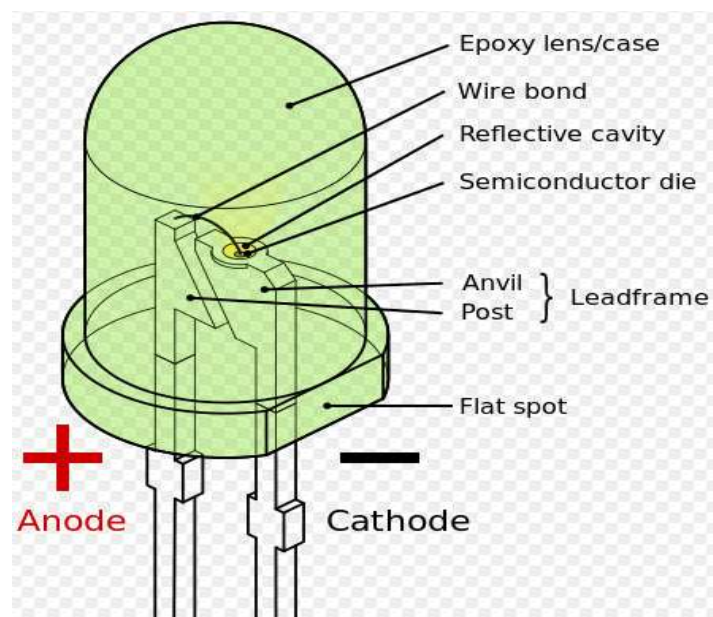


Fig 2.6.1: Light Emitting Diode

2.6.2 Working Principle of LED

The light emitting diode basically, we know as a diode. At the point when the diode is forward one-sided, at that point the electrons and gaps are moving quick over the intersection and they are consolidating always, expelling each other out. Not long after the electrons are moving from the n-type to the p-type silicon, it joins with the openings, at that point it vanishes. Subsequently it makes the entire molecule and progressively steady and it gives the little burst of vitality as a minor bundle or photon of light.

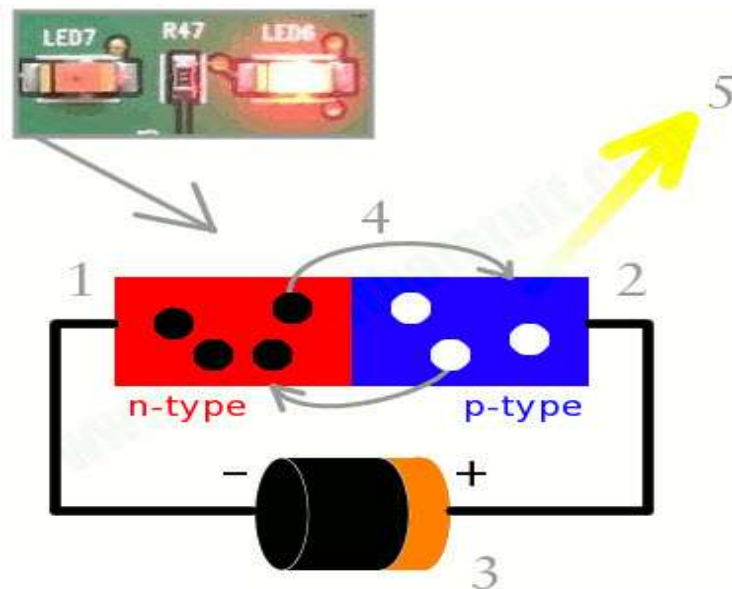


Fig 2.6.2: Working of Light Emitting Diode

The above graph indicates how the light emanating diode functions and the well-ordered procedure of the outline.

- From the outline, we can see that the N-type silicon is in red shading and it contains the electrons, they are demonstrated by the dark circles.
- The P-type silicon is in the blue shading and it contains gaps, they are shown by the white circles.
- The control supply over the p-n intersection makes the diode forward one-sided and pushing the electrons from n-type to p-type. Pushing the gaps the other way.
- Electron and openings at the intersection are joined.

2.6.3 Types of Light Emitting Diodes

There are diverse kinds of light producing diodes present and some of them are referenced underneath.

- Gallium Arsenide (GaAs) – infra-red
- Gallium Arsenide Phosphide (GaAsP) – red to infra-red, orange
- Aluminum Gallium Arsenide Phosphide (AlGaAsP) – high-brilliance red, orange-red, orange, and yellow
- Gallium Phosphide (Hole) – red, yellow and green
- Aluminum Gallium Phosphide (AlGaP) – green
- Gallium Nitride (GaN) – green, emerald green
- Gallium Indium Nitride (GaInN) – close bright, somewhat blue green and blue
- Silicon Carbide (SiC) – blue as a substrate
- Zinc Selenite (ZnSe) – blue
- Aluminum Gallium Nitride (AlGaIn) – bright

2.6.4 LED Working Principle

A Diode comprises of two semiconducting materials p-type material and n-type material. By associating these two kinds of materials, a p-n junction shapes. At the point when p-n junction is forward one-sided, the larger part bearers either electrons or openings begin moving over the junction. As appeared in the figure over, the electrons begin moving from the n locale and the openings begin moving from the p district. When they moved from their areas they begin to recombine over the exhaustion district. Free electrons will stay in the conduction band of vitality level while openings stay in the valence band of vitality level. The vitality dimension of the electrons is high than openings since electrons are more versatile than gaps for example current conduction because of electrons are more. Amid the recombination of electrons and gaps, some bit of vitality must be dispersed or discharged as warmth and light. Keep in mind forget that the dominant part of light is delivered from the junction closer to the p-type locale. So diode planning is done so that this territory is kept as near the outside of the gadget to guarantee that the base measure of light is assimilated.

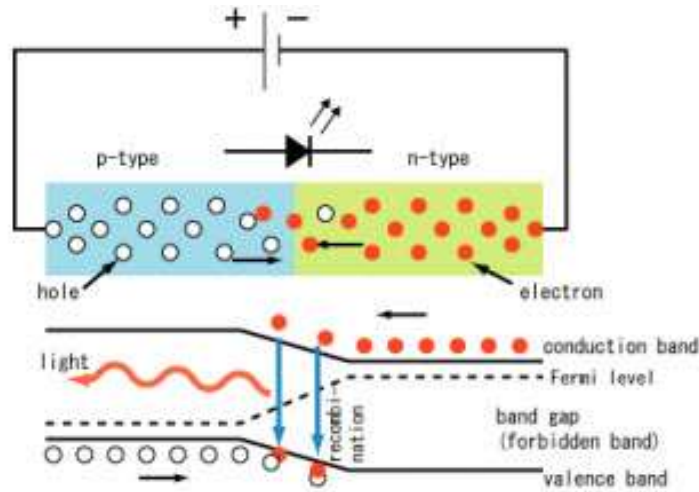


Fig 2.6.4: Working Principle of LED

The electrons disperse vitality in various structures relies upon the idea of the diode utilized. Like for silicon and germanium diodes it disperses vitality as warmth and for gallium phosphide (Hole) and gallium arsenide phosphide (GaAsP) semiconductors, it scatters vitality by emanating photons.

2.6.5 I-V Characteristics of LED

There are diverse sorts of light producing diodes are accessible in the market and there are distinctive Driven qualities which incorporate the shading light, or wavelength radiation, light force. The imperative normal for the Drove is shading.

In the beginning utilization of Drove, there is the main red shading. As the utilization of Drove is expanded with the assistance of the semiconductor procedure and doing the exploration on the new metals for Drove, the distinctive hues were framed.

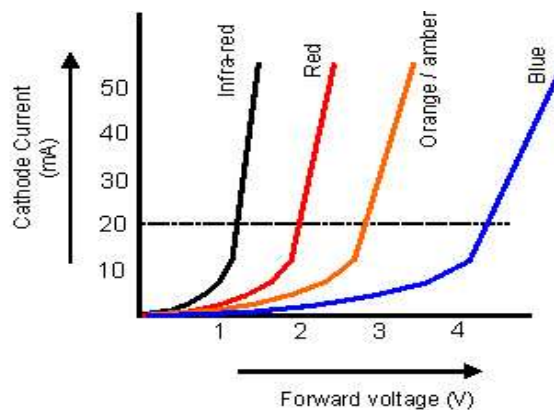


Fig 2.6.5: I-V Characteristics of LED

The accompanying diagram demonstrates the inexact bends between the forward voltage and the current. Each bend in the diagram shows the distinctive shading.

2.6.6 Advantages of LED lights

Easily controlled and programmed.

Large Life span.

High efficiency.

Low radiated heat.

High levels of brightness and intensity.

High reliability.

Low voltage and current requirements.

Less wiring required.

Low maintenance cost.

Instant lightning.

The intensity of the LED differs with the help of the microcontroller

2.7 Relay

2.7.1 Introduction

A hand-off is an electrically worked switch. Current coursing through the loop of the transfer makes an attractive field which pulls in a switch and changes the switch contacts. The loop current can be on or off so transfers have two switch positions and most have twofold toss (changeover) switch contacts as appeared in the graph.

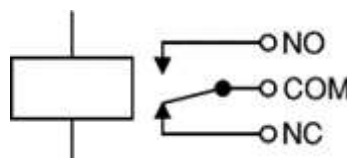


Figure 2.7.1 Circuit symbol of Relays

Transfers enable one circuit to switch a second circuit which can be totally independent from the first. For instance a low voltage battery circuit can utilize a transfer to switch a 230V Air conditioning mains circuit. There is no electrical association inside the transfer between the two circuits, the connection is attractive and mechanical.

2.7.2 How Relays Work

Transfers are switches that open and close circuits electromechanically or electronically. Transfers control one electrical circuit by opening and shutting contacts in another circuit. As transfer charts appear, when a hand-off contact is typically open (NO), there is an open contact when the hand-off isn't invigorated. At the point when a transfer contact is Regularly Shut (NC), there is a shut contact when the hand-off isn't empowered. Transfers are commonly used to switch littler flows in a control circuit and don't more often than not control devouring gadgets with the exception of little engines and Solenoids that draw low amps. In any case, transfers can "control" bigger voltages and amperes by having an intensifying impact in light of the fact that a little voltage connected to a transfers curl can result in a vast voltage being exchanged by the contacts. Defensive transfers can avert hardware harm by identifying electrical irregularities, including overcurrent, propensity, over-burdens and invert flows. Furthermore, transfers are likewise generally used to switch beginning curls, warming components, pilot lights and perceptible alerts.

2.7.3 Advantages of relays:

1. Transfers can switch air conditioning and DC, transistors can just switch DC.
2. Transfers can switch higher voltages than standard transistors.
3. Transfers are frequently a superior decision for exchanging vast flows (> 5A).
4. Transfers can switch numerous contacts without a moment's delay.

Disadvantages of relays:

1. Transfers are bulkier than transistors for exchanging little flows.
2. Transfers can't switch quickly, transistors can switch all the time.
3. Transfers utilize more power because of the present moving through their loop.

4. Transfers require more present than numerous ICs can give, so a low power transistor might be expected to switch the current for the hand-off's curl.

2.8 Battery

2.8.1 Introduction

An electric battery is a gadget comprising of at least one electrochemical cells with outer associations gave to control electrical gadgets, for example, spotlights, cell phones, and electric vehicles. At the point when a battery is providing electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal checked negative is the wellspring of electrons that when associated with an outer circuit will stream and convey vitality to an outside gadget. At the point when a battery is associated with an outside circuit, electrolytes can move as particles inside, enabling the substance responses to be finished at the different terminals thus convey vitality to the outer circuit. It is the development of those particles inside the battery which enables current to stream out of the battery to perform work. Generally the expression "battery" explicitly alluded to a gadget made out of various cells, anyway the use has developed moreover to incorporate gadgets made out of a solitary cell.

2.8.2 Working principle of battery

Power, as you presumably definitely know, is the stream of electrons through a conductive way like a wire. This way is known as a circuit. Batteries have three sections, an anode (-), a cathode (+), and the electrolyte. The cathode and anode (the positive and negative sides at either end of a conventional battery) are snared to an electrical circuit.

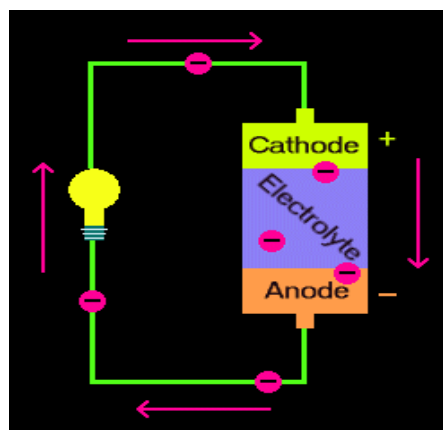


Figure 2.8.2 working principle of battery.

The synthetic responses in the battery causes a development of electrons at the anode. This outcomes in an electrical contrast between the anode and the cathode. You can think about this distinction as an insecure develop of the electrons. The electrons needs to adjust themselves to dispose of this distinction. Be that as it may, they do this with a particular goal in mind. Electrons repulse one another and attempt to go to a place with less electrons.

In a battery, the main place to go is to the cathode. Be that as it may, the electrolyte shields the electrons from going straight from the anode to the cathode inside the battery. At the point when the circuit is shut (a wire associates the cathode and the anode) the electrons will have the capacity to get to the cathode. In the image over, the electrons experience the wire, lighting the light en route. This is one method for portraying how electrical potential makes electrons move through the circuit.

Be that as it may, these electrochemical procedures change the synthetic substances in anode and cathode to make them quit providing electrons. So there is a restricted measure of intensity accessible in a battery.

2.8.3 Store energy in a battery

A battery for the reasons for this clarification will be a gadget that can store vitality in a substance frame and convert that put away synthetic vitality into electrical vitality when required.

Vitality can't be made or demolished, yet it very well may be spared in different structures. One approach to store it is as substance vitality in a battery. At the point when associated in a circuit, vitality put away in the battery is discharged to create power.

In a sun oriented board, Sun powered boards can't create vitality around evening time or amid shady periods. Be that as it may, battery-powered batteries can store power: the photovoltaic boards charge the battery amid the day, and this power can be attracted upon the night.

2.9 Solar panel

2.9.1 Introduction

Sun based boards are gadgets that convert light into power. They are designated "sun powered" boards on the grounds that more often than not, the most dominant wellspring of light

accessible is the Sun, called Sol by cosmologists. A few researchers call them photovoltaic which implies, essentially, "light-power."



Figure 2.9.1 Solar panel

A sun powered board is a gathering of sun based cells. Heaps of little sun based cells spread over a substantial territory can cooperate to give enough capacity to be helpful. The more light that hits a cell, the greater power it produces, so rocket are generally structured with sun oriented boards that can generally be pointed at the Sun even as whatever remains of the body of the shuttle moves around, much as a tank turret can be pointed freely of where the tank is going. DS1's sun based cells are significantly more effective than standard sun based boards made for satellites since they utilize sun based concentrators.

The sun based boards are made of sun based cells. A cell is a little plate of a semiconductor like silicon. They are connected by wire to a circuit. As light strikes the semiconductor, light is changed over into power that courses through the circuit. When the light is evacuated, the sun powered cell quits delivering.

2.9.2 Theory and Construction

Photovoltaic modules utilize light vitality (photons) from the Sun to create power through the photovoltaic impact. The greater part of modules use wafer-based crystalline silicon cells or thin-film cells. The basic (stack conveying) individual from a module can either be the best layer or the back layer. Cells should likewise be shielded from mechanical harm and dampness. Most modules are unbending, yet semi-adaptable ones are accessible, in view of

thin-film cells. The phones must be associated electrically in arrangement, to each other. Remotely, the vast majority of photovoltaic modules use MC4connectors type to encourage simple weatherproof associations with whatever remains of the framework.

Modules electrical associations are made in arrangement to accomplish an ideal yield voltage as well as in parallel to give an ideal flow capacity. The leading wires that take the current off the modules may contain silver, copper or other non-attractive conductive change metals. Sidestep diodes might be joined or utilized remotely, if there should be an occurrence of fractional module shading, to boost the yield of module areas still enlightened.

Some unique sun based PV modules incorporate concentrators in which light is engaged by focal points or mirrors onto littler cells. This empowers the utilization of cells with a surprising expense for each unit territory, (for example, gallium arsenide) in a practical way.

2.9.3 Working principle of solar panel

A sun powered concentrator utilizes focal points, called Fresnel focal points, which take an extensive zone of daylight and direct it towards a particular spot by bowing the beams of light and centering them. A few people a similar guideline when they utilize an amplifying focal point to concentrate the Sun's beams on a heap of fuel or paper to begin fires.

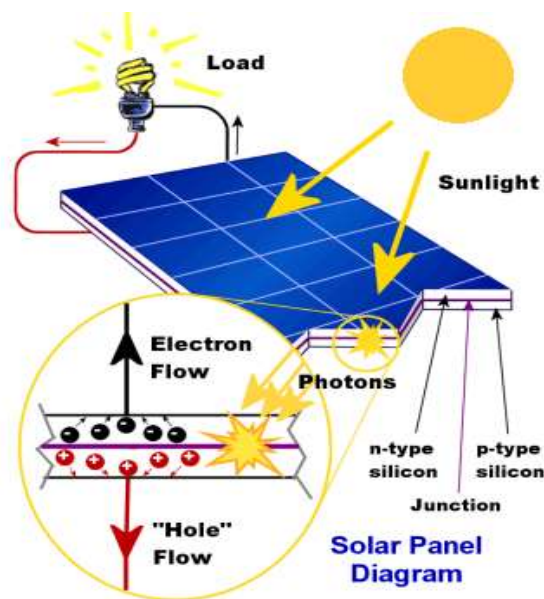


Figure: 2.9.3 working principle of Fresnel lenses

Fresnel focal points are molded like a shoot board, with concentric rings of crystals around a focal point that is an amplifying glass. These highlights let them center dissipated light from the Sun into a tight shaft.

Sun oriented concentrators put one of these focal points over each sun based cell. This makes significantly more centered light go to each sun oriented cell, making the cells endlessly increasingly productive. Concentrators work best when there is a solitary wellspring of light and the concentrator can be pointed comfortable. This is perfect in space, where the Sun is a solitary light source.

The sun based concentrators additionally have the favorable position that the sun powered cells can be separated more remote separated since light can be centered around every cell. This implies less sun powered cells should be made and the boards cost less to develop. Furthermore, specialists would now be able to put thick glass or plastic over the sun based board to shield it from micrometeorites, something they would experience serious difficulties doing on the off chance that they needed to stress over sufficiently enabling light to achieve the sun based cells.

2.9.4 Efficiency

Contingent upon development, photovoltaic modules can deliver power from a scope of frequencies of light, yet more often than not can't cover the whole sun oriented range. Subsequently, a significant part of the occurrence daylight vitality is squandered by sun oriented modules, and they can give far higher efficiencies whenever lit up with monochromatic light. Hence, another plan idea is to part the light into various wavelength goes and coordinate the shafts onto diverse cells tuned to those reaches. This has been anticipated to be fit for raising productivity by half. Researchers from Spectrolab, an auxiliary of Boeing, have detailed improvement of multi-intersection sun powered cells with a proficiency of over 40%, another world record for sun powered photovoltaic cells.

Efficiencies of sunlight based board can be determined by MPP (most extreme power point) estimation of sun oriented boards. Sunlight based inverters convert the DC capacity to air conditioning power by performing MPPT process: sun oriented inverter tests the yield Power (I-V bend) from the sun based cell and applies the best possible opposition (stack) to sun based cells to acquire most extreme power. MPP of the sun based board comprises of MPP voltage and MPP current.it is a limit of the sun powered board and the higher esteem can make higher MPP.

Table 2: Daily Average of Bright Sunshine Hours at Dhaka City

Month	Daily Mean	Maximum	Minimum
January	8.7	9.9	7.5
February	9.1	10.7	7.7
March	8.8	10.1	7.5
April	8.9	10.2	7.8
May	8.2	9.7	5.7
June	4.9	7.3	3.8
July	5.1	6.7	2.6
August	5.8	7.1	4.1
September	6.0	8.5	4.8
October	7.6	9.2	6.5
November	8.6	9.9	7.0
December	8.9	10.2	7.4
Average	7.55	9.13	6.03

2.9.5 Performance & Degradation

Module execution is for the most part appraised under standard test conditions (STC): irradiance of 1,000 W/m², sun oriented range of AM 1.5 and module temperature at 25°C.

Electrical qualities incorporate ostensible power (P_{MAX}, estimated in W), open circuit voltage (V_{OC}), cut off (I_{SC}, estimated in amperes), most extreme power voltage (V_{MPP}), greatest power flow (I_{MPP}), top power, (watt-pinnacle, W_p), and module effectiveness (%).

Ostensible voltage alludes to the voltage of the battery that the module is most appropriate to charge; this is a remaining term from the days when sunlight based modules were just used to charge batteries. The real voltage yield of the module changes as lighting, temperature and load conditions change, so there will never be one explicit voltage at which the module works. Ostensible voltage permits clients, initially, to ensure the module is good with a given framework.

Open circuit voltage or VOC is the most extreme voltage that the module can create when not associated with an electrical circuit or framework. VOC can be estimated with a voltmeter straightforwardly on a lit up module's terminals or on its detached link.

2.9.6 Maintenance

Sun oriented board change productivity, normally in the 20% territory, is decreased by residue, grime, dust, and different particulates that amass on the sun based board. "A grimy sun based board can decrease its capacity abilities by up to 30% in high residue/dust or desert regions", says Seamus Curran, relate educator of material science at the College of Houston and executive of the Organization for Nano Vitality, which spends significant time in the structure, building, and gathering of nanostructures.

Paying to have sun powered boards cleaned is regularly not a decent venture; scientists discovered boards that hadn't been cleaned, or rained on, for 145 days amid a mid year dry season in California, lost just 7.4% of their effectiveness. In general, for a run of the mill private nearby planetary group of 5 kW, washing boards part of the way through the late spring would convert into a simple \$20 gain in power creation until the mid year dry spell closes—in around 2 ½ months. For bigger business housetop frameworks, the monetary misfortunes are greater yet at the same time once in a while enough to warrant the expense of washing the boards. By and large, boards lost somewhat less than 0.05% of their general effectiveness every day.

2.9.7 Electricity Crisis in Bangladesh

In Bangladesh, the genuine interest supply hole of power is one of the biggest bottlenecks for monetary development. As the limit of intensity supply offices is just around 4,000 MW contrasted with the pinnacle power request of 6,100 MW, they must choose the option to have booked load-shedding of power supply amid the pinnacle time (JICA, 2010). Bangladesh is losing at any rate 3.5% of GDP (Gross domestic product) because of the deficiency of Intensity supply as indicated by an examination report of Place for Approach Exchange (CPD) (Ahmed, R., 2010)

In rundown the present power situation of Bangladesh is (Source: Rahman, M. M., 2009):

Key Actualities:

80 Million Individuals don't approach power

Rest 60 Million are getting untrustworthy power

Load shed up to 1500 MW amid sweltering summer days

Introduced Limit:

5450 MW (Jan 01, 2009)

BPDB: 3809 MW

IPP: 1641 MW

Request and Supply:

Pinnacle Request: 6000 MW (Summer 2009) Age Limit: 4500 MW (Summer 2009) Load Shedding: 1000-1500 MW (Summer 2009) Per Capita Utilization of Power: 149 kWh/annum (FY 2008) Access to Power: 45% (FY 2008).

2.9.8 Applications

There are numerous down to earth applications for the utilization of sunlight based boards or photovoltaic. It would first be able to be utilized in agribusiness as a power hotspot for water system. In human services sunlight based boards can be utilized to refrigerate restorative supplies. It can likewise be utilized for foundation. PV modules are utilized in photovoltaic frameworks and incorporate a vast assortment of electric gadgets:

Photovoltaic power stations

Housetop sun oriented PV frameworks

Independent PV frameworks

Sun powered half and half power frameworks

Concentrated photovoltaic

Sun based planes

Sun based siphoned lasers

Sun based vehicles

Sun based boards on space artworks and space stations.

2.10 Diode 1n4007

2.10.1 Introduction

A rectifier diode is utilized as a restricted check valve. Since these diodes just enable electrical flow to stream one way, they are utilized to change over air conditioning power into DC control. While building a rectifier, it is essential to pick the right diode for the activity; generally, the circuit may wind up harmed. Fortunately, a 1N4007 diode is electrically perfect with other rectifier diodes, and can be utilized as a swap for any diode in the 1N400x family.

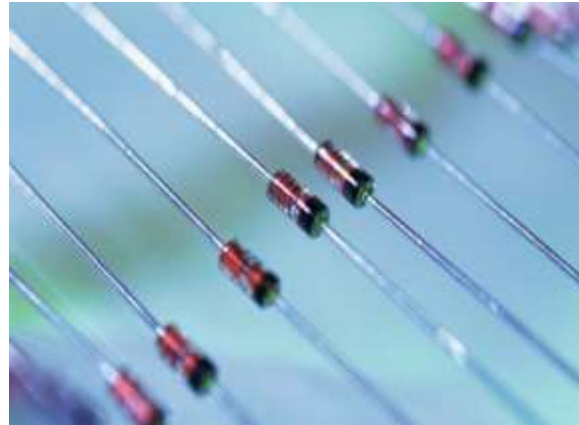


Figure 2.10.1 Diode 1n4007

2.10.2 Features

Case: Epoxy, Formed

Weight: 0.4 gram (roughly)

Completion: Every Outside Surface Consumption Safe and Terminal Leads are Promptly Bind capable

Lead and Mounting Surface Temperature for Fastening Purposes: 260 C Max. For 10 Seconds, 1/16 from case

Transported in plastic packs, 1000 for every sack. Accessible Tape and Reeled, 5000 for every reel, by including a "RL" postfix to the part number

Accessible in Fan-Crease Bundling, 3000 for every crate, by including a "FF" addition to the part number

Extremity: Cathode Shown by Extremity Band

Checking: 1N4001, 1N4002, 1N4003, 1N4004, 1N4005, 1N4006, 1N4007 sans PB Bundles are Accessible

2.10.3 Characteristics of 1N4007 diode

- Maximum Intermittent Pinnacle Turn around Voltage - 1000 V
- Maximum Normal Forward Yield Current - 1 A
- Maximum Forward Voltage Drop per component at 1.0A DC - 1.1 V
- Typical Intersection Capacitance 15 pF
- Package - DO-41
- Weight 0.33 grams
- Operating and Capacity Temperature Range - 65...+175 °C

2.10.4 Polarity & Pin out

1N4007 diode has a cathode (-) and anode (+). In the schematic image, the tip of the triangle with the line over it is the cathode. The cathode is set apart on the body of a diode by a band as appeared as follows.

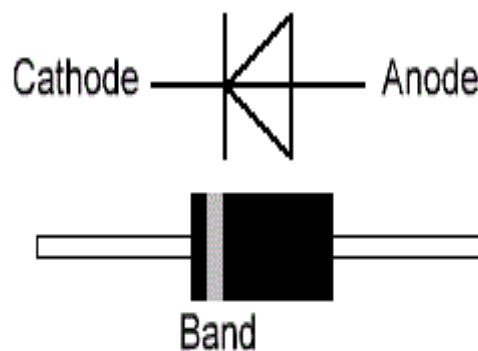


Figure: 2.10.3 Circuit symbol of diode 1N4007

Diode extremity Current can spill out of the anode to the cathode just and never from the cathode to the anode - has 1N4007 diode resembled a restricted valve.

2.11 Arduino Pro min:

2.11.1 Introduction

The Arduino Smaller than usual Professional 05 is a little microcontroller board initially dependent on the ATmega168, yet now provided with the 328. Intended for use on breadboards and when space is at a higher cost than expected. It has 14 advanced data sources/yield pins (of which 6 can be utilized as PWM yields), 8 simple information sources, and a 16 MHZ precious stone oscillator. It very well may be modified with the USB sequential connector or other USB or RS232 to TTL sequential connector. The new Smaller than expected (correction 05) has another bundle for the ATmega328, which empowers all segments to be on the highest point of the board. It additionally has an on board reset catch. The new form has a similar stick arrangement as modification 04. Arduino is an open-source PC equipment and programming organization, venture and client network that plans and produces microcontroller-based units for building advanced gadgets and intuitive items that can detect and control the physical world. The first Arduino was presented in 2005, meaning to give an economical and simple route for tenderfoots and experts to make gadgets that associate with their condition utilizing sensors and actuators. Basic instances of such gadgets expected for fledgling specialists incorporate basic robots, indoor regulators, and movement locators. Arduino sheets are accessible economically in preassembled shape, or as do it without anyone else's help units. The equipment plan determinations are straightforwardly accessible, permitting the Arduino sheets to be fabricated by anybody. Promotion natural product Ventures assessed in mid-2011 that more than 300,000 authority Arduinos has been monetarily created, and in 2013 that 700,000 authority sheets were in client's grasp. The Arduino Smaller than expected is an extremely reduced adaptation of the Arduino Nano without an on board USB to sequential association.

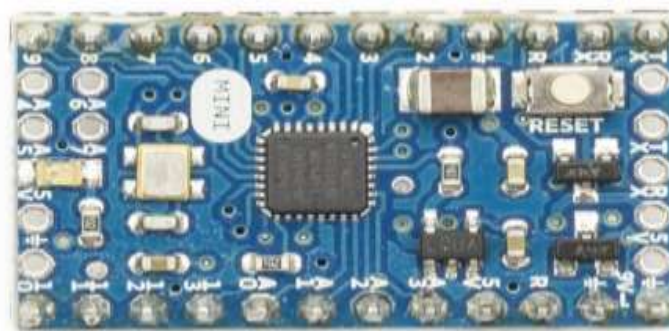


Figure: 2.11.1 Arduino pro min 05.

2.11.2 Configuration

Microcontroller	ATmega328
Operating Voltage	5V

Input Voltage	7-9 V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	8 (of which 4 are broken out onto pins)
DC Current per I/O Pin	40 mA
Flash Memory	32 KB (of which 2 KB used by boot loader)
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz
Length	30 mm
Width	18 mm

2.11.3 Programming

The Arduino Smaller than usual can be modified with the Arduino programming. To program the Arduino Small, it will be require a USB Sequential connector or other USB or RS232 to TTL sequential connector. The ATmega328 on the Arduino Scaled down comes pre consumed with a boot loader that permits to transfer new code to it without the utilization of an in-framework developer. The boot loader imparts utilizing the first STK500 convention (reference, C header documents). It can likewise sidestep the boot loader and program the ATmega328 with ICSP (In-Circuit Sequential Programming). Boot stacking the Smaller than normal for data on wiring up an ICSP header to the Scaled down and the software engineer for guidelines on utilizing a developer to transfer a draw.

2.11.4 Input and Output

Every one of the 14 advanced sticks on the little can be utilized as an information or yield. They work at 5 volts. Each stick can give or get a limit of 40 Mama and has an inner draw up resistor (detached of course) of 20-50 k Ohms. Pins 3, 5, 6, 9, 10, and 11 can give PWM yield. On the off chance that anything other than the Smaller than normal USB (or other) connector is associated with pins 0 and 1, it will meddle with the USB correspondence, keeping new code from being transferred or other correspondence with the PC. The Small scale has 8 simple data sources, every one of

which give 10 bits of goals (for example 1024 unique qualities). Information sources 0 to 3 are broken out onto pins; input 4 to 7 require fastening into the gave openings. Naturally the simple information sources measure from ground to 5 volts, however is it conceivable to change the upper end of their range utilizing the AREF stick and some low-level code.

2.11.5 Pin Configurations

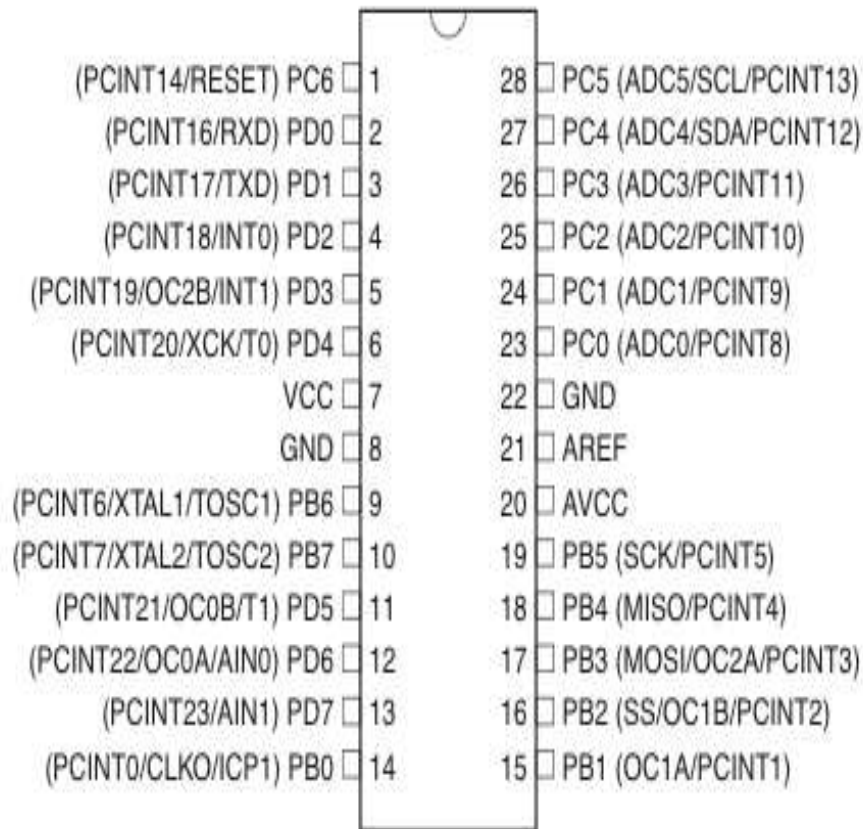


Figure 2.11.5 Pin out ATmega48A/PA/88A/PA/168A/PA/328/P

Table 2.1. 32UFPGA – Pin out ATmega48A/48PA/88A/88PA/168A/168PA

	1	2	3	4	5	6
A	PD2	PD1	PC6	PC4	PC2	PC1
B	PD3	PD4	PD0	PC5	PC3	PC0
C	GND	GND			ADC7	GND
D	VDD	VDD			AREF	ADC6
E	PB6	PD6	PB0	PB2	AVDD	PB5
F	PB7	PD5	PD7	PB1	PB3	PB4

2.11.6 Overview

The ATmega48A/Dad/88A/Dad/168A/Dad/328/P is a low-control CMOS 8-bit microcontroller dependent on the AVR improved RISC engineering. By executing ground-breaking guidelines in a solitary clock cycle, the ATmega48A/Dad/88A/Dad/168A/Dad/328/P accomplishes throughputs moving toward 1 MIPS for each MHz enabling the framework Originator to upgrade control utilization as opposed to handling speed.

2.11.7 Block Diagram

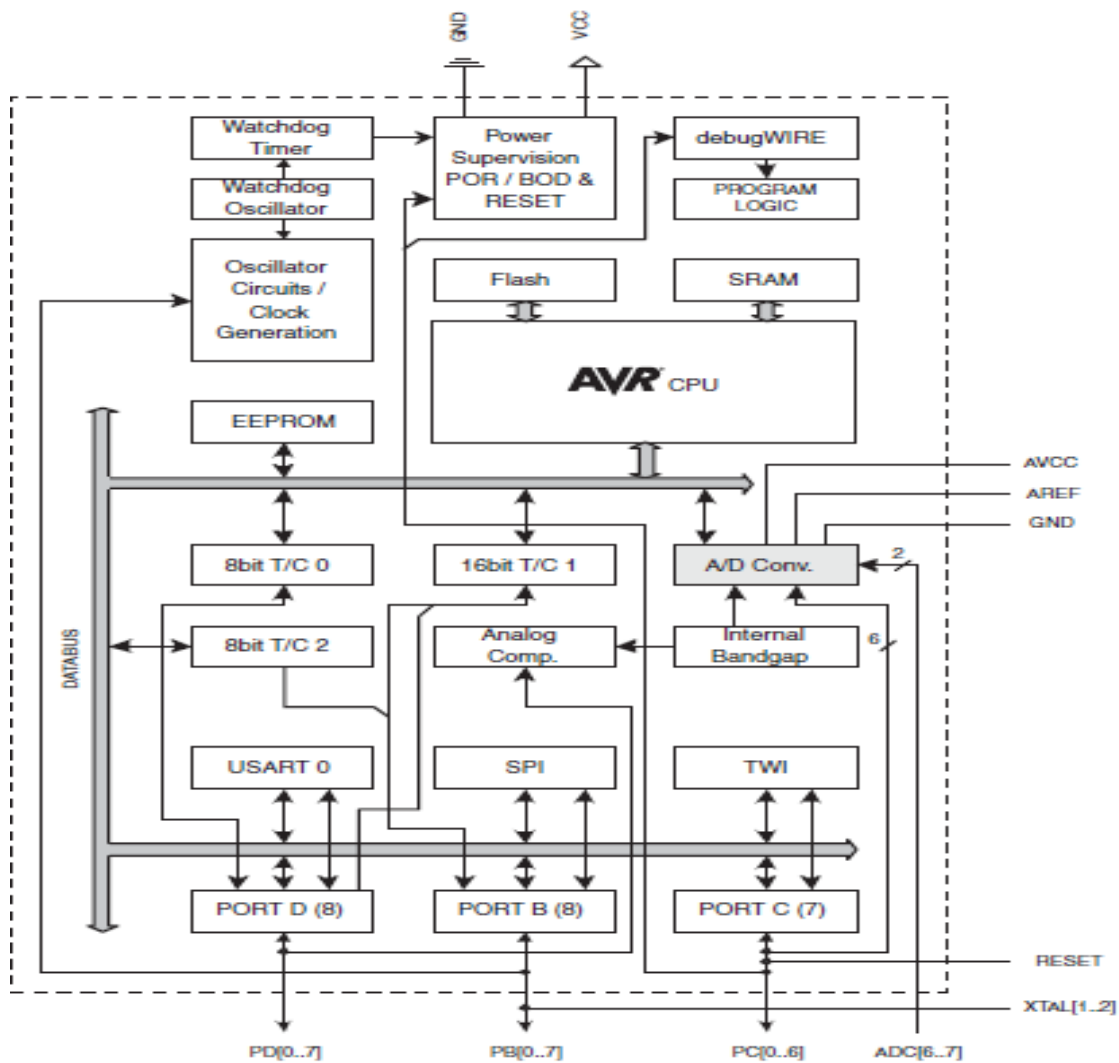


Figure no 2.11.7

The AVR center consolidates a rich guidance set with 32 universally useful working registers. All the 32 registers are specifically associated with the Number juggling Rationale Unit (ALU), enabling two autonomous registers to be gotten to in one single guidance executed in one clock cycle. The subsequent engineering is more code effective while accomplishing throughputs up to multiple times quicker than regular CISC microcontrollers.

The ATmega48A/Dad/88A/Dad/168A/Dad/328/P gives the accompanying highlights: 4K/8Kbytes of In-Framework Programmable Glimmer with Read-While-Compose abilities, 256/512/512/1Kbytes EEPROM, 512/1K/1K/2Kbytes SRAM, 23 broadly useful I/O lines, 32 universally useful working registers, three adaptable Clock/Counters with think about modes, interior and outside intrudes on, a sequential programmable USART, a byte-arranged 2-wire Sequential Interface, a SPI

Sequential port, a 6-channel 10-bit ADC (8 diverts in TQFP and QFN/MLF bundles), a programmable Guard dog Clock with inward Oscillator, and five programming selectable power sparing modes. The Inert mode stops the CPU while permitting the SRAM, Clock/Counters, USART, 2-wire Sequential Interface, SPI port, and intrude on framework to keep working. The Shutdown mode spares the enlist substance however solidifies the Oscillator, incapacitating all other chip capacities until the following hinder or equipment reset. In Power-spare mode, the no concurrent clock keeps on running, enabling the client to keep up a clock base while whatever is left of the gadget is dozing. The ADC Commotion Decrease mode stops the CPU and all I/O modules aside from no concurrent clock and

ADC, to limit exchanging clamor amid ADC changes. In Reserve mode, the precious stone/resonator Oscillator is running while whatever is left of the gadget is dozing. This permits quick start-up joined with low power utilization. Atmel offers the Q Contact library for installing capacitive touch catches, sliders and wheels usefulness into AVR microcontrollers. The protected charge-exchange flag procurement offers hearty detecting and incorporates completely de ricocheted detailing of touch keys and incorporates Nearby Key Concealment innovation for unambiguous identification of key occasions. The simple to-utilize Q Contact Suite device bind enables you to investigate, create and troubleshoot your very own touch applications.

The gadget is produced utilizing Atmel's high thickness non-unpredictable memory innovation. The On-chip ISP Streak enables the program memory to be reinvented In-Framework through a SPI sequential interface, by a traditional non-unstable memory developer, or by an On-chip Boot program running on the AVR center Programming in the Boot Streak segment will keep on running while the Application Streak area is refreshed, giving genuine Read-While-Compose task. By consolidating a 8-bit RISC CPU with In-Framework Self-Programmable Glimmer on a solid chip, the Atmel ATmega48A/Dad/88A/Dad/168A/Dad/328/P is a ground-breaking microcontroller that gives an exceedingly adaptable and financially savvy answer for some inserted control applications.

The ATmega48A/Dad/88A/Dad/168A/Dad/328/P AVR is upheld with a full suite of program and framework improvement instruments including: C Compilers, Large scale Constructing agents, program Debugger/Test systems, In-Circuit Emulators, and Assessment units.

2.12 Transistor 2n2222A

2.12.1 Introduction

The 2N2222 is a typical NPN bipolar junction transistor (BJT) utilized for universally useful low-control intensifying or exchanging applications. It is intended for low to medium current, low power, medium voltage, and can work at reasonably high speeds. It was initially made in the TO-18 metal can as appeared in the image.

The 2N2222 is viewed as an exceptionally regular transistor, and is utilized as a model of a NPN transistor. It is every now and again utilized as a little flag transistor, and it remains a little universally useful transistor of persisting ubiquity.

The 2N2222 was a piece of a group of gadgets portrayed by Motorola at a 1962 Rage tradition. From that point forward it has been made by numerous semiconductor organizations, for instance, Texas Instruments.

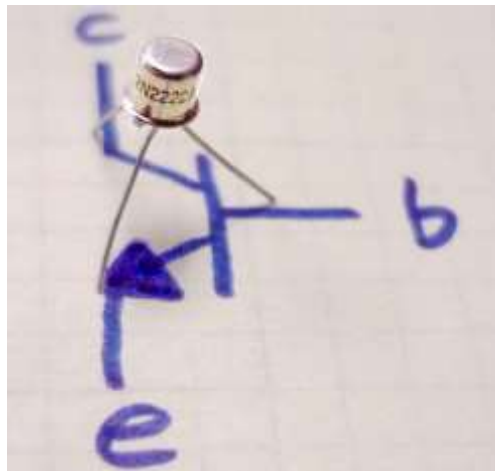


Fig 2.12.1 Transistor 2n2222A

2.12.2 Specification

The JEDEC enlistment of a gadget number guarantees specific appraised qualities will be met by all parts offered under that number. JEDEC enlisted parameters incorporate framework measurements, little flag current gain, change recurrence, most extreme qualities for voltage withstand, current rating, control scattering and temperature rating, and others, gauged under standard test conditions.

Other part numbers will have diverse parameters. The correct particulars rely upon the maker, case type, and variety. Thusly, it is vital to allude to the datasheet for the correct part number and producer.

Manufacturer	V_{ce}	I_c	P_D	f_T
ST Microelectronics 2N2222A	40 V	800 mA	500 mW/1.8 W	300 MHz

2.12.3 Features

Type Designator: 2N2222

Material of Transistor: Si

Extremity: NPN

Most extreme Gatherer Power Scattering (P_c): 0.5 W

Most extreme Gatherer Base Voltage |V_{cb}|: 60 V

Most extreme Gatherer Producer Voltage |V_{ce}|: 30 V

Most extreme Producer Base Voltage |V_{eb}|: 5 V

Most extreme Gatherer Current |I_{c max}|: 0.8 A

Max. Working Intersection Temperature (T_j): 175 °C

Change Recurrence (f_t): 250 MHz

Gatherer Capacitance (C_c): 8 pF

Forward Current Exchange Proportion (hFE), MIN: 100

Clamor Figure, dB: -

Bundle: TO18

2.13 Summary

In this task we utilize some significant hardware's and some various segments. A few parts are disregarded like wire. Those are not basically to portray. We depict every one of the segments quickly in this part. Each hardware's highlights, types and working rule are depict in past. That is the reason we can likewise find out pretty much every one of the segments that we utilized in our undertaking.

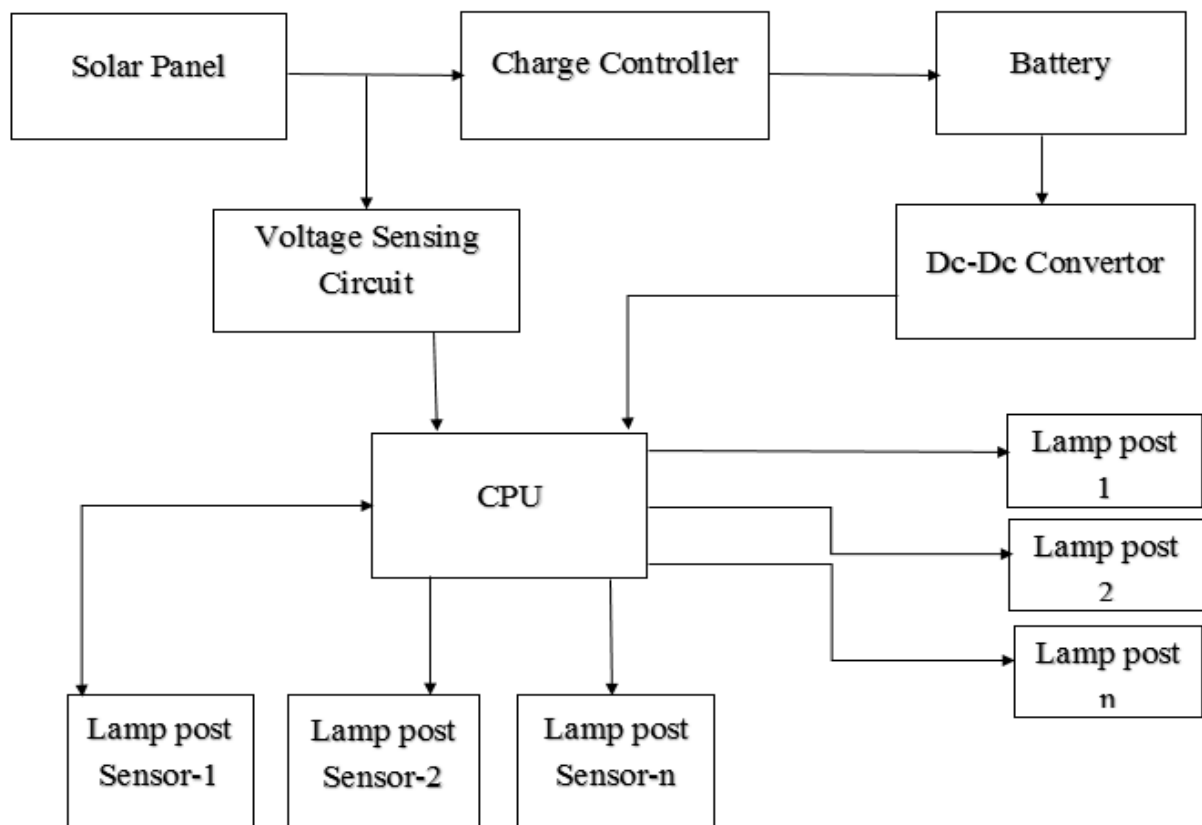
CHAPTER 3

DESIGN AND CONSTRUCTION

3.1 Introduction

In this section present square outline and circuit graph of sun oriented Drove Road light with auto power control. At that point we talk about quickly about working standard of this undertaking. Battery were charged from sun based in day time and its release in evening time. This procedure is extremely smooth and financially savvy. This procedure portrayed quickly in underneath.

3.2 Block Diagram:



3.3 Circuit Diagram:

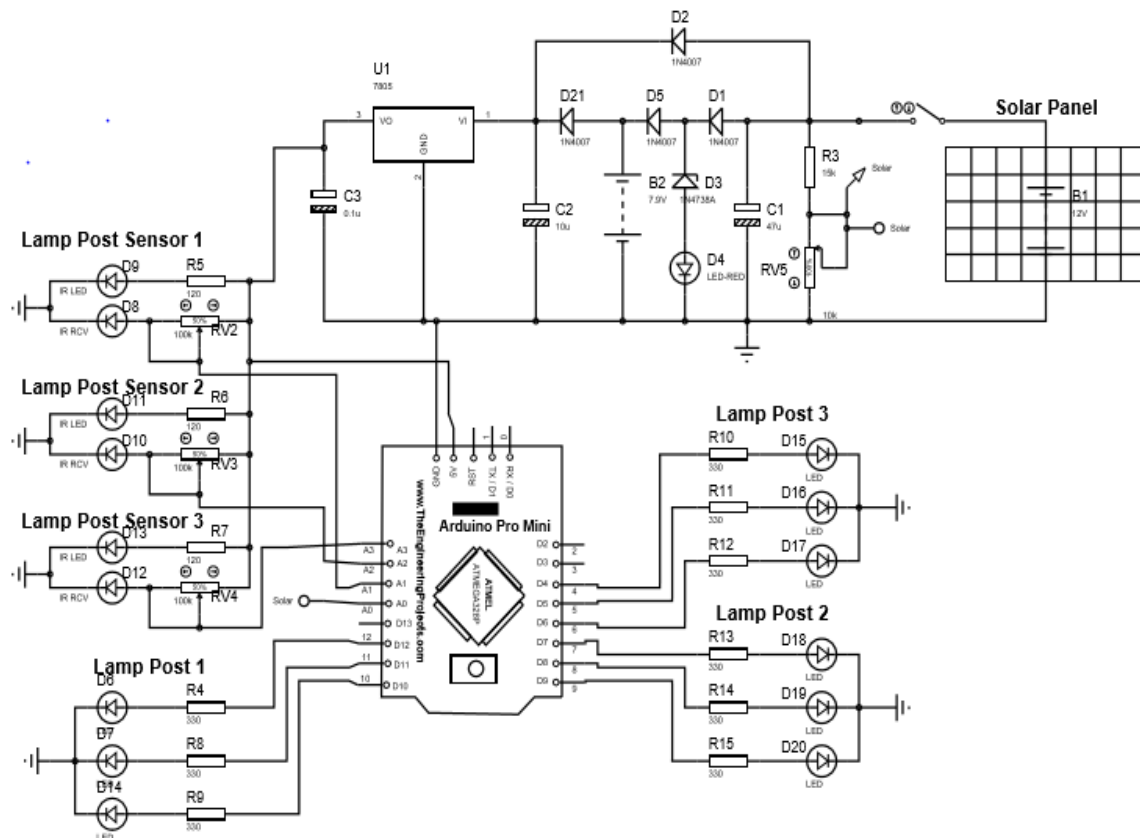


Figure 3.2: Circuit diagram

3.4 Working principle:

At the point when switch ON condition, in full daylight we will get greatest 12v in sun based board. What's more, when OFF condition (No daylight) we will get 0v in sun powered board. It will depends in daylight that what voltages we will get. Initially, we think about that we get 12v yield from sun powered. From circuit outline, this 12v will stream in the primary way. There is a diode D3 in this way. From diode qualities, we realize that every diode will drops 0.7v. So now we got 11.3v in this way and it will be 11.3v in wherever of this wire. Presently we witness what will in second way, this 12v will stream and 0.7v drop in diode D1. At that point 0.7v drop in diode D5 and .07 drops in D2. So we get 9.9v from this branch yet this is low voltage contrast with the primary branch voltage.

Presently as indicated by diode attributes, we realize that if low voltage stream in anode side and high voltages stream in cathode side, at that point it will be revers predisposition and diode will be open. So there will be no present streams from second branch and every one of the ebbs and flows will stream in first way. At that point current goes through the controller and running the framework. Adjacent to this the 8v battery will charge effectively on the grounds that we get 10.6v over the battery. We require more than 9.4v to charge the battery since it goes from the sun powered through two diodes and every diode will drops 0.7v crosswise over it.

Presently when OFF or night condition, 0v will streams over the diode D1 and D5 and it will be programmed open and no voltage will streams. At that point 8v spill out of the battery and when it passes the diode D2 it will drops 0.7 volt, so we get 7.3v in this way. Also, the principal way will turn around one-sided so no voltage stream towards the way. This 7.3v goes through the voltage controller and its believer 5v. At that point it running the microcontroller. Over the battery there is a zener diode R1 parallel and there is a Driven RED associated. The zener diode sparkle in 7v and the Drove sparkle in surmised 2v. So it have to surmise 9v to sparkle. In close circuit, we measure 10.5v from the sun based. Despite the fact that it will drop 0.7v in D1, it get 9.8v over this wire and it effectively sparkle the Drove light.

The voltage controller 7805 just can detect voltage up to 7-24v, and it changes over to 5v to run the controller. The capacitor are associates with evacuate the voltage swell. The R2 and R3 are two opposition that sense day or evening time. Beneath the 5v it sense that it will be night and over the 5v it sense day. It set up from the microcontroller.

Presently from light post sensor 1, the R5 opposition has one side associated with 5v yield from controller and another side is associated with the anode side of IR Drove. Its cathode is associated with the ground. In underneath there is a variable obstruction RV2 of 100k whose one side is associated with the Vcc and opposite side is associated with the anode side of photograph diode D8. The cathode of photodiode is associated with the ground. A wire is associated among resistor and photograph diode, It go to the microcontroller's A3 stick. The light post sensor 2 and light post sensor 3 has same association as light post 1.

At the point when objects like vehicle, individuals and so on is going through the IR Driven it has mirror a construed light to the sensor. The voltage of lights are relies on the reflected light. At the point when object goes through it, the lights are sparkling and when the article are passed, the lights would be off one-by-one.

We partitioned 30 sec in three timetable of evening every one of 10 sec. presently in light post, there will be 5v supply in initial 10 sec. at that point all lights are shining. It would be just 0v and 5v. In typical condition, one light was given 5v supply and 0v for the other two lights of every light post. At the point when there is object the others two lights get 5v supply and those are sparkling. So also when objects are crossed these two lights get 0v supplies and it winds up off.

3.5 summary

Since our nation has power lack, in the event that we utilize this idea, it will wipe out the vitality emergency to a bigger degree. In rainstorm season sun powered light is progressively troublesome with the goal that we utilize additional batteries in arrangement to spare more power. To enhance lighting we use Drove board. The change control is fundamental so as to accomplish security and increment the limit of the battery. In urban areas right now a large number of road lights are worked and the yearly power upkeep cost is high.

CHAPTER 4

ADVANTAGE DISADVANTAGE AND APPLICATION

4.1 Advantages:

1. Sun based Road light are autonomous of the solidarity matrix. Thus, the activity costs is limited.
2. Sun based Road lights are Require considerably less upkeep contrast with ordinary road lights.
3. Since outside wire are killed, danger of mishap is limited..
5. Separate parts of sun powered can be effectively conveyed to the remote region.
6. To light the road of rustic regions with transmission lines just as sun oriented power where there is such a significant number of intensity cuts happens.
7. Complete disposal of labor.
8. Diminish Ozone depleting substance outflow.
9. Diminish a bunches of vitality.

4.2 Disadvantages:

1. Beginning venture is higher contrasted with regular road light.
2. Its set aside prolonged stretch of time for charging the battery.
3. Snow or residue join with dampness can lessen or even stop vitality generation.

4.3 Application:

The Framework is structure for open air application in un-energized rustic regions. This framework is a perfect application for grounds and town road lighting.

1. Road lighting.
2. Pathway lighting.

3. Border security lighting.
4. Grounds lighting.
5. Park lighting.
6. Entryway lighting.
7. Natural life.
8. Remote region lighting.
9. Driven lighting offers high effectiveness, long working life and low voltage task which perfect for sun powered.

CHAPTER 5

RESULTS AND COST ANALYSIS

5.1 Introduction

In this chapter we calculate the charging and discharging value of our battery. Then calculate the cost comparison between tradition system and our system. We show that this process can save energy as well as lots of money. We show the calculation briefly in data table on below.

5.2 Results

Table 1

Charging Value

Time	V _{panel}	V _{Battery}	I
10 am	10.3 V	8.9 V	185 mA
11 am	11.56 V	10.16 V	193 mA
12 pm	11.33 V	9.93 V	191 mA
1 pm	12.32 V	10.92 V	204 mA
2 pm	12.26 V	10.86 V	201 mA
3 pm	10.4 V	9.00 V	187 mA
4 pm	9.92 V	8.52 V	175 mA

Average Charging Current, $I=190.86$ mA

Battery=1.2 A

So, require hour to charge = $1.2A/0.19086A$

= 6.287 Hours.

Table 2

Discharging Value

V Battery	I		
	3 lights on	2 lights on	1 lights on
8 V	159 mA	152 mA	145.7 mA
8 V	160 mA	153 mA	146 mA
8 V	158.7 mA	152.5 mA	145.2 mA
8 V	158 mA	153.5 mA	145 mA
8 V	157.8mA	153.7 mA	146.2 mA
8 V	158 mA	152.2 mA	144.9 mA
8 V	157.5 mA	151.7 mA	145.2 mA

So, when 3 lights ON, required hour to discharge the battery = $1.2A/0.15843A$

$$= 7.57 \text{ Hour}$$

When 2 lights ON = $1.2A/0.15266A$

$$= 7.86 \text{ Hour}$$

When 1 light ON = $1.2A/0.14546A$

$$= 8.25 \text{ Hour}$$

5.3 Cost Allocation

NAME	MODEL/VALUE	QUANTITY	PRICE IN TK
Resistor	15k	1	1
Resistor	330k	9	6
Resistor	120k	3	2
Capacitor	47u	1	2
Capacitor	10u	1	2
Capacitor	0.1u	1	1
Integrated Circuits	7805	1	10

Diode	1N4007	4	4
Diode	1N4738A	1	2
Diode	LED-RED	1	2
Diode	LED	9	18
Diode	IR RCV	3	15
Diode	IR LED	3	15
Microcontroller	Arduino Pro Mini	1	230
Solar Panel	12v	1	500
Battery	8v	1	180
Variable Resistance	100k	3	3
Variable Resistance	10k	1	1
Wires			50
Others			50

Total Cost = 1094 TK

5.4 Cost Comparison

Features	Traditional System	Our System
Load	10.8 Kw	7.8 Kw
No Of Battery Needed	7	5
Battery Cost	140000Tk(20000 Per Battery)	100000Tk
Power Require	2025 W	1462 W
Solar Cost	101250Tk(50Tk per Watt)	73100Tk
Others Cost	50000Tk	40000Tk
Total Cost	291250Tk	213100Tk

So, traditional system – auto intensity control = (291250-213100) =78510Tk.

We can save 78510Tk by Auto Intensity Control of Street Light.

5.5 Summary

Though our country faces energy crisis this system is very valuable for our government and our people as our country is victim in poverty. It is very helpful to consume energy and reduce the energy cost. So our government as well as power division should imply this method soon.

CHAPTER 6

CONCLUSIONS

6.1 Conclusions

The sun based vitality is one of the vital and major inexhaustible wellsprings of vitality and has likewise demonstrated it helpful in working of utilizations like road lights.

Sunlight based fueled programmed road light control is one of the utilizations of hardware to build the offices of life. The utilization of new electronic hypotheses has been put somewhere around ability to build the offices given by the current apparatus. Here the office of normal road light is expanded by the creation it controlled consequently.

The change control is vital so as to accomplish security and increment the limit of the battery. In urban areas right now a great many road lights are worked and the yearly power upkeep cost is high.

The underlying expense and upkeep can be the disadvantages of this undertaking. With the advances in innovation and great asset arranging the expense of the venture can be chopped down and furthermore with the utilization of good gear the support can likewise be diminished regarding occasional checks.

It spared around 40% of power from per road light. So all through the world on the off chance that we utilize this idea, it will dispense with the vitality emergency to a bigger degree. It is eco-accommodating and uses the inexhaustible wellspring of vitality great.

6.2 Future Scopes of the work

The sun based fueled Drove streetlight with Auto Force Control can control the electric charge and power of lights.

This venture can be improved by utilizing with clock based items and photograph sensor based items.

We can utilize sun based following framework for quick charging.

In rainstorm season sunlight based light is increasingly troublesome with the goal that we utilize additional batteries in arrangement to spare more power. To enhance lighting we use Drove board.

6.3 Summary

Since our nation has power lack, in the event that we utilize this idea, it will kill the vitality emergency to a bigger degree. Intensity control of road light as well as utilizing of clock based items and photograph sensor based items, we can spare bunches of vitality just as vitality cost. Sunlight based is additionally play an essential attributes to spare vitality. At that point the utilization of sun powered and auto force control based items ought to be expanded.

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Appendix

Programming Uses the Micro-controller

```
#define dayNightSensor_pin A0
#define on          true
#define off         false

//object for lamp post
class lampPost {
private:
    byte sensor_pin=0;
    byte light1_pin=0;
    byte light2_pin=0;
    byte light3_pin=0;

public:

    lampPost(byte light1_pin, byte light2_pin, byte light3_pin, byte sensor_Pin);
    int sensorRead(void);
    void light(bool light_1, bool light_2, bool light_3);

private:
    void pinSetup(void);
};

lampPost::lampPost(byte light1_pin, byte light2_pin, byte light3_pin, byte sensor_Pin){
    this -> light1_pin=light1_pin;
    this -> light2_pin=light2_pin;
    this -> light3_pin=light3_pin;
    this -> sensor_pin = sensor_Pin;
    pinSetup();
}
```

```
}
```

```
void lampPost::pinSetup(void){  
    pinMode(light1_pin,OUTPUT);  
    pinMode(light2_pin,OUTPUT);  
    pinMode(light3_pin,OUTPUT);  
}
```

```
int lampPost::sensorRead(){  
    return analogRead(sensor_pin);  
}
```

```
void lampPost::light(bool light1_on_off, bool light2_on_off, bool light3_on_off){  
    digitalWrite(light1_pin,light1_on_off);  
    digitalWrite(light2_pin,light2_on_off);  
    digitalWrite(light3_pin,light3_on_off);  
}
```

```
// to create lamp post object
```

```
lampPost lampPost_1(12,11,10,A1);
```

```
lampPost lampPost_2(9,8,7,A2);
```

```
lampPost lampPost_3(6,5,4,A3);
```

```
int timeCunt=0;
```

```
int sec = 0;
```

```
int cunt=0;
```

```
int lampPost_1_cunt = 0;
```

```
int lampPost_2_cunt = 0;
```

```
int lampPost_3_cunt = 0;
```

```
bool lamPost_1_flag = true;
```

```
bool lamPost_2_flag = true;
```

```
bool lamPost_3_flag = true;
```

```

void setup(){
    Serial.begin(9600);

    Timer1.initialize(100000); // set a timer of length 100000 microseconds
    //(or 0.1 sec - or 10Hz => the led will blink 5 times, 5 cycles of on-and-off, per second)
    Timer1.attachInterrupt( timerIsr );

}

bool t=false;
// The loop function is called in an endless loop
void loop(){

    if(dayNightSensor(>300){ // In day time all lamp posts are off

        lampPost_1.light(off, off, off);
        lampPost_2.light(off, off, off);
        lampPost_3.light(off, off, off);
        //Timer1.stop();
        timeCunt=0;
        sec=0;

    }else{ // In Night time

        timeCunt=0;
        sec=0;
        //Timer1.restart();
        Serial.println("Night");
        delay(1);
        while(1){

```

```

        Serial.println(sec);
        //delay(100);
        if(sec < 10){// evening to 12 AM
            Serial.print("Lamp 1: ");

Serial.println(lampPost_1_cunt);

            lampPost_1.light(on, on, on);
            lampPost_2.light(on, on, on);
            lampPost_3.light(on, on, on);//Serial.println("5to12");
            lamPost_1_flag = true;
            lamPost_2_flag = true;
            lamPost_3_flag = true;
        }else if(sec >= 10 && sec < 20){// 12AM - 2 AM
            Serial.print("Lamp 2: ");

Serial.println(lampPost_2_cunt);

            if(lampPost_1_cunt<=0)lampPost_1.light(on,      on,
off);else lampPost_1_cunt--;
            if(lampPost_2_cunt<=0)lampPost_2.light(on,      on,
off);else lampPost_2_cunt--;
            if(lampPost_3_cunt<=0)lampPost_3.light(on,      on,
off);else lampPost_3_cunt--;

        }else if(sec >= 20){// 2AM - Morning`
            Serial.print("Lamp 3: ");

Serial.println(lampPost_3_cunt);

            if(lampPost_1_cunt<=0)lampPost_1.light(on,      off,
off);else lampPost_1_cunt--;
            if(lampPost_2_cunt<=0)lampPost_2.light(on,      off,
off);else lampPost_2_cunt--;
            if(lampPost_3_cunt<=0)lampPost_3.light(on,      off,
off);else lampPost_3_cunt--;

```

```

    }

    if(lampPost_1.sensorRead()<800){
        lampPost_1_cunt=300; // (100 = 1sec)
        lampPost_2_cunt=300;
        lampPost_1.light(on, on, on);
        lampPost_2.light(on, on, on);
    }if(lampPost_2.sensorRead()<80){
        lampPost_2_cunt=300; // (100 = 1sec)
        lampPost_3_cunt=300;
        lampPost_2.light(on, on, on);
        lampPost_3.light(on, on, on);
    }if(lampPost_3.sensorRead()<800){
        lampPost_3_cunt=300; // (100 = 1sec)
        lampPost_3.light(on, on, on);
    }

    if(dayNightSensor() > 400){
        return;
    }
    //sec++;
    delay(10);
}
}/**/
}

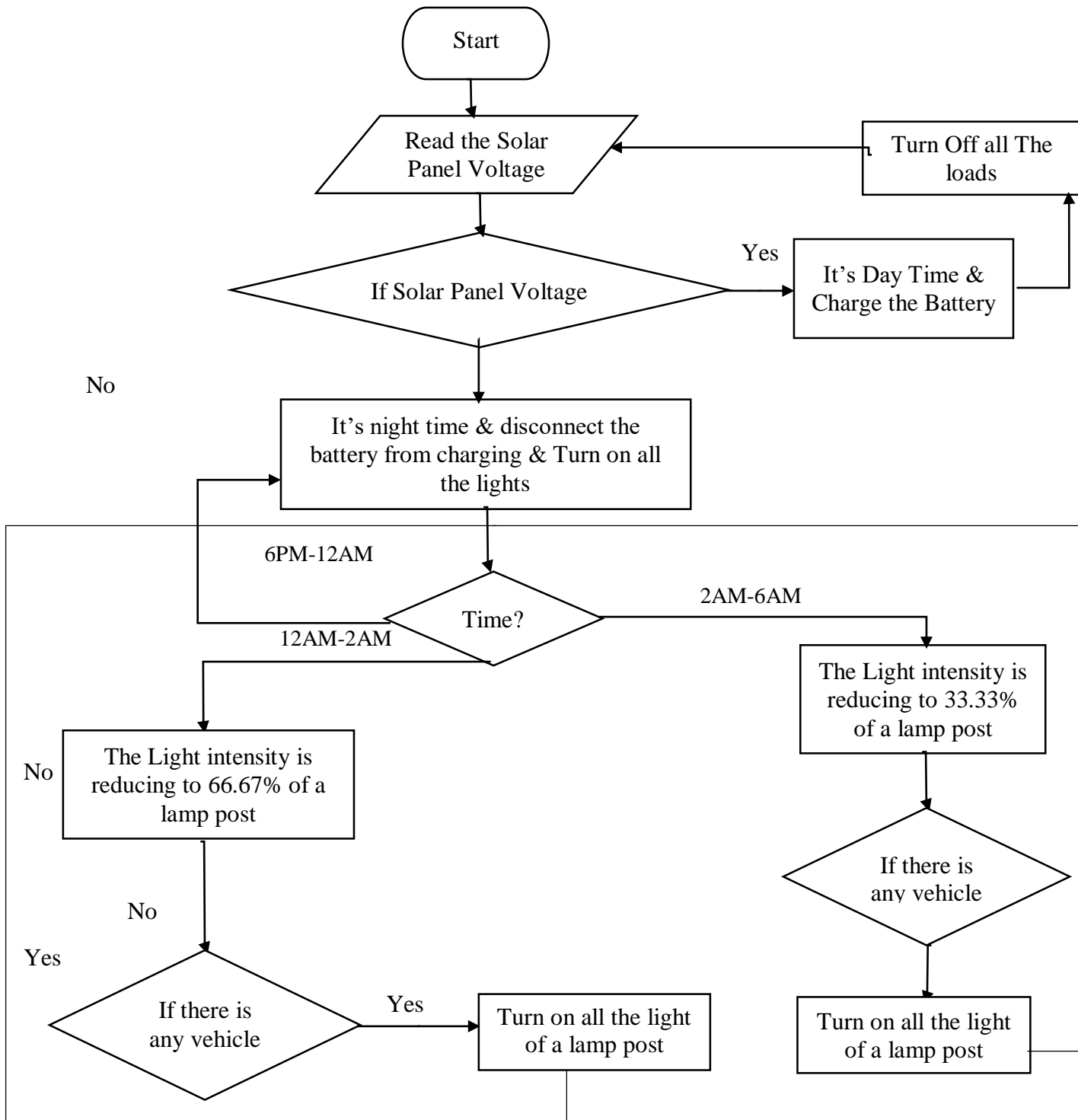
int dayNightSensor(void){
    return analogRead(dayNightSensor_pin);
}

void timerIsr()

```

```
{  
  if(timeCunt>=10){  
    sec++;  
  
    timeCunt=0;  
  }  
  //Serial.println(timeCunt);  
  timeCunt++;  
}
```

Flowchart



Cost Comparison:

Traditional Street Light

Each lamp post has 3 LED lamp of 30 watt

So, load in each lamp post = 90 watt

For 10 lamp post $10 \times 90 = 900$ watt

Light load = 900 watt = 0.9 Kw

Let, the night hour 6pm-6am = 12 h

Total energy consumed by load = $0.9 \times 12 = 10.8$ Kwh = 10800wh

Capacity = 150%

$$= 10800 \times 1.5 = 16200 \text{wh}$$

$$= 16.2 \text{ Kwh}$$

Battery configuration = 12v/190Ah tubular

Cost of each battery = 20000Tk

Load current = $16200 / 12 = 1350$ Ah

Number of battery required = $1350 / 190 = 7$ battery

So, battery cost = $20000 \times 7 = 140000$ Tk

Solar power = $16200 / 8 = 2025$ W (8 hour day time to charge)

Solar panel cost = 50tk/w

Total solar cost = $2025 \times 50 = 101250$ tk

Others cost = 50000tk

Total cost = $140000 + 101250 + 50000 = 291250$ tk

Our system (auto intensity control of LED Street light)

We divided a night in 3 slot like,

(1) 6pm-12am = 6h – all 3 light ON

(2) 12am-2am = 2 - light ON 1light OFF

(3) 2am-6am = 4h -1 light ON 2 light OFF

(1) Energy consumed for 1st load (6-12) =6h

1 lamp post = $90 \times 6 = 540\text{wh} = 0.54\text{Kwh}$

So, for 10 lamp post = $540 \times 10 = 5400\text{w} = 5.4\text{Kwh}$

(2) 12am-2am = 2h (2 ON 1 OFF)

1 lamp post = $30 \times 2 = 60\text{wh}$

$60 \times 2 = 120\text{wh}$ (2 ON)

So, for 10 lamp post = $120 \times 10 = 1200\text{wh} = 1.2 \text{ Kwh}$

(3) 2am-6am = 4h (1 ON 2 OFF)

1 lamp post = $30 \times 1 = 30\text{w}$

$30 \times 4 = 120\text{wh} = 0.12\text{Kwh}$

So, for lamp post = $120\text{wh} \times 10 = 1200\text{wh} = 1.2 \text{ Kwh}$

So total power consumed = $5400 + 1200 + 1200$

$= 7800\text{wh} = 7.8\text{Kwh}$

So, required load = $7800\text{wh} = 7.8\text{Kwh}$

Capacity = 150 % = $7800\text{wh} \times 1.5 = 11700\text{wh} = 11.7 \text{ Kwh}$

Battery = 12 V

Current = 190Ah

Cost = 20000tk

Total load current = $11700 / 12 = 975 \text{ Ah}$

Num. of battery = $975/190 = 5.13 = 5$ battery

Total battery cost = $20000 \times 5 = 100000$ tk

Solar panel = $11700/8 = 1462$ w

Panel cost = $1462 \times 50 = 73100$ tk

Others cost = 40000 tk

Total cost = $100000 + 73100 + 40000$

= 213100 tk

So, traditional system – auto intensity control system = $(291250 - 213100) = 78150$ Tk.

We can save 78150 Tk by Auto Intensity Control of Street Light.