SMART AUTOMATIC SOLAR STREET LIGHT CONTROL SYSTEM

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

Submitted by

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DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING
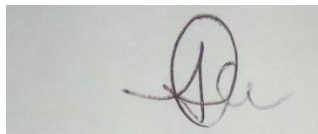**FACULTY OF ENGINEERING**
DAFFODIL INTERNATIONAL UNIVERSITY

December 2018

Certification

This is to certify that this project and thesis entitled "**Smart Automatic Solar Street Light Control System"** 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 December 2018.

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The project and thesis entitled **"Smart Automatic Solar Street Light Control System,"** submitted by **Name**: Md. Fazle Rabbi **Id:** 153-33-2843, **And Name:** Pritom Ghose **Id:**153-33-2939 Session: Fall2018 has been accepted as satisfactory in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electrical and Electronic Engineering** on December 2018.

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Dedicated to

Our Parents and Honorable Teacher

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LIST OF SYMBOLS

ω Angular frequency

M Modulation Index

T Fundamental Time Period

λ Wavelength

λ_B Bragg wavelength

N	Effective index
Z	Position along the grating
N	Mode index
F	Fundamental Frequency
ω	Angular frequency
M	Modulation Index
T	Fundamental Time Period

ACKNOWLEDGEMENT

As a matter of first importance, we express appreciation to Almighty Allah. At that point we might want to accept this open door to express

our gratefulness and appreciation to our undertaking and proposal Professor Dr. A K M Alamgir , Associate Professor, Department of EEE for being committed in supporting, persuading and managing us through this task. This task isn't possible without his valuable guidance and makes a difference. Additionally much thanks for giving us chance to pick this undertaking.

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To our cherished family, we need to give them our most profound love and appreciation for being exceptionally strong and furthermore for their motivation and consolation amid our investigations in this University.

ABSTRACT

These days customarily high force release lights (HID) utilized for urban road light on the parkways stay entire night. Part of vitality is squandered when there is no vehicle development. This is an obstruction to a creating nation. Present day building is dependably continue running for administration something inventive, keen and programmed so it will help the entire reasonable advancement for our nation. So it is conceivable to accomplish something creative, keen and programmed in this issue. This undertaking is self needy and extremely brilliant so there is no compelling reason to work by human hand. This undertaking is anything but difficult to introduce in each road of nation. On the off chance that we introduce this framework appropriately in our nation, our road light framework ends up present day.

Along these lines we will be one stage in front of the created nation. This venture is improved to identify the vehicle development on the thruways so as to switch on a square of road lights in front of the vehicle moving towards them just as turn off the lights when the vehicle passes away utilizing IR sensor innovation to spare vitality. In this venture, we utilize a microcontroller named Arduino ace smaller than normal. Utilizing IR sun based board we will charge 5v battery. We utilize a microcontroller named Adriano ace small scale. Utilizing 12v sun oriented board we will charge 5v battery. The IR sensors are put on the either side of the way to detect the vehicle development and to send the rationale directions to the microcontroller to switch on/off a lot of LEDs. The task works in three modes: complete ON mode, medium mode and diminish mode. From night (what identified by sun oriented board and voltage controller which task relies upon daylight) at 12am this timeframe keep on dynamic "ON MODE". After 12am to 2am our populace mass is winding up less, presently "Medium Mode" is turn on. At that point after 2am to morning distinguished by circuit lights are in "Diminish Mode". In this way, this framework significantly changes the force of the lights are to spare a great deal of vitality.

INTRODUCTION

1.1 Introduction

Road lighting is a fundamental open administration that gives a more secure condition during the evening time to workers including wayfarer. Appropriate utilization of road lighting can be considered as a defensive technique which gives monetary and social advantages to the general population. Across the board sunlight based road light give savvy, support free elective vitality answer for enlightening boulevards, interstates, lodging provinces and business complex. There is a deficiency of legitimate road lighting offices in numerous regions in creating nations because of absence of money related assets. The absence of enough light during the evening has offered ascend to poor living conditions and in that capacity, road wrongdoings, and different incidents are ordinary. The electrical vitality utilization of road lighting comprises an imperative piece of all out vitality Consumption. Sparing vitality in road lights is subsequently imperative for complete vitality reserve funds. Our Street Light undertakings are most appropriate for upkeep free lighting arrangements at least cost. Utilization of LED Streetlights in Bangladesh is financially reasonable and a superior option for ordinary lighting frameworks and to cut down the power bill radically. For example, on account of low traffic volumes, the lighting levels are inordinate and could be diminished with the goal that vitality investment funds can be accomplished. Then again, in explicit circumstances and for traffic wellbeing reasons, light dimensions ought to be expanded even on account of low traffic volume. Without a doubt, astounding road lighting would not just diminish the quantity of mishaps on the streets, however they would likewise assist the general population with powerless visual perception. These are the general population who think that its hard to go outside their homes at evenings. Our Street lights are outfitted with programmed movement sensors and dimmer settings to guarantee most extreme vitality investment funds. These photovoltaic boards help in charging the batteries in the day time, and afterward they control the LED lights to give ideal light in the evenings. An excess of lighting can likewise cause issues. The lights can be redone to diminish the danger of mishaps. In any case, before doing that, it is constantly vital to break down the area and standard traffic. Distinctive kind of light innovation utilized in lighting structure with their brilliant effectiveness, LED is thinking about a promising

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answer for current road lighting framework. As fortify in a section from that, the benefits of LED are probably going to supplant the conventional road lights, for example, the radiant light, fluorescent light and High weight Sodium light.

The sun oriented LEDs are savvy, and the circuit are intended to turn on and off consequently as per the lighting mode. Keeping up framework is so natural and they are so successful. Road lighting must be unavoidable on the grounds that it can prompt transiency and loss of property too. Having brilliant road lights does not just fill the need of security in the urban and country territories, yet they additionally have a great deal for effect on our vivid of living. Via auto power control of road lights, we can spare immense vitality. The sun oriented vitality is primarily helpful in sun powered road lights, auto sun oriented water system framework, traffic intersection flag lighting and so on.

1.2 Objectives:

1. To compensate the growing energy demand by using renewable energy source as solar.

2. To reduce the energy as our country faces energy crisis.

3. To reduce the energy cost.

4. To implement low power consumption, longevity, reliability our product

5. To light the streets of rural areas where there is so many power cuts occurs.

6. To make colorful smart digital Bangladesh.

7. To reduce night crime occurrence.

1.3 Methodology:

1. Study about the theory of auto Intensity control of LED Street light.

2. Construction and performance of circuit.

3. Study about the solar.

4. Learn more and more about solar

1.4 Outline of this Report

This report consists of five chapters. In first chapter, we discussed introduction and importance of solar and auto intensity control of LED street light. Whereas in chapter 2, we discussed more on Design and Construction that have been done. In chapter 3, the discussion will be on functional details of each equipment which used in our project. Cost analysis and cost comparison of my Well Equipped project are discussed and we have also discussed advantage, disadvantage and application of this project in chapter 4. In chapter 5, the discussion will be on the project results and conclusions.

CHAPTER 2

EQUIPMENTS

2.1 IR LED (Infrared Light Emitting Diode)

2.1.1 Introduction

This report comprises of five parts. In first section, we examined presentation and significance of sun based and auto force control of LED road light. While in section 2, we talked about additional on Design and Construction that have been finished. In part 3, the dialog will be on utilitarian subtleties of every gear which utilized in our task. Cost investigation and cost correlation of my Well Equipped undertaking are talked about and we have additionally examined favorable position, weakness and use of this task in part 4. In section 5, the discourse will be on the venture results and ends.

2.1.2 Pin Diagram of IR LED

An IR LED is one kind of diode or clear semiconductor. Electric stream is to stream in only a solitary heading in diodes. Exactly when the present will start stream then electrons tumble from one a player in the diode holes on another part. In this condition electron shed imperativeness by proton which essentialness makes light. It is imperative to adjust the release from it in electronic application to prevent deluding actuating. Modification makes the banner from IR LED develop over the confusion. Infrared diodes have a package that is cloudy to undeniable light yet clear to infrared. The tremendous use IR LEDs in remote controls and security ready systems has fundamentally limited the evaluating of IR diodes in the market. The enormous use IR LEDs in remote controls and security alert frameworks has radically discounted the estimating of IR diodes in the market. Of IR LEDs in remote controls and security alert frameworks has definitely scaled down the evaluating of IR diodes in the market.
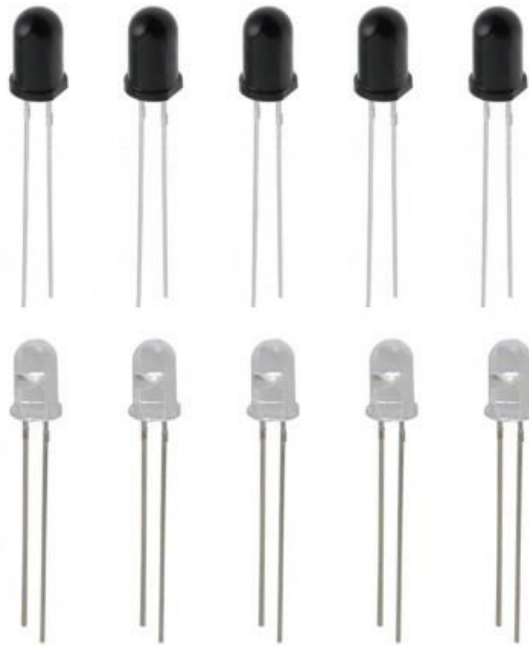
Figure: 2.1.1 IR LED (Infrared Light Emitting Diode)

2.1.3 IR sensor

IR is a gadget that distinguishes IR radiation which is falling on it. This sensor likewise called inactive infrared sensor Proximity sensor, differentiate sensor, obstacle counters sensors are a few applications including IR sensors.

2.1.4 Principle of Working

It has two areas one is maker circuit and another is recipient circuit. Here maker is an IR LED and discoverer is an IR photodiode. The IR photodiode is sense to the IR light transmitted by an IR LED. The photo diode's resistance and yield voltage both are change in degree to the IR light got. This is the essential working guideline of the IR sensor. This kind of rate will be immediate rate or roundabout occurrence. In direct occurrence, the photodiode is put before IR LED and there is no obstruction in the middle. In roundabout recurrence, both the diodes are set one alongside the other with a cloudy article before the sensor. The light from the IR LED hits the obscure surface and reflects back to the photodiode.

The light from the IR LED hits the opaque surface and reflects back to the photodiode
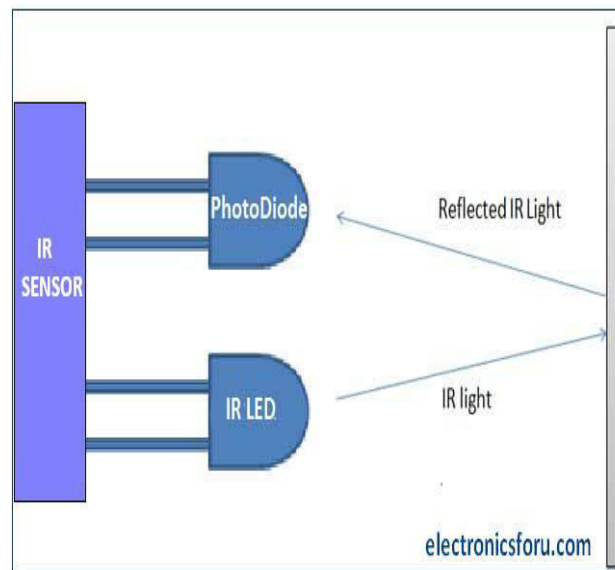
Figure: 2.1.4 working principle of IR LED

2.2 Photodiode:

2.2.1 Introduction

A photodiode is one kind of light discoverer and it in like manner a semiconductor device. It can change over light into an electrical stream. Exactly when photons are gotten up to speed in the photodiode then current are created. Photodiodes is containing optical channels, worked in central focuses, and may have extensive or minimal surface zones. Photodiodes generally have a slower response time as their surface locale increases. The typical, ordinary sun controlled cell used to make electric sun situated power is a far reaching an area photodiode. Various diodes planned for use unequivocally as a photodiode use a PIN crossing point rather than a p– n convergence, to fabricate the speed of response.

Figure: 2.2.1 Photodiode

2.2.2 Types of Photodiode

There are such enormous quantities of sort of photodiode available in the market anyway all are managing a comparative essential standard and some are upgraded by various effects. The working of different sorts of photodiodes work in a to some degree phenomenal way, yet the basic assignment of these diodes proceeds as previously.

1. PIN Photodiode
2. Scotty Photo Diode
3. Avalanche Photodiode

2.2.3 Working of Photodiode

Right when photons of imperativeness most extraordinary and more conspicuous than 1.1 eves hit the diode, electron-hole are start sets. The power of photon maintenance depends upon the imperativeness of photons – the lower the essentialness of photons is the more significant the absorption. This system is known as the inward photoelectric effect. When enough energy of photon enters into depleted region of a diode then it could hit an

Atom with enough energy to release said electron from the atomic structure, that's why creating a free electron and a holei.e. an electron space. This opening has a positive charge, and the electron has a positive charge. These electron-hole sets move isolated and are prod from the crossing point - because of the verifiable electric field of the weariness region. As needs be, the openings advance toward the anode and the electrons advance toward the cathode, thusly conveying photocurrent. The hard and fast photocurrents and dull streams, which can stream with or without light. The affectability of the contraption can be created by constraining the diminish current.

Figure: 2.2.3 PN junction diode

If a photon of satisfactory essentialness enters a depleted territory of a diode, it could hit a particle with enough imperativeness to release said electron from the atomic structure, thusly making a free electron and a holei.e. a particle with an electron space. The electron has a negative charge, and the opening a positive charge. These electron-opening sets coast isolated and are cleared from the convergence - because of the verifiable electric field of the weariness area. Along these lines, the openings advance toward the anode and the electrons push toward the cathode, thusly making photocurrent.

2.2.4 Modes of Operation

Photovoltaic mode, Photoconductive mode, avalanche diode mode is the mode available in photodiode operation.

Photovoltaic Mode: This mode is also called zero bias modes. The lightened photodiode is also produce voltage. It creates a little dynamic range and non-linear necessity of the voltage formed.

Photoconductive Mode: when reverse biased create than the photodiode used in this photoconductive mode. The reverse voltage application will increase the depletion layer's width, which in turn decreases the response time & the junction capacitance. This mode is very fast and displays electronic noise.

Avalanche Diode Mode: Torrential slide diodes work in a high switch predisposition condition, which licenses duplication of a torrential slide breakdown to every photograph delivered electron-opening pair. Or on the other hand Avalanche diodes work in a high invert predisposition condition, which licenses increase of a torrential slide breakdown to every photograph created electron-gap combine. This result in an interior thing of gain in the photodiode, which gradually expands the gadget reaction.

2.2.5 Applications of Photodiode

A photodiode is one sort of light locator; it utilizes for believer the light into current or voltage dependent on the method of activity of the gadget.

1. These diodes can follow the application in character seeing procedures and IR remote control circuits.

2. It is utilized for the two headings obvious just as undetectable light beams.

3. It is extremely influenced for advanced and rationale circuits which require quick exchanging and best speed activity.

4. Photodiodes are utilized for the demodulation and correspondence framework for encoding reason.

5. Photodiodes are pondered as one of the essential optoelectronics device which is extensively utilized in the optical fiber correspondence framework.

6. It is utilized in demodulation.

7. It is utilized in rationale circuit.

2.3 Resistor

2.3.1 Introduction
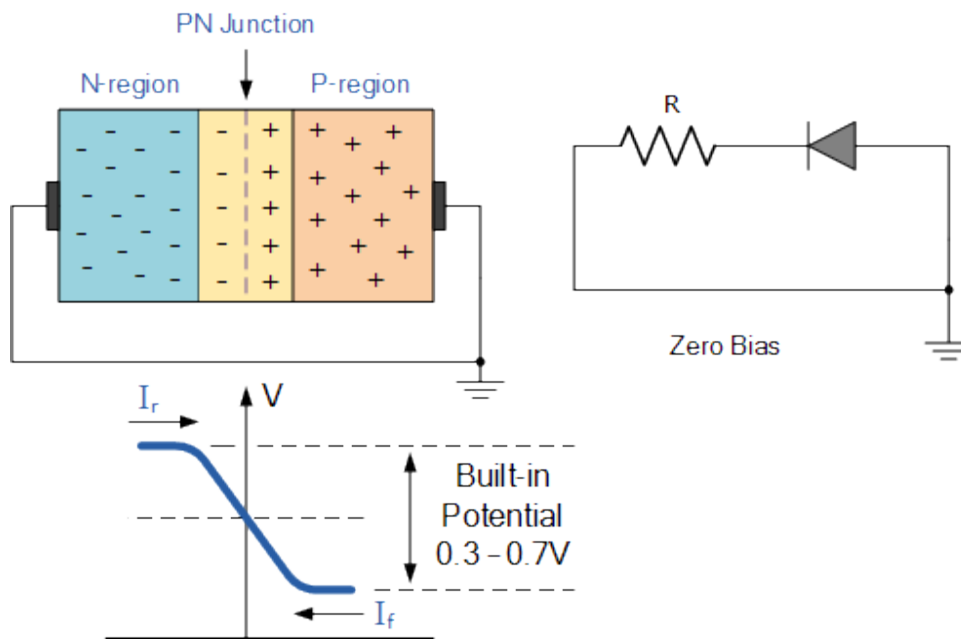
If a photon of satisfactory essentialness enters a depleted territory of a diode, it could hit a particle with enough imperativeness to release said electron from the atomic structure, thusly making a free electron and a holei.e. a particle with an electron space. The electron has a negative charge, and the opening a positive charge. These electron-opening sets coast isolated and are cleared from the convergence - because of the verifiable electric field of the weariness area. Along these lines, the openings advance toward the anode and the electrons push toward the cathode, thusly making photocurrent.

2.3.2 Symbol of Resistor

It is a two terminal passive device. The symbol is given below.
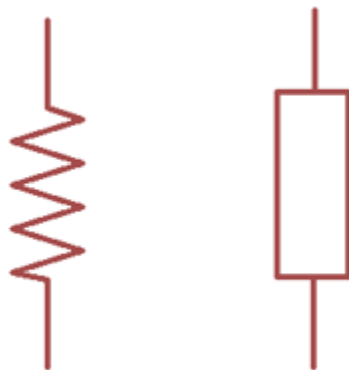
Fig 2.3.2: Symbol of resistor

2.3.3 Working of Resistor

If a photon of satisfactory essentialness enters a depleted territory of a diode, it could hit a particle with enough imperativeness to release said electron from the atomic structure, thusly making a free electron and a holei.e. a particle with an electron space. The electron has a negative charge, and the opening a positive charge. These electron-opening sets coast isolated and are cleared from the convergence - because of the verifiable electric field of the weariness area. Along these lines, the openings advance toward the anode and the electrons push toward the cathode, thusly making photocurrent.

2.3.4 Color Code of Resistor

COLOR	1ST BAND	2ND BAND	3RD BAND	MULTIPLIER	TOLERANCE	
Black		0	0	1Ω		
Brown	1	1	1	10Ω	± 1%	(F)
Red	2	2	2	100Ω	± 2%	(G)
Orange	3	3	3	1KΩ		
Yellow	4	4	4	10KΩ		
Green	5	5	5	100KΩ	± 0.5%	(D)
Blue	6	6	6	1MΩ	± 0.25%	(C)
Violet	7	7	7	10MΩ	± 0.10%	(B)
Grey	8	8	8	100MΩ	± 0.05%	
White	9	9	9	1GΩ		
Gold				0.1Ω	± 5%	(J)
Silver				0.01Ω	± 10%	(K)

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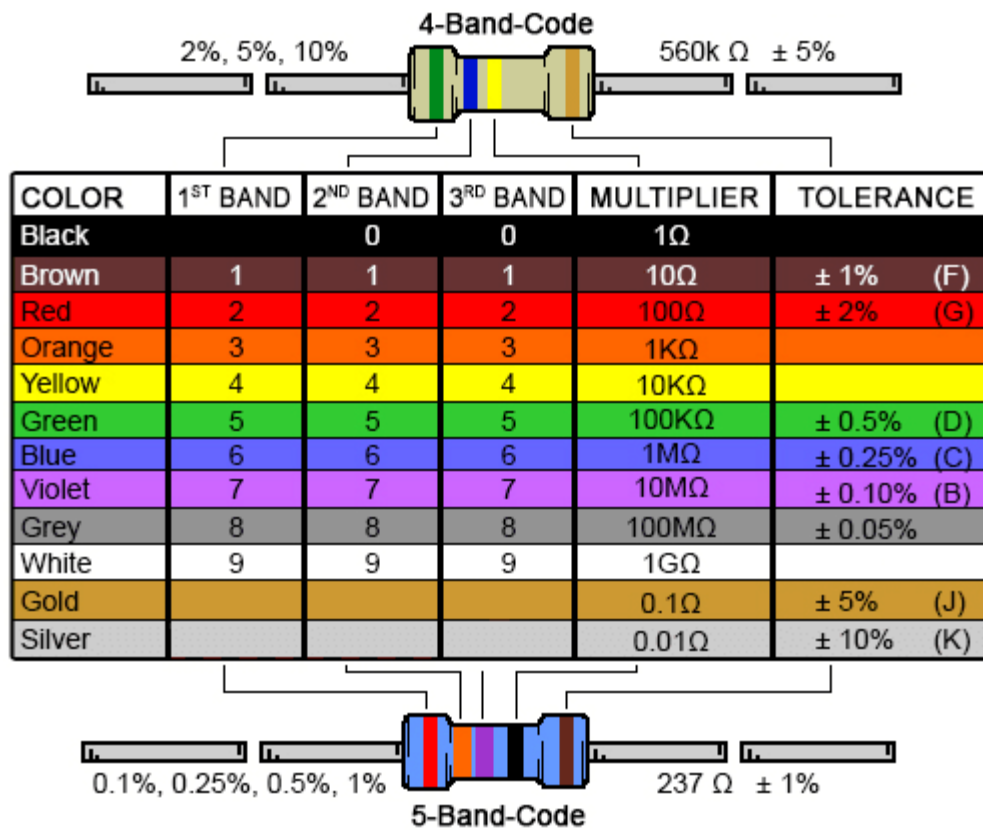
2.3.5 Types of resistors

Most of the resistance is same. They look like a small worm with colored stripes on the side. There are many types of resistors available in market.

1. Wire-wound Resistors

Comprise of a tube shaped center which mess up with wire. The tube shaped center is ordinarily produced using a fired, plastic, or fiberglass center material. The wire is a kind 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. Run of the mill applications for wire wound resistors incorporate gadget requiring high current dealing with capacity, warm dissemination and opposition soundness and precision.

2. Carbon Film Resistors

A general class portrayal for round and hollow resistors made by entrusting a carbon film on the outside of an inside center cover.

3. Thin Film Resistors

A kind of surface-mount film resistor with a nearly thin resistive component, estimated in angstroms. Thin film resistors are made by sputtering a resistive material, for example, nickel chromium or tantalum nitride, onto the outside of a layer.

4. Thick Film Resistor

Extraordinarily fabricated surface-mount film resistor that conveys high power for the part measure. For thick film resistors, a ruthenium oxide film or metal coating film is utilizing for the most part screen-printing innovation. These resistor film can be astounding for high-control gadgets.

5. Carbon Composition Resistors

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

6. Metal Film Resistors

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

2.3.6 Uses of Resistors

There is some utilization of obstruction

1. Obstruction is one of the principle components in the working of a light. At the point when power goes through the fiber of the light, it consumes splendid as it turns exceedingly hot because of its littler size. In spite of the fact that this instrument scattering a great deal of power, we are compelled to utilize it to get light. The light utilized these days are more effective than the more established radiant lights.

2. The comparative fiber working is the fundamental component in the working of a portion of our typical family unit works like electric pots, electric radiators, electric showers, espresso producers, toasters, etc.

3. The utilization of variable opposition is additionally useful to us. Our TV's, radios, noisy speakers, etc take a shot at this standard.
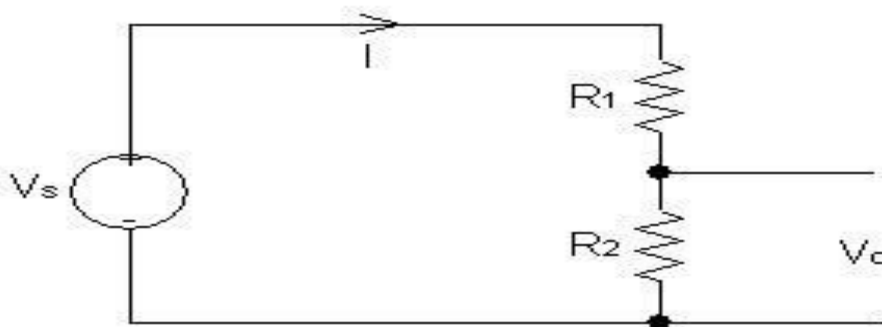
2.3.6Working resistance

2.4 Capacitor

2.4.1 Introduction

The capacitor is a moderate part and it treasury the electrical imperativeness into an electrical field. The consequence of the capacitor is known as a capacitance. It conveyed of two close transmitters and secluded by the dielectric material. In case the plates are related with the power, the plates accumulate the electric charge. One plate assemble the positive charge and another plate accumulate the negative charge. The electric image of the capacitor is appeared as follows
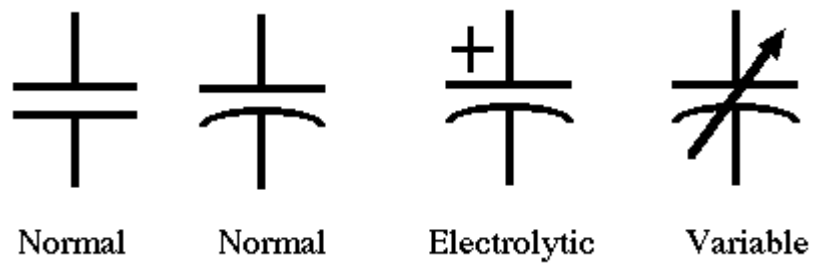
Fig 2.4.1: Capacitor Symbol

2.4.2 Types of Capacitors

1. Electrolytic Capacitor:

The capacitor is a moderate portion and it treasury the electrical vitality into an electrical field. The result of the capacitor is known as a capacitance. It passed on of two close transmitters and isolated by the dielectric material. In the event that the plates are connected with the power, the plates aggregate the electric charge. One plate collect the positive charge and another plate gather the negative charge. The electric image of the capacitor is appeared as seeks after. Capacitors and Tantalum Electrolytic

.

Fig 2.4.2: Electrolytic Capacitor

This securing layer is thin, it is possible to make capacitors with an immense estimation of capacitance for a physical size, which is in pretty much nothing and the partition between the two plates is nearly nothing. The sorts of capacitors in the majority of electrolytic are enamored, which is DC voltage is associated with the capacitor terminal and they ought to be correct furthest point. If the positive to the positive terminal and the negative to the negative terminal as a misguided polarization will break the ensuring oxide layer and there will be invariable mischief.

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2. Mica Capacitor:

Mica capacitors are one kind silver mica capacitors and furthermore store electric charge and this charge stockpiling should be possible by utilizing distinctive sorts of capacitors. This capacitor has offer high accuracy, unwavering quality and steadiness. They are accessible in little qualities and are commonly utilized at high frequencies and in circumstances where low misfortunes and low capacitor change after some time are required. This capacitor is commonly utilized when the structure requirement for steady, solid capacitor of generally little qualities.
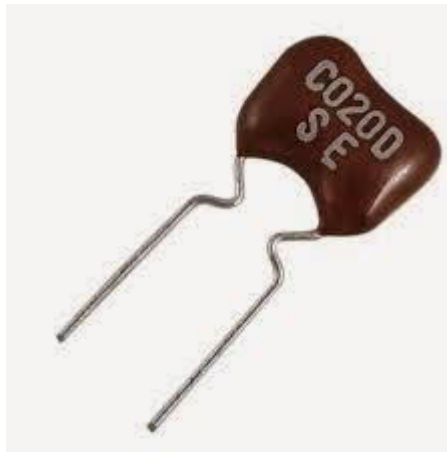
Fig 2.4.3: Mica Capacitor

The mica capacitors are the low loss capacitors, used at high frequencies and this capacitor is very stable chemically, electrically, and mechanically, because of its specific crystalline structure binding & it is a typically layered structure. The most common used are Muscovite and Phologopite mica. The Muscovite mica is better in the electrical properties and the other Mica has a high-temperature resistance.

3. Paper Capacitor

Paper capacitors are making from paper or oil-impregnated paper and aluminum frustrate sheets transform into a drum and checked with wax. These paper capacitors were normally used yet are right now substituted by the polymer or plastic made capacitor. The barrel molded shape and after that it is encased into the plastic compartment. The two thin upsets of the paper capacitors interface with the outside load.

Fig 2.4.4: Paper Capacitor

The paper capacitors are expansive, hygroscopic and douses sogginess which roots to misfortune to the dielectric undignified its complete execution is the principle disservice with this kind of capacitors. Alternate choices comprise of paper-polyester, Kraft paper and oil impregnated capacitor. The capacitance scope of the paper capacitor is from 0.001 to 2.000micro farad and the voltage is dependent upon 2000V.

4. Film Capacitor

Film capacitor is a standout amongst the most accessible of all kind of capacitor and comprising of a generally expansive number of capacitors with the distinction being in their dielectric properties. Polyester

polystyrene, polypropylene, polycarbonate, metalized paper, Teflon are incorporate there. This kind of capacitors are accessible in capacitance and range from as little as 5pF to as large as 100uF rely upon genuine the sort of capacitor and voltage rating.

Fig2.4.5: Film Capacitor

There are another types of film capacitors are available like polyester film, metalized film, polypropylene film, PTE film and polystyrene film.

5. Non-Polarized Capacitors

The non-energized capacitors is two sorts plastic thwart capacitor and electrolytic non-captivated capacitor. The precedents are the speaker hybrid channels and power factor redress organize. In these two applications, a substantial AC voltage flag is connected over the capacitor.

Fig2.4.6: Non-Polarized Capacitor

The models are the speaker hybrid channels and power factor redress organize. In these two applications, a vast AC voltage flag is connected over the conductor

6. Ceramic capacitor

This kind of capacitor is utilized in numerous applications from sound to RF. Qualities run from a couple Pico farads4 to around 0.1 microfarads. This kind of capacitor being shoddy and solid and their misfortune factor is especially low in spite of the fact that this is reliant on the correct dielectric being used. In perspective of their constructional properties, these capacitors are broadly utilized both in leaded and surface mount groups.
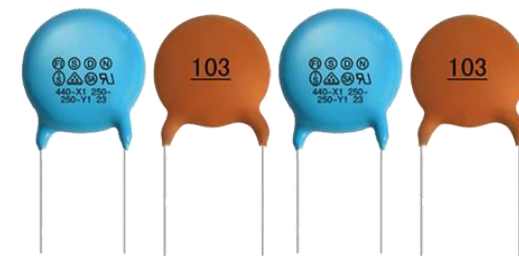
Fig2.4.7: Ceramic Capacitor

There are many geometries are used in the ceramic capacitors and some of them are the ceramic tubular capacitor, barrier layer capacitors are obsolete because of their size, parasitic effects or electrical characteristics. The two common types of ceramic capacitors are multilayer ceramic capacitor (MLCC) and ceramic disc capacitor.

2.4.3 Uses of Capacitors

Capacitors are normally useful as an electronic part and used in electrical device. Capacitors are moreover one sorts of contraptions which store electrical charge. Capacitor is commonly used for conductive imperativeness amassing and this essentialness is use in basic contraptions part ' and has a substantial gathering of various applications. .Capacitors have been used to store electrical imperativeness since the late eighteenth century. Benjamin Franklin was the first to bring forth the maxim "battery" for a movement of capacitors in an imperativeness store application. Capacitors are one of most fundamental application for the embellishment of power supplies. Capacitors square DC hails yet allow AC signals when they are charged. Capacitor can reasonably part these two banner sorts, cleaning the supply of power. Capacitors are also used as a sensor to check a grouping of things, including air suddenness, fuel levels and mechanical strain.

2.6 Light Emitting Diode (LED)

2.6.1 Introduction

A light-transmitting diode (LED) is a two-lead semiconductor light age and a p-n intersection diode.

This diode is fabricated exceptional sorts of semiconductor. At the point when the light radiates in the forward one-sided, at that point it is called as a light emanating diode.
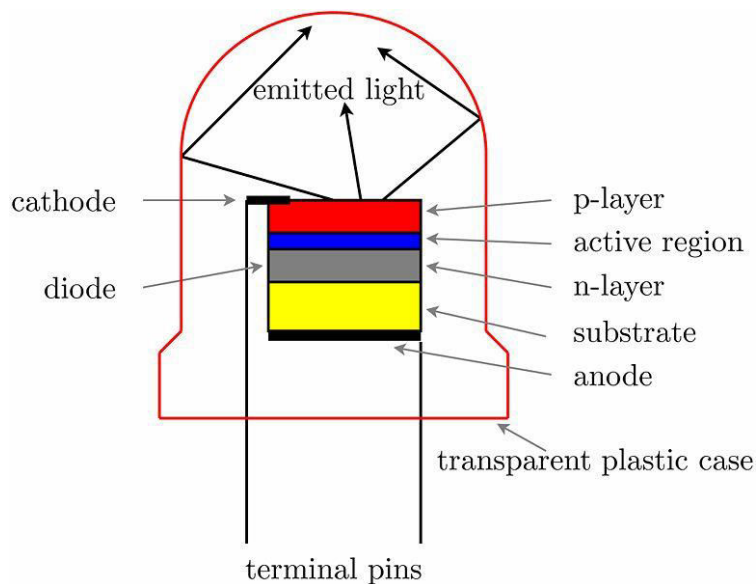
Fig 2.6.1: Light Emitting Diode

2.6.2 Working Principle of LED

The LED essentially, perceive as a diode. In the event that the diode is forward one-sided, the electrons and openings are moving fast over the intersection and that are blend continually, evacuating each other out.

Not long after the electrons are moving from the n-type to the p-type silicon, it consolidates with the openings, at that point it vanishes. Subsequently it makes the total particle and increasingly steady and it gives the little

Burst of vitality as a small bundle or photon of light
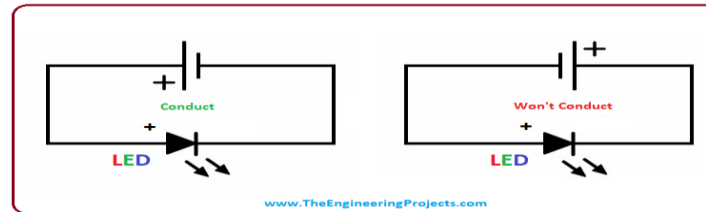
Fig 2.6.2: Working of Light Emitting Diode

The diagram showing the light emitting diode how works and step by step action of the diagram.

- In this diagram, we can look on that the N-type silicon is in red color and hold the electrons, they are reported by the black circles.

- The P- type silicon in the blue color and it hold holes, they are reported by the white circles.

- Electron and holes at the junction are attached.

- The power supply across the p-n junction create the diode forward biased and shoving the electrons from n-type to p-type. shoving the holes in the inverse direction.

2.6.3 Types of Light Emitting Diodes

There are different types of light emitting diodes present and some of them are mentioned below.

- Gallium Phosphide (GaP)

- Gallium Arsenide (GaAs)

- Aluminum Gallium Arsenide Phosphide (AlGaAsP)

- Gallium Arsenide Phosphide (GaAsP)

- Silicon Carbide (SiC)

- Gallium Nitride (GaN)

- Aluminum Gallium Phosphide (AlGaP)

- Gallium Indium Nitride (GaInN)

- Zinc Selenide (ZnSe)
- Aluminum Gallium Nitride (AlGaN)
-

2.6.4 LED Working Principle

Semiconducting P-type material and n-type material are two vital fragments of driven. By interfacing these two sorts of materials, a p-n crossing point outlines. The lion's offer carrier's electrons or openings start moving over the crossing point when p-n convergence is forward uneven. Shape n area electron start to moving and from the p region the openings start moving.

When they moved from their areas they start to recombine over the utilization region. Free electrons will remain in the conduction band of imperativeness level while openings remain in the valence band of essentialness level. The Energy measurement of the electrons is high than holes since electrons are more convenient than openings for instance current conduction due to electrons are more. In the midst of the recombination of electrons and holes, some section of essentialness must be scattered or transmitted as warmth and light.

The ponder into which light released from the semiconductor influenced by electric field is known as electroluminescence. Remember overlook that a large portion of light is made from the crossing point nearer to the p-type region. So diode organizing is done as such that this zone is kept as close to the outside of the device to ensure that the base proportion of light is held. The electrons scatter essentialness in different structures depends upon the possibility of the diode used.
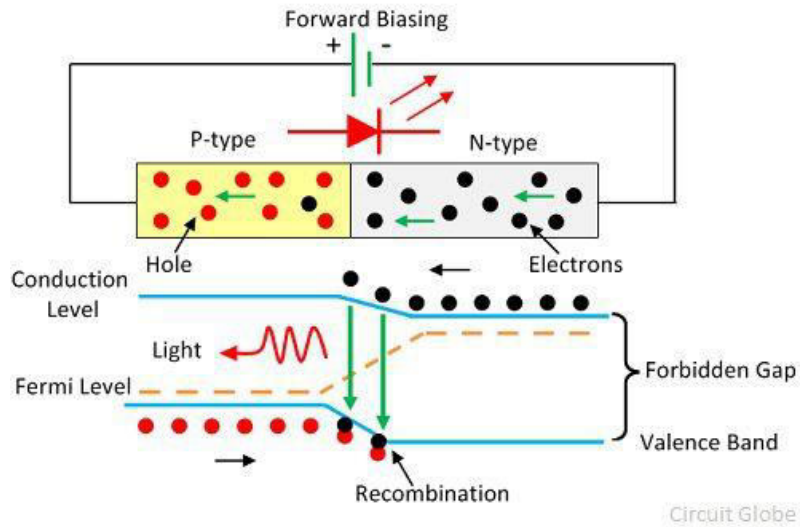
Fig 2.6.4: Working Principle of LED

Like for silicon and germanium diodes it disperses vitality as warmth and for gallium phosphide (GAPA) and gallium arsenide phosphide (GaAs) semiconductors, it scatters vitality by transmitting photons. For the emanation of various hues diverse semiconductors are utilized like phosphorus for a red light, gallium phosphide for green light and aluminum indium gallium phosphide for yellow and orange light.

2.6.5 I-V Characteristics of LED

There are numerous sorts of LEDs are reachable in the bazaar and there are many LED attributes incorporate the shading light, or wavelength radiation, light power. The fundamental normal for the LED is shading.
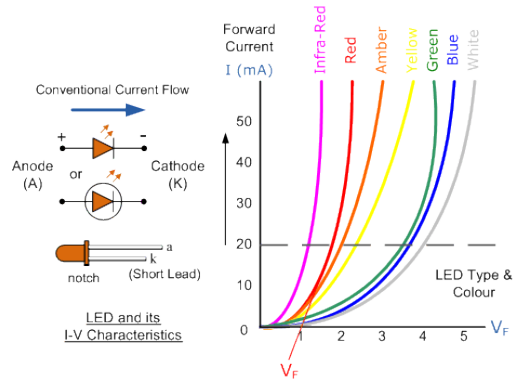
Fig 2.6.5: I-V Characteristics of LED

This graph showing the inferential curves between the forward voltage and the current.

2.6.6 Advantages of LED lights

Easily controlled and programmed.

Large Life span.

High levels of brightness and intensity.

High efficiency.

Low radiated heat.

Low maintenance cost.

Low voltage and current requirements.

Less wiring required.

High reliability.

Instant lightning.

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

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2.7 Relay

2.7.1 Introduction

A hand-off is an electrically worked switch. It starts from validness. Most by far of the highest point of the line mechanical application contraptions have exchanges for their accommodating working. The center of a hand-off is an electromagnet circle of wire that transforms into a short magnet when control travels through it. Current coursing through the circle of the hand-off makes an alluring field which pulls in a switch and changes the switch contacts as showed up in the framework

2.7.2 How Relays works

A hand-off is an electrically worked switch. It begins from validness. Most by a long shot of the most elevated purpose of the line mechanical application contraptions have trades for their obliging working. The focal point of a hand-off is an electromagnet hover of wire that changes into a short magnet when control goes through it. Current coursing through the hover of the hand-off makes a charming field which pulls in a switch and changes the switch contacts as appeared in the structure:

Fig 2.7.2

The data circuit (blue circle) is killed and no present courses through it until something (either a sensor or a switch closing) turns it on. The yield circuit (red circle) is moreover killed. Exactly when a little current streams in the data circuit, it establishes the electromagnet.

diminish blue circle), which makes an alluring field encompassing it. The animated electromagnet pulls the metal bar in the yield circuit toward it, closing the switch and empowering a much more noteworthy current to course through the yield circuit. The yield circuit works a high-stream machine, for instance, a light or an electric motor. Protective exchanges can deflect adapt hurt by distinguishing electrical varieties from the standard, including over stream, tendency, over-weights and pivot streams. Besides, exchanges are moreover comprehensively used to switch starting twists, warming segments, etc.

Defensive transfers can avoid gear harm by distinguishing electrical irregularities, including over flow, inclination, over-burdens and switch flows. Likewise, transfers are additionally generally used to switch beginning curls, warming components, pilot lights and discernable alerts.

2.7.3 Advantages of relays

- Relays can switch AC and DC, transistors can only switch DC.

- Relays can switch higher voltages than standard transistors.

- Relays can switch many contacts at once.

- Electromagnetic relays have fast operation and fast reset

- They can be used for both ac and dc systems for protection of ac and dc equipment's

- Electromagnetic relays operating speeds which has the ability to operate in milliseconds are also can be possible

- They have the property such as simple, robust, compact, and most reliable

Disadvantages of relays

- Relays are bulkier than transistors for switching small currents.

- These relays do not have the directional feature.

- Relays cannot switch rapidly; transistors can switch many times per second.

- Multifunction is not possible. One relay can perform only one function.

- Relays use more power due to the current flowing through their coil.

2.8 Battery

2.8.1 Introduction

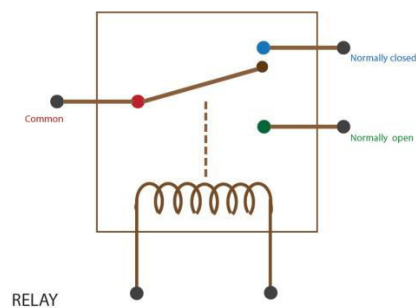The information circuit (blue circle) is slaughtered and no present courses through it until something (either a sensor or a switch shutting) turns it on. The yield circuit (red circle) is likewise executed. Precisely when a little current streams in the information circuit, it foundations the electromagnet (appeared as a lessen blue circle), which makes an engaging field including it. The reinforced electromagnet pulls the metal bar in the yield circuit toward it, shutting the switch and enabling a considerably more conspicuous current to course through the yield circuit. The yield circuit works a high-stream machine, for example, a light or an electric engine. Defensive trades can avoid prepare harmed by recognizing electrical assortments from the standard, including over stream, inclination, over-loads and turn streams. Moreover, trades are besides extensively used to switch beginning turns, warming sections, and so forth.

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.
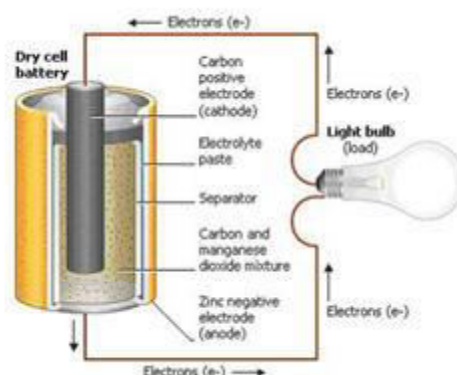
Figure 2.8.2 working principle of battery

The compound responses in the battery causes a development of electrons at the anode. This outcomes in an electrical distinction between the anode and the cathode. You can think about this distinction as a flimsy develop of the electrons. The electrons needs to improve themselves to dispose of this

Distinction. In any case, they do this with a particular goal in mind. Electrons repulse one another and endeavor 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 course through the circuit.

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

When somebody revive battery, at that point alter the course of the stream of electrons utilizing another power source, for example, sun oriented boards. The electrochemical procedures occur backward, and the anode and cathode are reestablished to their unique state and can again give full power.

2.8.3 Store energy in a battery

A battery for the inspirations driving this illumination will be a contraption that can store imperativeness in a compound shape and convert that set away blend essentialness into electrical essentialness when required.

Imperativeness can't be made or smashed, anyway it will in general be saved in various structures. One way to deal with store it is as manufactured imperativeness in a battery. Exactly when related in a circuit, imperativeness set away in the battery is released.

In a daylight based load up, sun powered loads up can't make essentialness around night time or in the midst of cloudy periods. Regardless, battery-fueled batteries can store control: the photovoltaic sheets charge the battery in the midst of the day, and this power can be pulled in upon the night.

2.9 Solar panel

2.9.1 Introduction

Sun based boards are a savvy framework to change over light into power. They are designated "sun based" board. We realize that daylight is an incredible wellspring of vitality close planetary system, the most grounded wellspring of light accessible is the Sun, called Sol by stargazers. A few researchers call them photovoltaic which implies, essentially, "light-power."

Figure 2.9.1 Solar panel

Sun oriented cells are gathering power by a sunlight based cell. A lot of little sunlight based cells cost over a tremendous region can cooperate to give anticipated that power should be helpful. The more light that harm a cell, the greater power it produces, spaceship are commonly demonstrate with sunlight based boards that can ever be keen at the Sun even as whatever is left of the body of the spaceship moves around, much as a tank turret can be pointed individually of where the tank is going. DS1's sun powered cells are considerably more gifted than flexible sunlight based boards shaped for satellites in light of the fact that sun powered concentrators are utilized by them. The sun oriented boards are made of sun based cells. A cell is an almost no circle of a semiconductor like silicon. They are associated by wire to a circuit. As light walkout the semiconductor, light is adjusted power that entered the circuit. As quickly as time permits the light is expelled, the sun based cell discourage directing.

2.9.2 Theory and Construction

Light essentialness (photons) is used by the photovoltaic modules from the Sun to convey control through the photovoltaic effect. Wafer-based crystalline silicon cells or thin-film cells are used by the greater part of modeless. The number of(load passing on) individual from a module can either be the upper layer or the lower layer. Cells ought to in like manner be saved from mechanical damage and wetness. Most modules are in versatile, yet semi-versatile ones are practical, in perspective of thin-film cells. The telephones must be joined electrically in course of action, to one another. Externally,MP4 legally binding laborers are used by the most photovoltaic sort to unravel straightforward weatherproof relationship with whatever is left of the way.

Modules electrical affiliations are made in course of action to get a needed for yield voltage or possibly in parallel to give a wished to stream limit. The coordinating wires that make the current off the modules may proceed with silver, copper or other non-alluring conductive trade metals. Evade diodes may be solidified or used remotely, if there ought to emerge an event of fragmentary module shading, to intensify the yield of module sections still progressively astonishing.

Some basic sun controlled PV modules consolidate concentrators in which light is locked in by central focuses or mirrors onto cut down cells. This skilled the usage of cells with an amazing cost for each unit zone, (for instance, gallium arsenide in a down to earth way.

2.9.3 Working principle of solar panel

A focal point is utilized by sun powered concentrator, called Fresnel focal points, which take a tremendous territory of daylight and direct it towards a specific spot by accommodation the beams of light and centering them. Numerous individuals a similar standard when they use intensifying focal point to concentrate the Sun's beams on a heap of fuel or paper to begin fires.
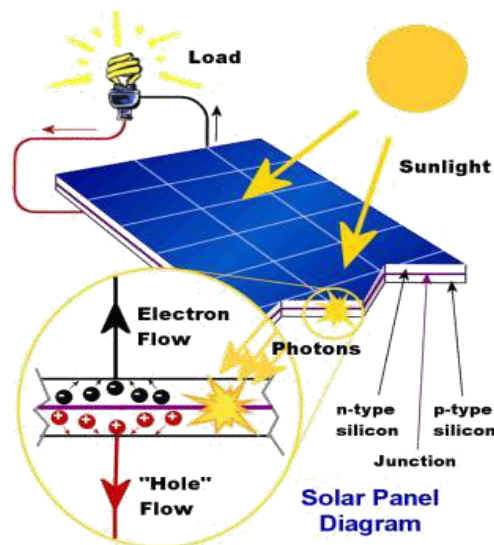
Figure: 2.9.3 working principle of Fresnel lenses

Fresnel central focuses are shaped like a shoot board, with concentric rings of precious stones around a point of convergence that is an intensifying glass. These features let them focus scattered light from the Sun into a tight shaft.

Sun situated concentrators put one of these central focuses over each sun based cell. This makes essentially progressively focused light go to every daylight based cell, making the cells colossally progressively powerful. Concentrators work best when there is a singular wellspring of light and the concentrator can be pointed agreeable. This is impeccable in space, where the Sun is a single light source.

The sun controlled concentrators moreover have the favored point of view that the sun based cells can be isolated increasingly remote isolated since light can be focused on each cell. This infers less sun fueled cells ought to be made and the sheets cost less to create. Moreover, planners would now have the capacity to put thick glass or plastic over the daylight based board to shield it from micrometeorites, something they would encounter genuine troubles doing if they expected to worry over adequately empowering light to accomplish the sun fueled cells. Fresnel central focuses have been around since Augustine Jean Fresnel envisioned them in 1822. Theaters use them for spotlights and reference points use them to make their lights clear at increasingly unmistakable partitions.

2.9.4 Efficiency

Dependent upon improvement, photovoltaic modules can make control from an extent of frequencies of light, anyway generally can't covering the whole sun based range. From now on, an incredible piece of the event sun situated modules is misused by sunlight essentialness, and they can make far most outrageous efficiencies if decline with monochromatic light. Thusly, another model subject is to part the light into another wavelength reaches and versus the bars onto assorted cells tuned to those degrees. This has been foreseen to be prepared for growing capability considerably. Analysts from Spectro lab, a reinforcement of Boeing, have declared enhancement of multi-crossing point sun controlled cells with an efficiency of over a large portion of, a different universe record for sun based photovoltaic cells. The Spectro lab specialists predict that of over 45% efficiencies achieve daylight based cells by concentrator. Or on the other hand even half later on, with theoretical efficiencies with numerous crossing points being about 58% in cells.

Daylight based leading group of capability can be dictated by MPP (most prominent power point) estimation of sun situated sheets. Daylight based inverters convert the DC ability to AC control by performing MPPT process: the yield Power (I-V twist) of sun arranged inverter tests from the sun based cell and applies the most ideal check (stack) to sun situated cells to secure most bewildering power. The sun situated leading group of MPP includes MPP voltage and MPP current. The sun based board limit and the best regard can make higher MPP.

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

Month	Daily Mean	Maximum	Minimum
January	8.5	9.5	7.5
February	9.2	10.8	7.6
March	8.95	10.5	7.4
April	9.05	10.4	7.7
May	7.65	9.8	5.5
June	5.55	7.6	3.5
July	4.6	6.5	2.7
August	5.85	7.5	4.2
September	6.7	8.9	4.5
October	8.25	9.8	6.7
November	8.4	9.3	7.5
December	9.25	10.7	7.8
Average	7.61	9.15	6.07

2.9.5 Performance & Degradation

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

Electrical attributes incorporate ostensible power (PMAX, estimated in W), open circuitvoltage (VOC), impede (ISC, estimated in amperes), most extreme power voltage (VMPP), greatest power flow (IMPP), crest control, (watt-pinnacle, We), and module productivity (%).

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Ostensible voltage alludes to the voltage of the battery that the module is most appropriate to charge; this is an extra term from the days when sun oriented modules were just used to charge batteries'

The module changes of the actual voltage output as lighting, temperature and load conditions change, one specific voltage will never at which the module operates. General voltage allows users, suddenly, to make sure the module is compatible with a given system.

Open circuit voltage or V_{OC} is the highest voltage that the modules can generate when not connected to an electrical circuit or system. A voltmeter can be measured by vow directly on an illuminated module's terminals or on its disconnected cable.

2.9.6 Maintenance

Conventionally in the 20% region by sun fueled board change, is light up by buildup, grime, dust, and diverse particulates that gather on the sun controlled board. "Its control capacities can diminish an untidy sun based block by to 30% in high buildup/residue or desert regions", says Seamus Curran, relate teacher of material science at the University of Houston and official of the Institute for non-particulate Energy, which setup, building, and assembling by routine with regards to nanostructures.

there is definitely not a better than average endeavor is much of the time to paying have daylight based loads up is cleaned; masters found loads up that hadn't been cleaned, or rained on, In California for 145 days in the midst of a pre-summer drought , lost only 7.4% of their capability. By and large talking, for an ordinary private close planetary arrangement of 5 kW, Through the mid year washing loads up halfway would change over into a minor $20 gain in power age until the point that the pre-summer drought closes—in around 2 ½ months. For greater business rooftop systems, the money related mishaps are so more noteworthy yet sufficiently occasional to warrant the cost of washing the sheets. Everything considered, sheets lost fairly under 0.05% of their general adequacy consistently.

2.9.7 Electricity Crisis in Bangladesh

In Bangladesh, the serious demand-supply gap of electricity is one of the highest bottlenecks for economic growth in Bangladesh. As power supply of the capacity facilities is only around 17340

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MW contrasted with the pinnacle power request of 11387 MW which is history of Bangladesh till 18-072018.There are few load-shedding amid the pinnacle time (BPBD, 2018). Our electrical inclusion are practically 95%. In future will accomplish 100% electrical inclusion. Our administration money related 56% and private monetary is 46%. It is an uplifting news for us that Bangladesh began development of the 2.4-gigawatt (GW) Rooppur Nuclear Power plant expected to go into task in 2023.

In summary the present power scenario of Bangladesh is:

Key Facts:

3563956 People do not have access to electricity.

Rest 95% Million are getting unreliable power

Load shed up is few during hot summer days

Installed Capacity:

20000 MW

Demand and Supply:

Peak Demand: 11387MW (BPBD 2018) Generation Capacity: 17340MW (BPDB 2018) . Our Per Capita Consumption of Electricity: 297kWh

2.9.8 Applications

There are numerous applications, all things considered, for the utilization of sun powered boards. As a power hotspot for water system can be first utilized in horticulture. Refrigerate medicinal supplies can be utilized to in social insurance sun powered board. It can likewise be utilized for framework. Modules and incorporate a substantial assortment of electric gadgets:

Photovoltaic power stations

Rooftop solar PV systems

Solar hybrid power systems

Standalone PV systems

Solar planes

Concentrated photovoltaic

Solar-pumped lasers

Solar panels on space crafts and space stations.

Solar vehicles

2.10 Diode 1n4007

2.10.1 Introduction

As a solitary heading check valve is used a rectifier diode. The electrical stream to stream one way is allowed by these diodes; all around they are used to change over AC control into DC control. Exactly when a rectifier is working, to pick the correct diode for the action is progressively basic; for the most part, the circuit will be hurt. Luckily, an electrically decent a 1N4007 diode with other rectifier diodes, and can be used as a swap for any diode in the 1N400x family.

Figure 2.10.1 Diode 1n4007

2.10.2 Features

Case: Epoxy, Molded

Weight: 0.3 gram (approximately)

Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solder able

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

Shipped in plastic bags, 1000 per bag.

1N4007 Pb-Free Packages Are Available

Polarity: Cathode Indicated by Polarity Band

Available in Fan-Fold Packaging, 3000 per box, by adding a "FF" suffix to the part number

Marking: 1N4001, 1N4002, 1N4003, 1N4004, 1N4005, 1N4006,

Available Tape and Reeled, 5000 per reel, by adding a "RL" suffix to the part number

2.10.3 Characteristics of 1N4007 diode

•   Maximum Average Forward Output Current - 1 A

•   Maximum Forward Voltage Drop per element at 1.0A DC - 1.1 V

•   Typical Junction Capacitance 15 pF Package - DO-41

•   Weight 0.33 grams

•   Maximum Recurrent Peak Reverse Voltage - 1000 V

•   Operating and Storage Temperature Range -65...+175 °C

2.10.4 Polarity & Pin out

Each diode has a cathode and anode. Correspondingly, 1N4007 diode additionally has a cathode (-) and anode (+). In the schematic image, the tip of the triangle with the line over it is the cathode. A band the cathode is set apart on the body of a diode by a band as appeared as follows.
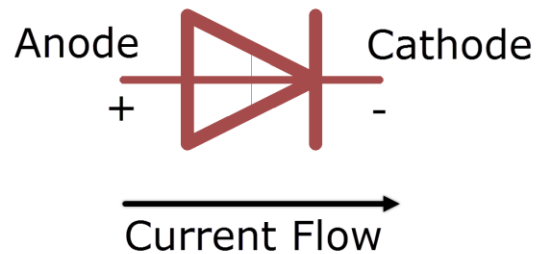
Figure: 2.10.3 Circuit symbol of diode 1N4007

Diode polarity Current can flow from the anode to the cathode only and never from the cathode to the anode - 1N4007 diode is like a one-way valve.

2.11 Adriano Pro min:

2.11.1 Introduction

The Arduino Mini Pro 05 is a little microcontroller board at first subject to the ATmega168, anyway now furnished with the 328.When at premium is a space and expected for use on breadboards. It has 14 electronic data sources/yield pins (of which 6 can be used as PWM yields), 8 basic data sources, and a 16 MHZ valuable stone oscillator. The USB consecutive connector can be adjusted or other USB or RS232 to TTL successive connector. Another package for the ATmega328 has the new littler than expected, which played out all parts to be on the most astounding purpose of the board. It also has an on board reset get. A comparable stick setup as alteration 04 has the new frame.

An open-source PC hardware and programming association named is Arduino, undertaking and customer arrange that creates microcontroller-based units and structures for building propelled contraptions and instinctive things that control and sense the physical world.

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The first Arduino was concocted in 2005, intending to give a simple way and cheap and path for experts and beginners to make gadgets that cooperate with their condition utilizing actuators and sensors and. Normal instances of such gadgets planned incorporate straightforward robots for amateur specialists, movement locators and indoor regulators. In preassembled frame Arduino sheets are accessible monetarily, or as do it without anyone's help packs. The equipment plan details are transparently accessible, permitting the Arduino sheets to be produced by anybody.

Advertisement natural product Industries assessed in mid-2017 that more than 1000,000 authority Arduino has been industrially delivered, and in 2018 that 1050,000 authority sheets were in client's grasp. Arduino Nano is exceptionally conservative form by the Arduino little without an on board USB to sequential association
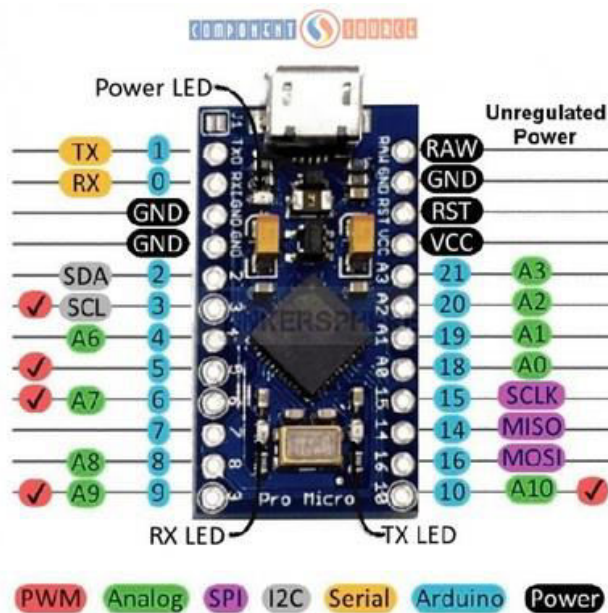
Figure: 2.11.1 Arduino pro min 05

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 programming can be tweaked with the Arduino little. To program the Arduino Mini, A required or other USB or RS232 to TTL consecutive connector. The ATmega328 on the Arduino Mini comes pre overwhelmed by a boot loader that grants to exchange new code to it without the usage of an in - system programming engineer. Using the first STK500 tradition (reference, C header records) with the boot loader passes on. It can in like manner avoid the program and the boot loader the ATmega328 with ICSP (In-Circuit Serial Programming).The little boot stacking for information on wiring up an ICSP header to the Mini and the product design for rules on using a designer to exchange a draw.

2.11.4 Input and Output

Each of the 14 digital pins on the Mini can be used as an input or output. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull -up

40

Resistor (disconnected by default) of 20-50 k Ohms. Pins 3, 5, 6, 9, 10, and 11 can provide PWM output. If anything besides the Mini USB (or other) adapter is connected to pins 0 and 1, it will interfere with the USB communication, preventing new code from being uploaded or other communication with the computer. The Mini has 8 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). Inputs 0 to 3 are broken out onto pins; input 4 to 7 require soldering into the provided holes. By default the analog inputs measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and some low-level code.

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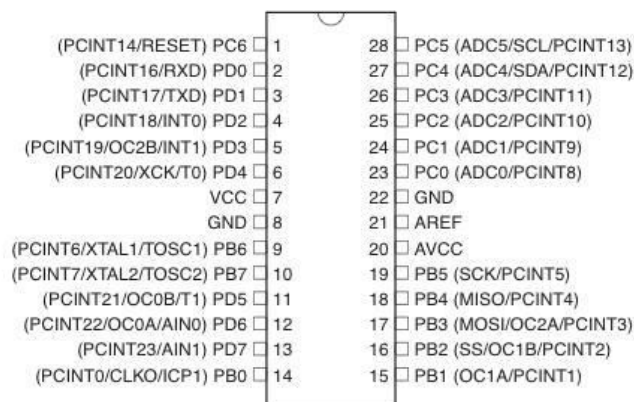
Figure 2.11.5 Pin out ATmega48A/PA/88A/PA/168A/PA/328/P

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

Atmel-ICE AVR port pin	Target pins	Mini-squid pin
Pin 1 (TCK)		1
Pin 2 (GND)	GND	2
Pin 3 (TDO)		3
Pin 4 (VTG)	VTG	4
Pin 5 (TMS)		5
Pin 6 (nSRST)	RESET	6
Pin 7 (Not connected)		7
Pin 8 (nTRST)		8
Pin 9 (TDI)		9
Pin 10 (GND)		0

2.11.6 Overview

The ATmega48A/PA/88A/PA/168A/PA/328/P is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega48A/PA/88A/PA/168A/PA/328/P achieves throughputs approaching 1 MIPS per MHz allowing the system Designed to optimize power consumption versus processing speed.

2.11.7 Block Diagram:
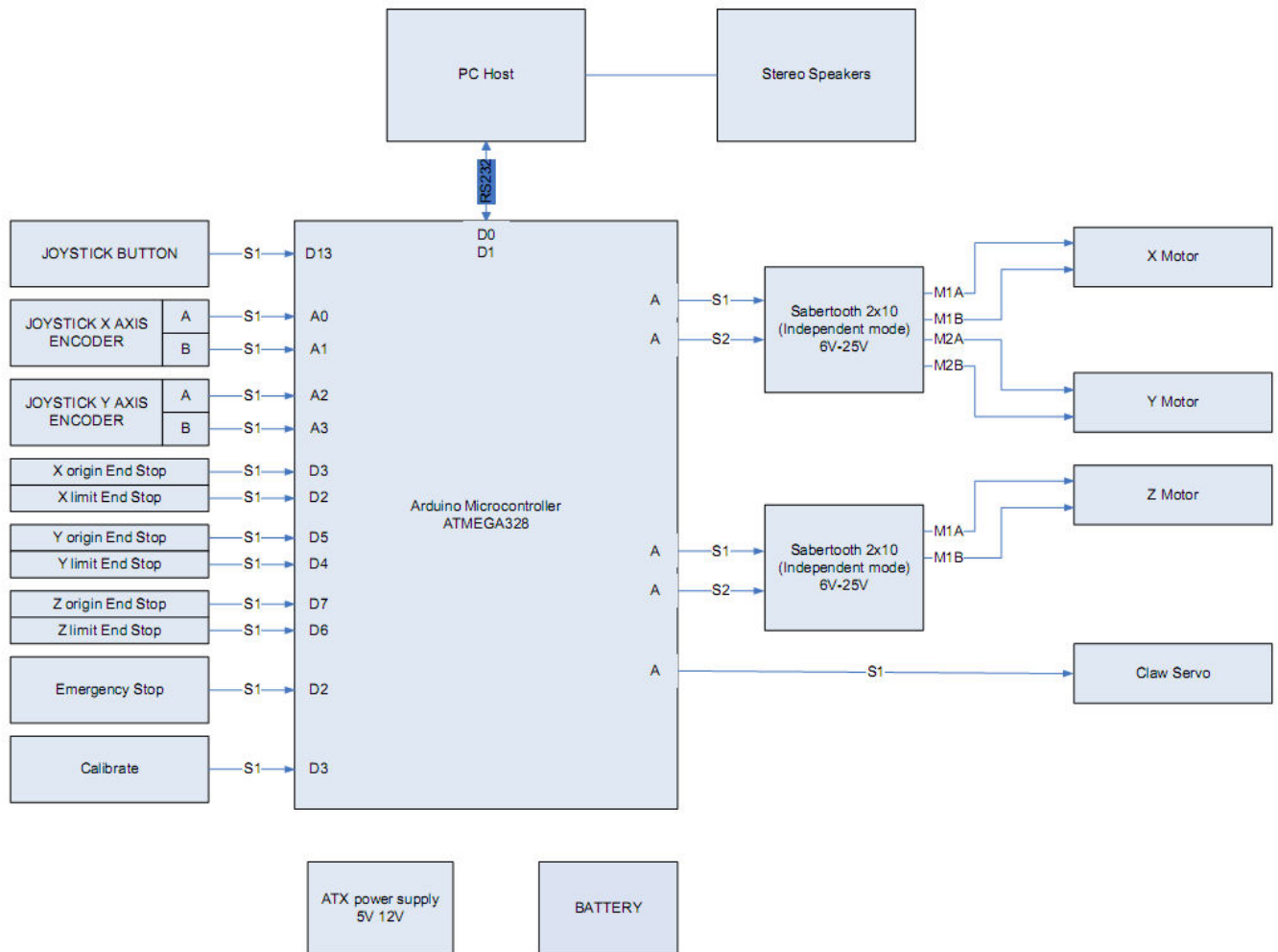
Figure no 2.11.7

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting

Architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The ATmega48A/PA/88A/PA/168A/PA/328/P provides the following features: 4K/8Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 256/512/512/1Kbytes EEPROM, 512/1K/1K/2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, a byte-oriented 2-wire Serial Interface, an SPI serial port, a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable Watchdog Timer with internal Oscillator, and five software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, USART, 2-wire Serial Interface, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or hardware reset. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous timer and

ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption. Atmel offers the Q Touch library for embedding capacitive touch buttons, sliders and wheels functionality into AVR microcontrollers. The patented charge-transfer signal acquisition offers robust sensing and includes fully de bounced reporting of touch keys and includes Adjacent Key Suppression technology for unambiguous detection of key events. The easy-to-use Q Touch Suite tool chain allows you to explore, develop and debug your own touch applications.

The device is manufactured using Atmel's high density non-volatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed In-System through an SPI serial interface, by a conventional non-volatile memory programmer, or by an On-chip Boot program running on the AVR core. The Boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By

Combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega48A/PA/88A/PA/168A/PA/328/P is a powerful microcontroller that provides a highly flexible and cost effective solution to many embedded control applications.

The ATmega48A/PA/88A/PA/168A/PA/328/P AVR is supported with a full suite of program and system development tools including: C Compilers, Macro Assemblers, program Debugger/Simulators, In-Circuit Emulators, and Evaluation kits.

2.12 Transistor 2n2222A

2.12.1 Introduction

The 2N2222 is a common NPN bipolar crossing point transistor (BJT) used for all around valuable low-control escalating or trading applications. It is proposed for low to medium current, low power, medium voltage, and can work at sensibly high speeds. It was at first made in the TO-18 metal can as showed up in the picture.

The 2N2222 is seen as an extraordinarily essential transistor, and is used as a model of a NPN transistor. It is as regularly as conceivable used as a little banner transistor, and it remains a little comprehensively valuable transistor of proceeding with commonness.

The 2N2222 was a bit of a gathering of contraptions delineated by Motorola at a 1962 IRE custom.

Starting now and into the foreseeable future it has been made by various semiconductor associations, for example, Texas Instruments
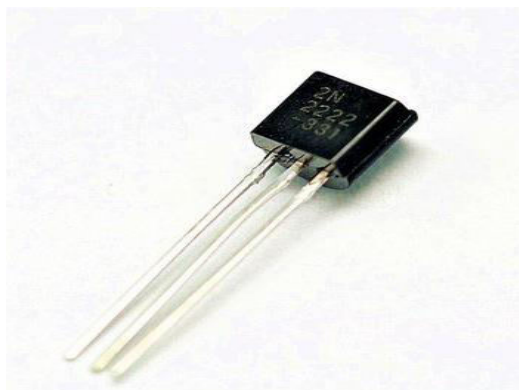
Fig 2.12.1 Transistor 2n2222A

2.12.2 Specification

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

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

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

Polarity: NPN

Maximum Collector-Base Voltage |Vcb|: 60 V

Maximum Collector Power Dissipation (Pc): 0.5 W

Maximum Collector-Emitter Voltage |Vce|: 30 V

Maximum Emitter-Base Voltage |Veb|: 5 V

Max. Operating Junction Temperature (Tj): 175 °C

Transition Frequency (ft): 250 MHz

Maximum Collector Current |Ic max|: 0.8 A

Collector Capacitance (Cc): 8 pF

Noise Figure, dB: -

Package: TO18

Forward Current Transfer Ratio (hFE), MIN: 100

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2.13 Summary

In this project we use some major equipment's and some miscellaneous components. Some components are ignored like wire. Those are not essentially to describe. We describe all the components briefly in this chapter. Every equipment's features, types and working principle are describing in previous. That's why we can also learn about all the components that we used in our project.

CHAPTER 3

Design and Construction

3.1 Introduction

In this part present square chart and circuit outline of sun powered LED Street light with auto force control. At that point we examine quickly about working standard of this venture. Battery were charged from sun based in day time and its release in evening time. This procedure is exceptionally smooth and savvy. This procedure portrayed quickly in beneath.

3.2 Block Diagram
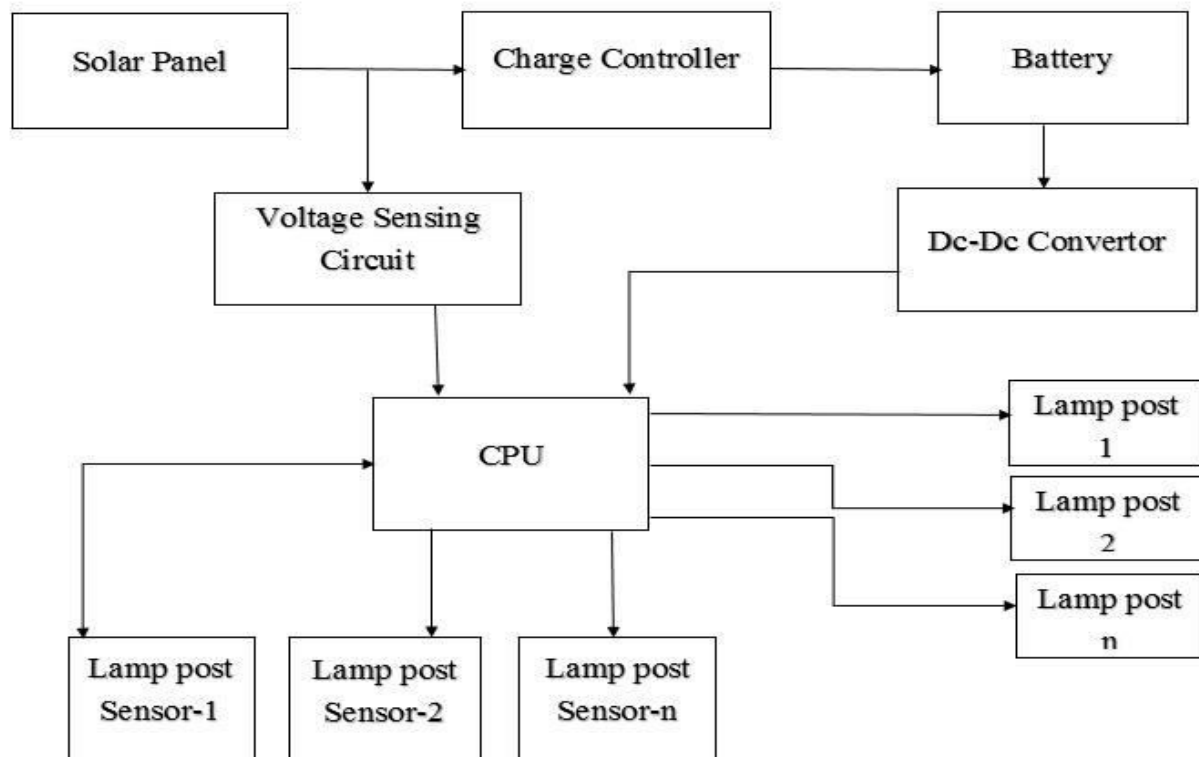
Sun based board retains charge from daylight which limit is 12 volts then it sends the charge to battery through charge controller for changing over the surge into 5 volts in view of the limit of the battery is 5 volts. After that the dc-dc controller again convert this voltage into 5 volts for CPU. What's more, voltage detecting dependably take change from the sunlight based direct to energies the total framework. Around evening time (after 12 am) light post sensor will identify any moving article and it sends flag to CPU which train the light post to turn on. As each light post has 3 lights if the sensor couldn't discover any item, the CPU additionally train the light post to kill for 2 lights.

Circuit Diagram
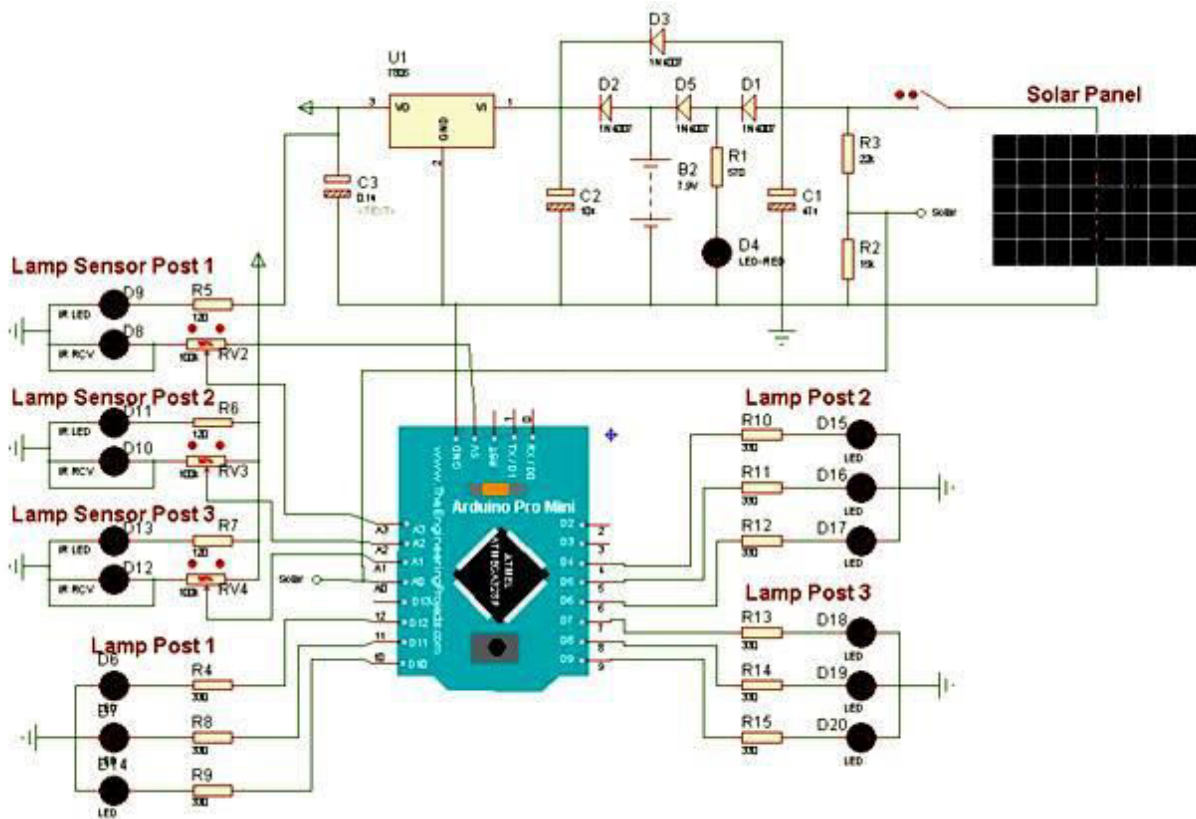
Flowchart
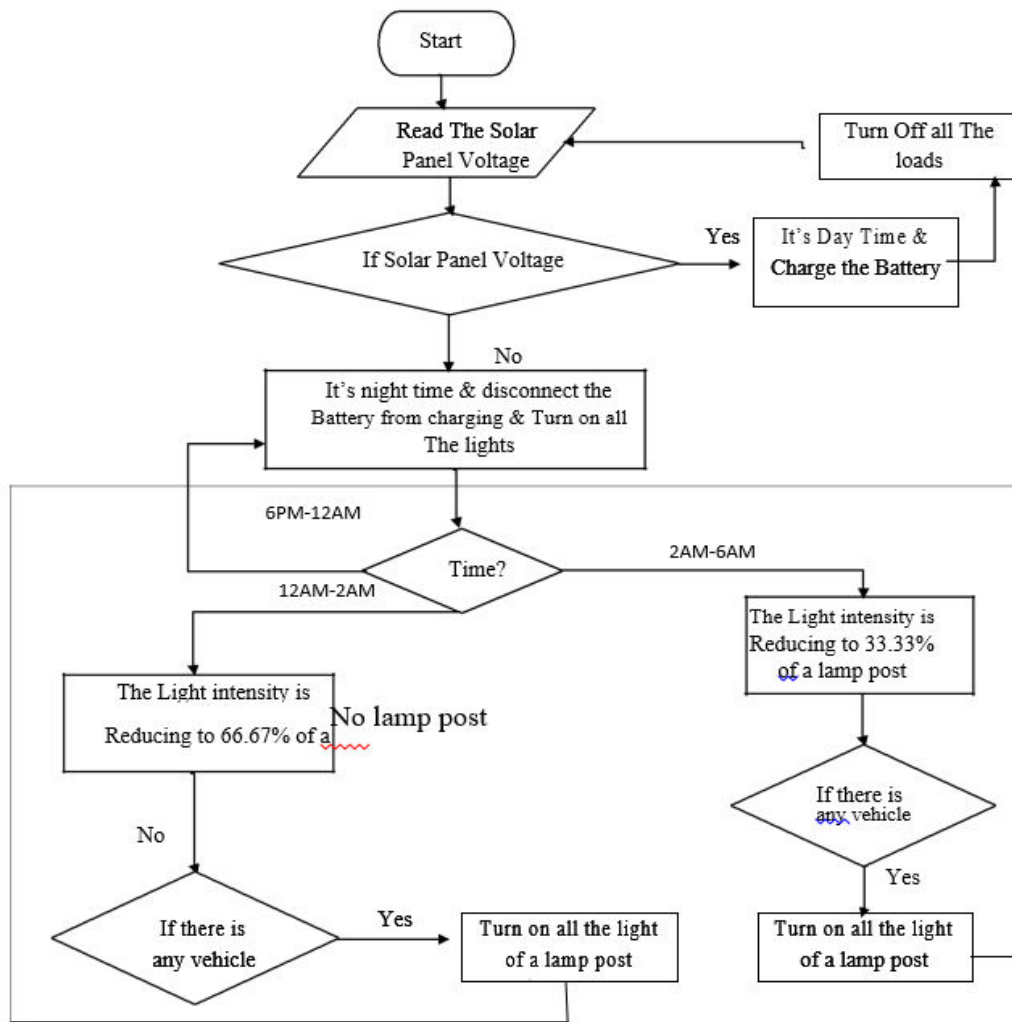
direct to energies the all out structure. Around night time (after 12 am) light post sensor will recognize any moving article and it sends banner to CPU which train the light post to turn on. As each light post has 3 lights if the sensor couldn't find any thing, the CPU moreover train the light post to murder for 2 lights.

3.3 Working principle

Exactly when switch ON condition, in full sunshine we will get most prominent 12v in daylight based board. In addition, when OFF condition (No sunshine) we will get 0v in sun arranged board. It will depend in light that what voltages we will get. Directly off the bat, we consider that we get 12v yield from sun arranged. From circuit outline, this 12v will stream in the primary way. There is a diode D3 along these lines. From diode characteristics, we understand that each diode will drops 0.7v. So now we got 11.3v along these lines and it will be 11.3v in wherever of this wire. By and by we witness what will in second way, this 12v will stream and 0.7v drop in diode D1. By then 0.7v drop in diode D5 and .07 drops in D2. So we get 9.9v from this branch yet this is low voltage appear differently in relation to the essential branch voltage.

By and by as demonstrated by diode properties, we understand that if low voltage stream in anode side and high voltages stream in cathode side, by then it will be pivot inclination and diode will be open. So there will be no present streams from second branch and all of the recurring patterns will stream in first way. By then current experiences the controller and running the system. Neighboring this the 5v battery will charge viably in light of the way that we get 10.6v over the battery. We require more than 9.4v to charge the battery since it goes from the daylight based through two diodes and each diode will drop 0.7v across over it.

By and by when OFF or night condition, 0v will streams over the diode D1 and D5 and it will be modified open and no voltage will stream. By then 5v spill out of the battery and when it passes the diode D2 it will drop 0.7 volt, so we get 4.3v along these lines. Moreover, the important way will switch uneven so no voltage stream towards the way. This 4.3v passes. By then it running the microcontroller. Over the battery there is a zener diode R1 parallel and there is a LED-RED related. The zener diode shimmer in 7v and the LED shimmer in gathered 2v. So it need to harsh 9v to shimmer. In close circuit, we measure 10.5v from the sun controlled. In spite of the way that it will drop 0.7v in D1, it gets 9.8v over this wire and it successfully shimmer the LED light.

The voltage controller 7805 simply can recognize voltage up to 7-24v, and it changes over to 5v to run the controller. The capacitor is interfacing with empty the voltage swell. The R2 and R3 are two securities that sense day or night time. Underneath the 5v it identifies that it will be night and over the 5v it recognizes day. It set up from the microcontroller.

By and by from light post sensor 1, the R5 deterrent has one side related with 5v yield from controller and another side is related with the anode side of IR LED. Its cathode is related with

The ground. In underneath there is a variable opposition RV2 of 100k whose one side is connected with the Vcc and converse side is connected with the anode side of photograph diode D8. The cathode of photodiode is connected with the ground. A wire is connected among resistor and photograph diode it goes to the microcontroller's A3 stick. The light post sensor 2 and light post sensor 3 has same relationship as light post 1.When things like vehicle, people, etc is experiencing the IR LED it has reflect an instigated light to the sensor. The voltage of lights is depending on the reflected light. Right when object experiences it, the lights are shining and when the thing is passed, the lights would be off one-by-one.

We isolated 30 seconds in three timetable of night all of 10 sec. by and by in light post, there will be 5v supply in introductory 10 sec. by then all lights are shinning. It would be simply 0v and 5v. In ordinary condition, one light was given 5v supply and 0v for the other two lights of each light post. Exactly when there is object the others two lights get 5v supply and those are shimmering. In this way, when objects are crossed these two lights get 0v supplies and it winds up off.

3.5 summaries

Since our nation has power emergency, on the off chance that we utilize this idea, it will expel the vitality emergency to a bigger degree. In storm season sunlight based light is increasingly troublesome so we utilize additional batteries in arrangement to spare more power. To enhance lighting we use LED board. The change control is fundamental so as to accomplish security and increment the limit of the battery. In urban communities as of now a great many road lights are worked and the yearly power support cost is high. In our nation there is an extensive number of towns are deny from road lightings for staggering expense of usage lighting framework.

CHAPTER 4

RESULTS AND COST ANALYSIS

4.1 Introduction

Since our country has control crisis, in case we use this thought, it will remove the essentialness crisis to a greater degree. In tempest season daylight based light is progressively troublesome so we use extra batteries in game plan to save more power. To improve lighting we use LED board. The change control is basic in order to achieve security and augmentation the limit of the battery. In urban networks starting at now a considerable number of street lights are worked and the yearly power bolster cost is high. In our country there is a broad number of towns are deny from street lightings for amazing cost of use lighting structure.

4.2 Results

Table 1

Charging Value

Time	V_{panel}	$V_{Battery}$	I
10 am	10.4 V	8.7 V	181 mA
11 am	11.6 V	10.6 V	193 mA
12 pm	11.93 V	9.3 V	191 mA
1 pm	12.12 V	10.2 V	201 mA
2 pm	12.46 V	10.6 V	201 mA
3 pm	10.49 V	9.10 V	183mA
4 pm	9.91 V	8.12 V	171 mA

Average Charging Current, I=160 mA

Battery=1.1 A

So, require hour to charge = 1.1A/.16A

$$= 6.84 \text{ Hours.}$$

Table 2

Discharging Value

V$_{Battery}$	I		
	3 lights on	2 lights on	1 lights on
5 V	116 mA	142 mA	165.7 mA
5 V	140 mA	143 mA	176 mA
5 V	168.7 mA	162.5 mA	185.2 mA
5 V	148 mA	173.5 mA	135 mA
5 V	167.8mA	123.7 mA	156.2 mA
5 V	168 mA	132.2 mA	134.9 mA
5 V	157.5 mA	141.7 mA	145.2 mA

So, when 3 lights ON, required hour to discharge the battery = 1.1A/0.15228A =

7.22 Hour

When 2 lights ON = 1.1A/0.14551A

= 7.55 Hour

When 1 light ON = 1.1A/0.1376A

= 7.99 Hour

4.3 Cost Allocation

NAME	MODEL/VALUE	QUANTITY	PRICE IN TK
Resistor	15k	1	1.5
Resistor	330k	9	7
Resistor	120k	3	2.5
Capacitor	47u	1	2.7
Capacitor	10u	1	2.5
Capacitor	0.1u	1	1.3
Integrated Circuits	7805	1	15
Diode	1N4007	4	7
Diode	1N4738A	1	4
Diode	LED-RED	1	4
Diode	LED	9	25
Diode	IR RCV	3	20
Diode	IR LED	3	20
Microcontroller	Arduino Pro Mini	1	250
Solar Panel	12v	1	550
Battery	5v	1	150
Variable Resistance	100k	3	6
Variable Resistance	10k	1	2.5
Wires			70
Others			60

Total Cost = 1201 TK

4.4 Cost Comparison

Features	Traditional System	Our System
Load	10.12 Kw	7.5 Kw
No Of Battery Needed	8	4
Battery Cost	16000Tk(20000 Per Battery)	8000Tk
Power Require	2030 W	1450 W
Solar Cost	101500Tk(50Tk per Watt)	72500Tk
Others Cost	55000Tk	35000Tk
Total Cost	172500Tk	115500Tk

So, traditional system – auto intensity control = (172500-115500) =57000Tk.

We can save 57000Tk by Auto Intensity Control of Street Light.

4.5 Summary

In spite of the fact that our nation faces vitality emergency this framework is truly important for our administration and our kin as our nation is injured individual in neediness. It very well may be extremely useful to expend vitality and decrease the vitality cost. Additionally it very well may be a piece of creating of our nation. With the goal that the administration of our nation just as power division should execute this technique early.

4.6 Advantages:

1. Reduce a lots of energy.

2. Save energy by turning of lights when the vehicle is not detected

3. Solar Street light are independent of the unity grid. Hence, the operation costs is minimized.

4. Solar Street lights are Require much less maintenance compare to conventional street lights.

5. This is a non-polluting source of electricity.

6. Since external wire is eliminated, risk of accident is minimized.

7. Separate parts of solar can be easily carried to the remote area.

8. Complete elimination of manpower.

9. Reduce Greenhouse gas emission.

10. To light the street of rural areas with transmission lines as well as solar power where there is so many power cuts occurs.

4.7 Disadvantages:

1. Initial investment is higher compared to conventional street light.

2. Its take long time for charging the battery.

3. Dust combine with moisture can reduce or even stop energy production.

4.8 Application:

The System is design for outdoor application in un-electrified rural areas. This system is an ideal application for campus and village street lighting.

1. Street lighting.

2. Pathway lighting.

3. Security lighting.

4. Campus lighting.

5. Park lighting.

6. Gate lighting.

7. Wildlife life.

8. Remote area lighting.

9. LED lighting offers high efficiency, long operating life and low voltage operation which ideal for solar.

10.   Office are lighting

11.   Market area lighting

12.   Bus stand lighting

CHAPTER 5

CONCLUSIONS

5.1 Conclusions

The sun arranged imperativeness is one of the crucial and major unlimited wellsprings of essentialness and has in like manner exhibited it supportive in working of uses like street lights.

Daylight based controlled customized street light control is one of the employments of devices to extend the workplaces of life. The use of new electronic theories has been put some place close bent to extend the workplaces given by the present machine. Here the workplace of ordinary street light is extended by the creation it controlled normally.

The change control is basic to achieve prosperity and addition the limit of the battery. In urban networks starting at now a large number of street lights are worked and the yearly power bolster cost is high.

The fundamental cost and support can be the drawbacks of this undertaking. With the advances in development and incredible resource masterminding the cost of the endeavor can be cleaved down and moreover with the use of good rigging the upkeep can in like manner be reduced similar to irregular checks.

It saved around 45% of intensity from per street light. So all through the world in case we use this thought, it will clear the essentialness crisis to a greater degree. It is eco-obliging and utilizes the feasible wellspring of essentialness extraordinary. The earth don't sully by using this. Standard power resource is boundless, so we ought to using this benefit as we can.

5.2 Future Scopes of the work

The sun arranged controlled LED streetlight with Auto Intensity Control can control the electric charge and intensity of lights.

This assignment can be redesigned by using with clock based things and photo sensor based things.

We can use sun arranged after structure for speedy charging.

In tempest season daylight based light is continuously troublesome so we use extra batteries in course of action to save more power. To improve lighting we use LED board.

We can join Night vision CC Camera in urban regions by this undertaking for security and prosperity explanation behind wayfarer.

5.3 Summary

Since our country has control insufficiency, in case we use this thought, it will discard the imperativeness crisis to a greater aggregate. Power control of street light just as using of clock based things and photo sensor based things, we can save heaps of essentialness similarly as imperativeness cost. Sun based is similarly playing a basic trademark to save essentialness. By then the use of sun fueled and auto drive control based things should be pushed ahead.

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Appendix

Program Used in the Micro-controller

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



//object for lamp post
classlamppost {
private:
        bytesensor 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);
        intsensor Read(void);
        voidlight (bool light_1, bool light_2, bool light_3);

private:
        voidpin Setup(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 -> _pin;
        this ->sensor_pin = sensor_Pin;
        pinSetup ();
}

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

intlampPost: sensorRead () {
        returnanalogRead(sensor_pin);
```

```
}

voidlampPost: 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);

inttimeCunt=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;
```

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```
//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);
                }
        }//*/


}


intdayNightSensor(void){
        returnanalogRead(dayNightSensor_pin);
}

voidtimerIsr()
{
        if(timeCunt>=10){
                sec++;

                timeCunt=0;
        }
        //Serial.println(timeCunt);
        timeCunt++;
}
```