

PROJECT REPORT
AIRCRAFT EXTERNAL LIGHTS SYSTEM

Submitted in partial fulfillment of the award of the

Bachelor of Science
IN
AERONAUTICS(AVIONICS)
By

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Bonafide Certificate

This is to certify that project report entitled "AIRCRAFT EXTERNAL LIGHT SYSTEM", is a bonafide record of work carried out BY BHANDAKKAR VICKY VINAYAK (2017-A-01) during the final semester from November 2020 to April 2020 under my guidance, in partial fulfillment of the **requirements for the award of Bachelor of Science in Aeronautics (Avionics)**.

Prof.Dr.Suresh Kumar

Principal

DECLARATION

I, BHANDAKKAR VICKY VINAYAK (2017-A-01) hereby declared that this project report titled AIRCRAFT EXTERNAL LIGHTS SYSTEM submitted in partial fulfillment of the requirement for the award of **"BACHALOR OF SCIENCE – in AERONAUTICS(AVIONICS)** is my original work and it has not formed the basis for the award of any other degree.

BHANDAKKAR VICKY VINAYAK

Place:

Date:

Aircraft External Lights System



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BHANDAKKAR VICKY VINAYAK

(2017-A-01)

Date: / / .

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ABSTRACT

Aircraft lights are used for safe take off and landing at the night, taxiing on the ground and to avoid the collision in the air. Aircraft lighting system provides illumination for both exterior and interior use. Lights on the exterior provides illumination for such operation as landing at light, inspection of icing conditions, and safety from midair collision. Certain special lights, such as indicator and warning lights, indicate the operation status of equipment.

External light consist of Landing, Taxi, Navigation, Beacon, Anti-collision strobe and wing inspection lights. Control of Landing and Taxi light is provided by switches on the LANDING LTS panel located on the overhead panel. All other external light controlled by switches on the EXTERNAL LTS panel, also located on the overhead panel.

Navigation Light:- Navigation Light are used to give the position, heading and status. Navigation light is Red on Port wing(Left Wing) and Green on Starboard(right wing).

Strobe/Anti-collision Lights;- Strobe Lights are used to avoid the accident of aircraft are also known as anti collision light. The strobe lights is of white color in a flashing state. It is usually mounted on the wing tip.

Landing and Taxi Light:- Landing lights of smaller aircraft are usually located midway in the leading edge of each wing or streamlined into the aircraft surface. On some aircraft, the landing light is mounted in the same area with a taxi light. A sealed beam, halogen, or high intensity xenon discharge lamp is used.

Beacon Lights:- Beacon lights are flashing red lights fitted on the top and bottom fuselage of an aircraft usually on larger passenger aircraft.

INTRODUCTION

Virtually all aircraft types are fitted with external lights of some description. The type, purpose and complexity of the lighting systems installed on the exterior of a particular aircraft vary in accordance with its size, role and normal flight environment. External lights, in general terms, serve one of three purposes:

- to make the aircraft more visible to other aircraft,
- to improve pilot visibility during critical phases of flight or
- to provide illumination for some other specific purpose.

Aircraft lighting systems provide illumination for both exterior and interior use. Lights on the exterior provide illumination for such operations as landing at night, inspection of icing conditions, and safety from midair collision. Interior lighting provides illumination for instruments, cockpits, cabins, and other sections occupied by crewmembers and passengers. Certain special lights, such as indicator and warning lights, indicate the operation status of equipment.

Note that there is often overlap in the utility of some of the external lights. As an example, landing lights greatly improve a pilot's ability to see the runway during takeoff and landing but also enable the aircraft to be seen by ground personnel and by other airborne traffic.

Position, anti-collision, landing, and taxi lights are common examples of aircraft exterior lights. Some lights are required for night operations. Other types of exterior lights, such as wing inspection lights, are of great benefit for specialized flying operation.

Planes are equipped with a variety of lights that are used for navigation, safety, and to improve visibility during flight or when taxiing on the ground. The external lights on aircraft fall into two general categories. The first is navigation lights or beacons that are always

illuminated while the aircraft is in operation. A second type includes takeoff and landing lights that are used to improve visibility when the plane is close to or on the ground

AIRCRAFT LIGHTS

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1. Navigation light
2. Strobe Lights/Anti-Collision Light
3. Landing Light
4. Taxi Light
5. Beacon Lights

- **Navigation Light:**

A navigation light, also known as a running or position light, is a source of illumination on a vessel, aircraft or spacecraft. Navigation lights give information of aircraft's position, heading, and status. Their placement is mandated by international conventions or civil authorities. Navigation lights are not intended to provide illumination for the craft making the passage, only for other craft to be aware of it.

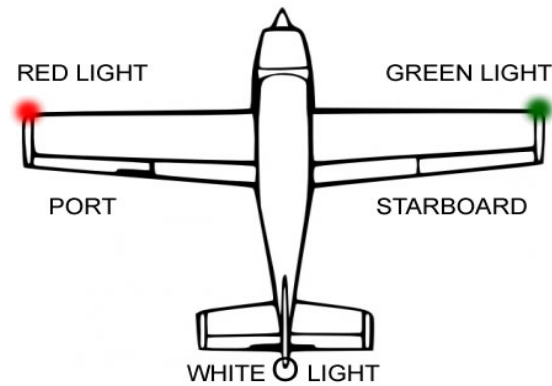


Fig no:- 1

Aircraft operating at night must be equipped with position lights that meet the minimum requirements specified by Title 14 of the Code of Federal Regulations. A set of position lights consist of one red, one green, and one white light.

On some types of installations, a switch in the cockpit provides for steady or flashing operation of the position lights. On many aircraft, each light unit contains a single lamp mounted on the surface of the aircraft. Other types of position light units contain two lamps and are often streamlined into the surface of the aircraft structure. The green light unit is always mounted at the extreme tip of the right wing. The red unit is mounted in a similar position on the left wing. The white unit is usually located on the vertical stabilizer in a position where it is clearly visible through a wide angle from the rear of the aircraft.

In addition to the red and green lights, most planes are also fitted with other steady white navigation lights in various locations. Large airliners, in particular, will often have such lighting on the trailing edge of each wingtip. These lights are also sometimes placed along the trailing edges of the horizontal tail. Another popular location is at the very aft end of the fuselage or at the top of the vertical tail.

One of these latter lights placed along the aircraft centerline is especially common on smaller airliners and commuter planes. Whatever the location, the purpose of these steady white lights is to improve the plane's visibility from behind the aircraft.

Applications:

- o Navigation lights gives the information of aircraft position, heading and status.
 - o When taxing or flying in the night when it is more difficult to tell the direction the plane is going without them.
 - o The Position light shows your position and relative direction.
 - o Make it possible for an outside observer, such as the pilot of another aircraft, to determine which direction the plane is flying.
-
- **Strobe Lights/Anti-Collision Light**

An anti-collision light system may consist of one or more lights. They are rotating beam lights that are usually installed on top of the fuselage or tail in such a location that the light does not affect the vision of the crewmember or detract from the visibility of the position lights. Large transport type aircraft use an anti-collision light on top and one on the bottom of the aircraft.

Usually mounted at the wing tips and, possibly, at empennage extremities, strobe lights produce an extremely bright intermittent flash of white light that is highly visible. The light is produced by a high voltage discharge of a capacitor. A dedicated power pack houses the capacitor and supplies voltage to a sealed xenon-filled tube. The xenon ionizes with a flash when the voltage is applied.



Fig no:-2

Applications

- o The Strobe light is a safety light to warn other aircraft ,especially in congested areas.
- o A white strobe light is second type of anti-collision light that is also common.

● Landing and Taxi Light

Landing lights of smaller aircraft are usually located midway in the leading edge of each wing or streamlined into the aircraft surface. Landing lights for larger transport category aircraft are usually located in the leading edge of the wing close to the fuselage. Each light may be controlled by a relay, or it may be connected directly into the electric circuit. On some aircraft, the landing light is mounted in the same area with a taxi light. A sealed beam, halogen, or high intensity xenon discharge lamp is used.

Taxi lights are not designed to provide the degree of illumination necessary for landing lights. On aircraft with tricycle landing gear, either single or multiple taxi

lights are often mounted on the non-steerable part of the nose landing gear. They are positioned at an oblique angle to the center line of the aircraft to provide illumination directly in front of the aircraft and also some illumination to the right and left of the aircraft's path. On some aircraft, the dual taxi lights are supplemented by wingtip clearance lights controlled by the same circuitry.



Figno:-3

Applications

- Landing lights are installed in aircraft to illuminate runways during night landings.
- Landing lights are directed by the parabolic reflector at an angle providing a maximum range of illumination.
- Taxi lights are designed to provide illumination on the ground while taxiing or towing the aircraft to or from a runway, taxi strip, or in the hangar area.
- Taxi lights are also mounted in the recessed areas of the wing leading edge, often in the same area with a fixed landing light.

- Beacon Light

Beacon lights are flashing red lights fitted on the top and bottom fuselage of an aircraft usually on larger passenger aircraft. Their purpose is to alert ground crew and other aircraft that an engine is starting up, running or shutting down, or that the aircraft is about to start moving.

Some spin to produce the flashing effect, increasing the chance they will be noticed. Beacon lights are bright enough to be seen from the ground, and can be used to identify aircraft from the ground in dark or overcast conditions where the plane itself isn't completely visible.



Fig no :-4

Two beacon lights are fitted to aircraft near the center of the fuselage. One is located on top of the fuselage and the other on the bottom. These lights are colored reddish orange and rotate to produce a flashing effect. The beacons are turned on just before the engines are started and they remain active until the last engine is shut down. The beacons help to serve as a safety warning to

ground personnel that the engines are operational.

Application

- o The Aircraft Beacon Lights are red in color and either flash or rotate to provide a pulsating warning lights.
- o The beacon lights is normally turned on prior to engine start and turned off after engines have been shut down.
- o Constantly working beacon lights help the ground engineers identify whether the aircraft engine works properly.



Fig no:-5

COMPONENTS USED IN PROJECT

The proposed Aircraft Lighting System will include :

- Plywood
- Led (Light Emitting Diode) of Red, White and Greencolors.
- Two Transformers of 4V and 12V.
- 5 Toggle Switches
- Single conductor Wire for Connection
- Printed Outline of aircraft diagram of "A1Size".

Detailed Description of Components

Now we are going to discuss the details of the components that we have been used in our project one by one.

➤ **Plywood**

We have used the 12mm plywood. The Size of the plywood is 3ft*2ft of our project.

➤ **Led(Light Emitting Diode)**

A **light-emitting diode (LED)** is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.

The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

- **Anode**:-The anode is now defined as the electrode at which

electrons leave the cell and oxidation occurs.

- **Cathode:-** cathode as the electrode at which electrons enter the cell and reduction occurs.

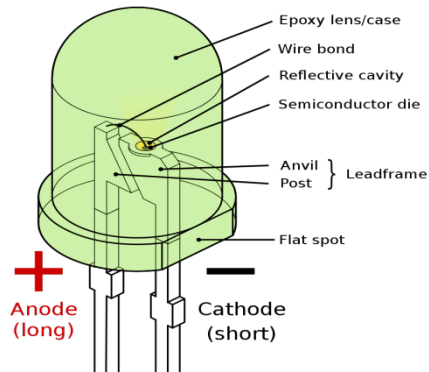


Fig no:-6

In this project we have used Red , White, Green Leds. Where Red leds indicates Beacon Lights and two Navigation light, White Leds Indicates Strobe/Anti-collision lights , Landing and Taxing Lights And one Navigation light.Green Leds Indicates Navigation Lights.

➤ Transformers

A **transformer** is a passive electrical device that transfers electrical energy from one electrical circuit to another, or multiple circuits. A varying current in any one coil of the transformer produces a varying magnetic flux in the transformer's core, which induces a varying electromotive force across any other coils wound around the same core. Electrical energy can be transferred between separate coils without a metallic (conductive) connection between the two circuits.

Transformers are most commonly used for increasing low AC voltages at high current (a step-up transformer) or decreasing high AC voltages at low current (a step-down transformer) in electric power applications, and for coupling the stages of signal processing circuits. Transformers can also be used for isolation, where the voltage in equals the voltage out, with separate coils not electrically bonded to one another.



Fig no:-7

We have used two transformers in this project

- 4V
- 12V

4V transformer is used to operate the landing lights, Taxing lights, Navigation lights.

12V Transformer is used to operate the Strobe/Anti-collision Light and Beacon light. Though the strobe light and beacon light are flashing/blinking lights so we have made the small circuits to operate the leds in flashing conditions.

➤ **Toggle Switches**

A toggle switch or tumbler switch is a class of electrical switches that are manually actuated by a mechanical lever, handle, or rocking mechanism.

We have used 5 3PDT Mini Toggle switches in our project to operate the leds.



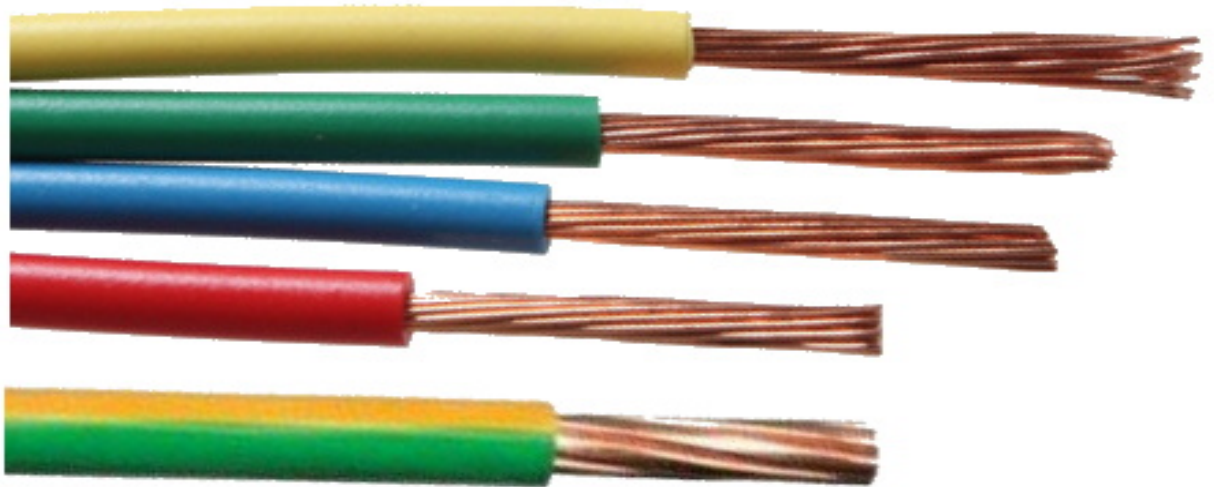
Fig no:-8(a)



Fig no:-8(b)

➤ Single Conductor Wire

Single stranded wire is made of multiple thin strands of wires that form together one conductor. The stranded design offers flexibility thus they are suitable for applications where wires need to be bent or twisted. Electrician prefer stranded over solid because it is easier to route through pipes in walls due to its flexibility.



Single Stranded Wires

Fig no :- 9

Stranded wire is used when higher resistance to metal fatigue is required. Such situations include connections between circuit boards in multi-printed-circuit-board devices.

PRINTED OUTLINE OF AIRCRAFT DIAGRAM

We have used the printed sheet of aircraft to do this project. The size of the print is A1 size. The sheet shows the top view of the aircraft and Front view of the aircraft. The printed is pasted on the plywood sheet.

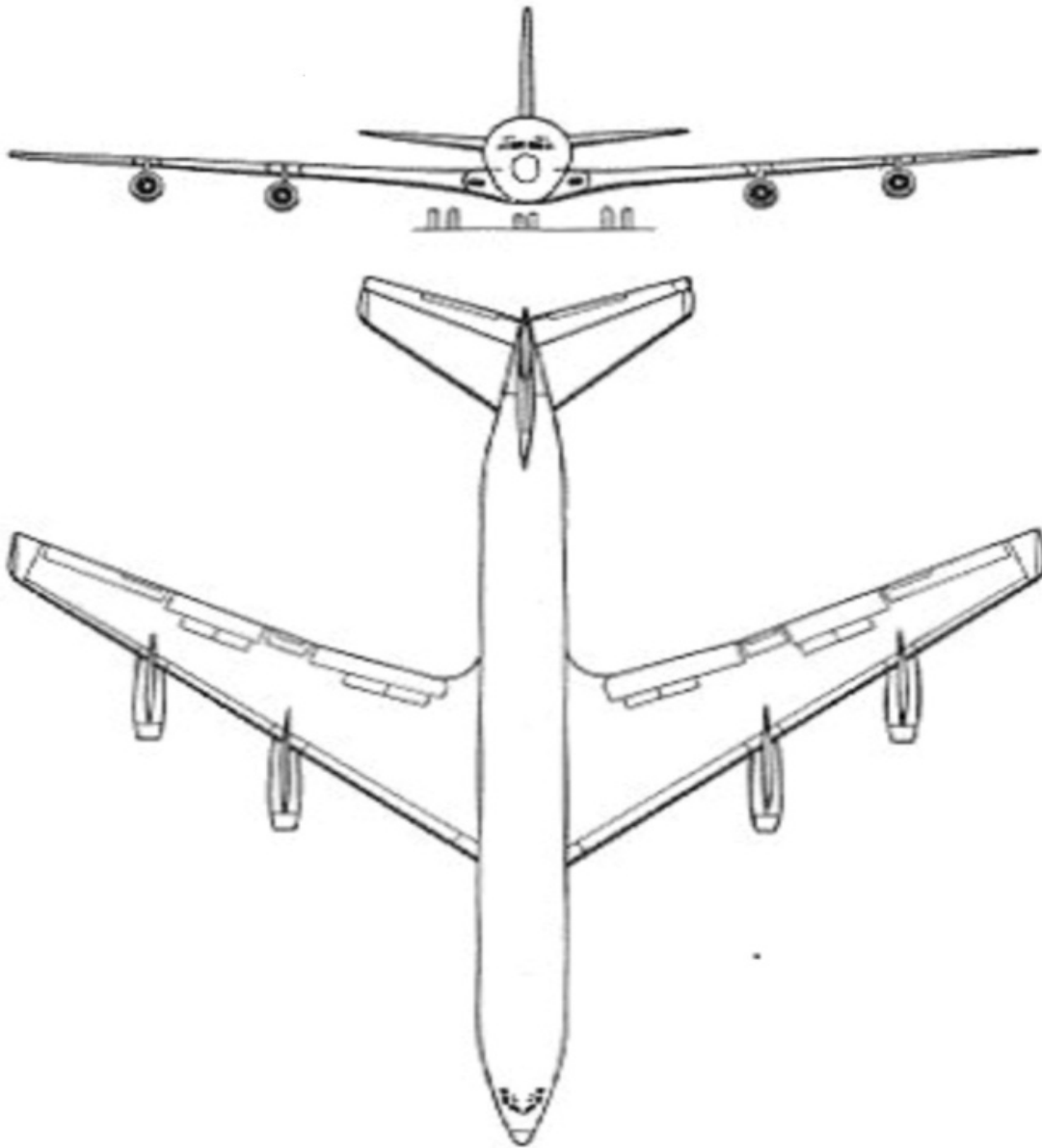
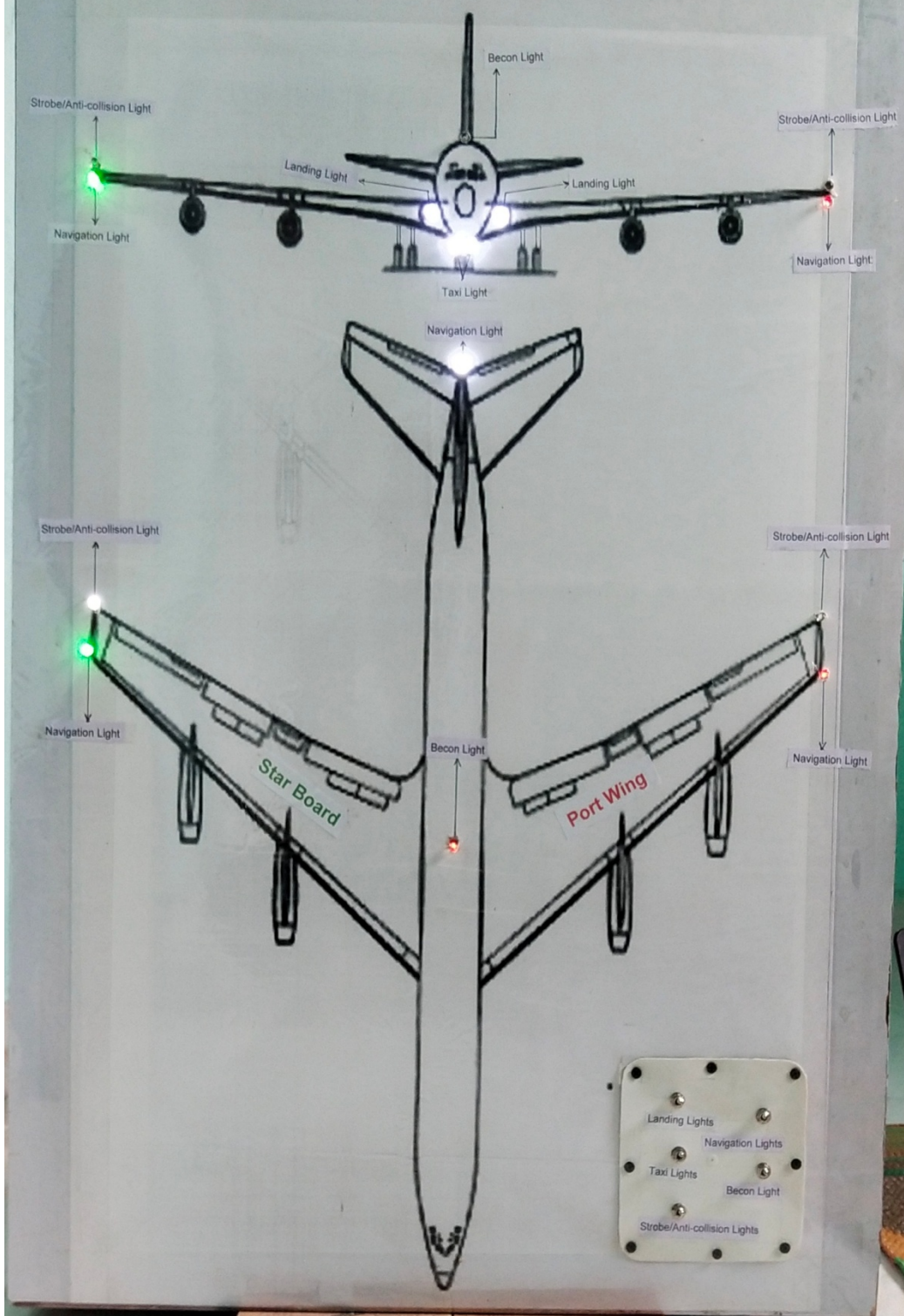


Fig no:-10

Aircraft External Lights System



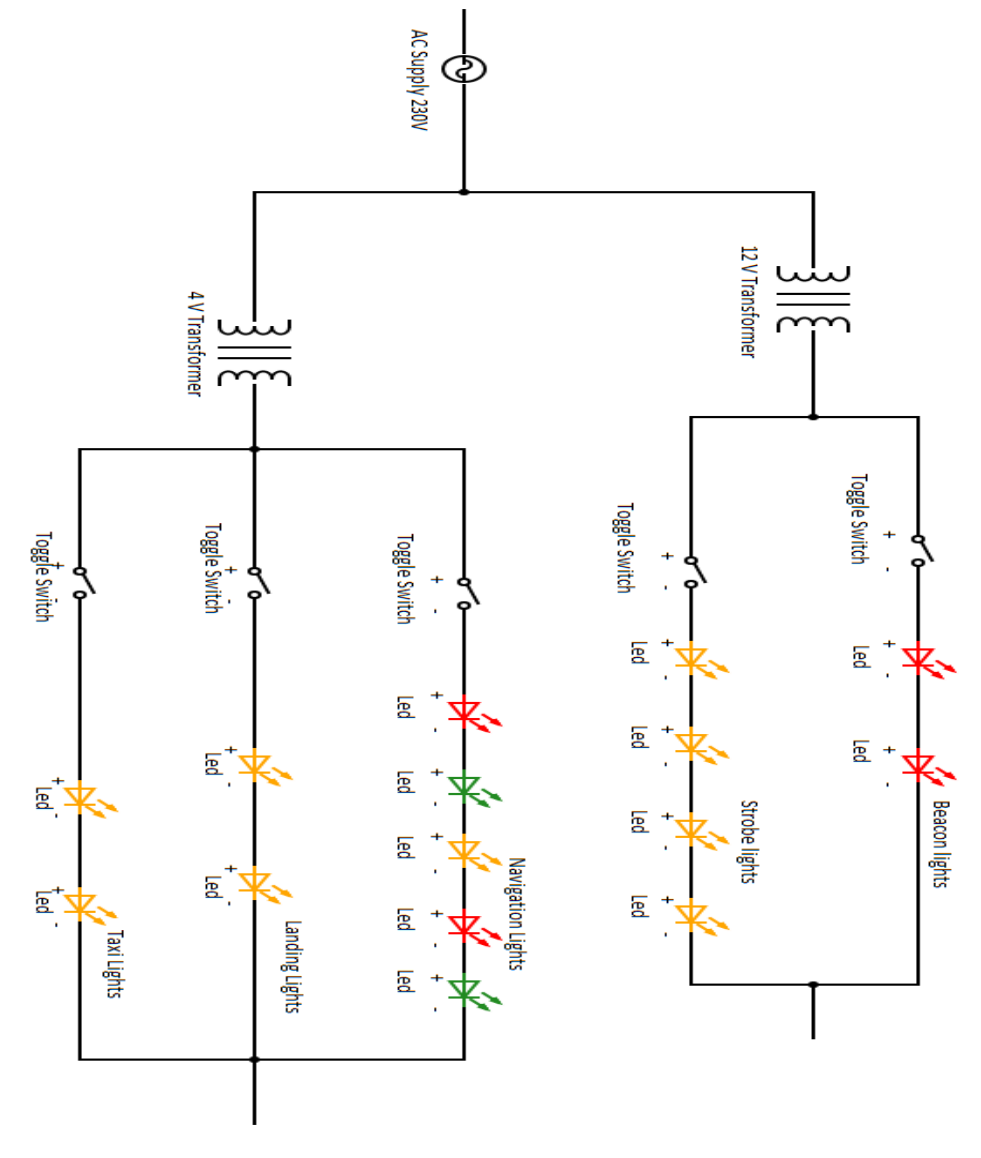
PROJECT PROCEDURE

- i. Procedure of our project is first we have took a sheet of plywood and cut in the size of 3ft*2ft .
- ii. After Cutting the sheet we have pasted the Printed sheet of the aircraft on that panel.
- iii. After that we have we have drill the panel on the points were we are going to place the led to show the lights.
- iv. The led bulb are used in this project are in colors Red, Green, andWhite. Were red led is used is to show navigation lights on port wing and beacon lights on the fuselage. White led is used for strobe light, landing, taxing and navigation on the tail of the aircraft and the green led is for Navigation lights on the star board side the aircraft wings.
- v. Used the 5 3PDT mini toggle switches to operate the led lights in on and off condition. For toggle switch we have used a fabric box cover to place the switch on it.
- vi. We have used the standard wire to give the connection.
- vii. To operate and to make the strobe and beacon light in flashing condition have use the 12V transformer and we have 4V transformer for Navigation lights, Landing Lights and Taxi lights.
- viii. All the connection in the project is series we have made one circuit diagram which shows the connection and wiring of the project.
- ix. We Have used the AC Supply as the main Source of current(I).
- x. The lights will be operated by Toggles switch to indicate the

specific lights have been shown this project.

- xi. The main purpose of the project is to explain the students where are the aircraft external lights located and to explain where the lights have been located on the aircraft.

PROJECT CIRCUIT DIAGRAM



Circuit Diagram Fig no:-11

- i. Circuit diagram explain the connection given in the project .
- ii. As we have mentioned above in the procedure we have used AC supply as the main source of supply.
- iii. We have used the two transformers of 4V and 12V. As the 4V Transformer is for the navigation, Landing and taxiing lights and 12V transformer is for the strobe light and beacon lights. In this project connection are in series
- iv. As the transformer flow the current to the switch and when switch is operates In on condition the led blinks and off condition the led switch offs.
- v. The main use of transformer in this project to control the flow of current. If the current flows in the high Volt the it can Fuse the leds. So we have used the transformer.
- vi. So as shown in the circuit the current is flow from the AC supply to the transformers from the transformer the current is flown to the leds and the leds started blinking.
- vii. On 12V transformer 2 switches are operated.
- viii. On 4V transformer 3 Switches are operated.
- ix. The input of transformer is high so the transformer helps to reduce the current flow.
- x. After completion of all the connection we have cover the panel form side an back though the connection should not cause lose contact.

CONCLUSION

In this Project we have shown the Aircraft Lights System and the uses of lights on aircraft, we have tried to show the purpose of lights used on the aircraft and how they are operated on aircraft while aircraft is on ground and flying. We have also shown the simple circuit which is easy to understand the motive of our project.

In this project, we have shown external lights of an aircraft which are as follows:-

1. Navigation lights
2. Strobe/Anti-collision lights
3. Beacon lights
4. Landings lights
5. Taxiing lights

THANK YOU!