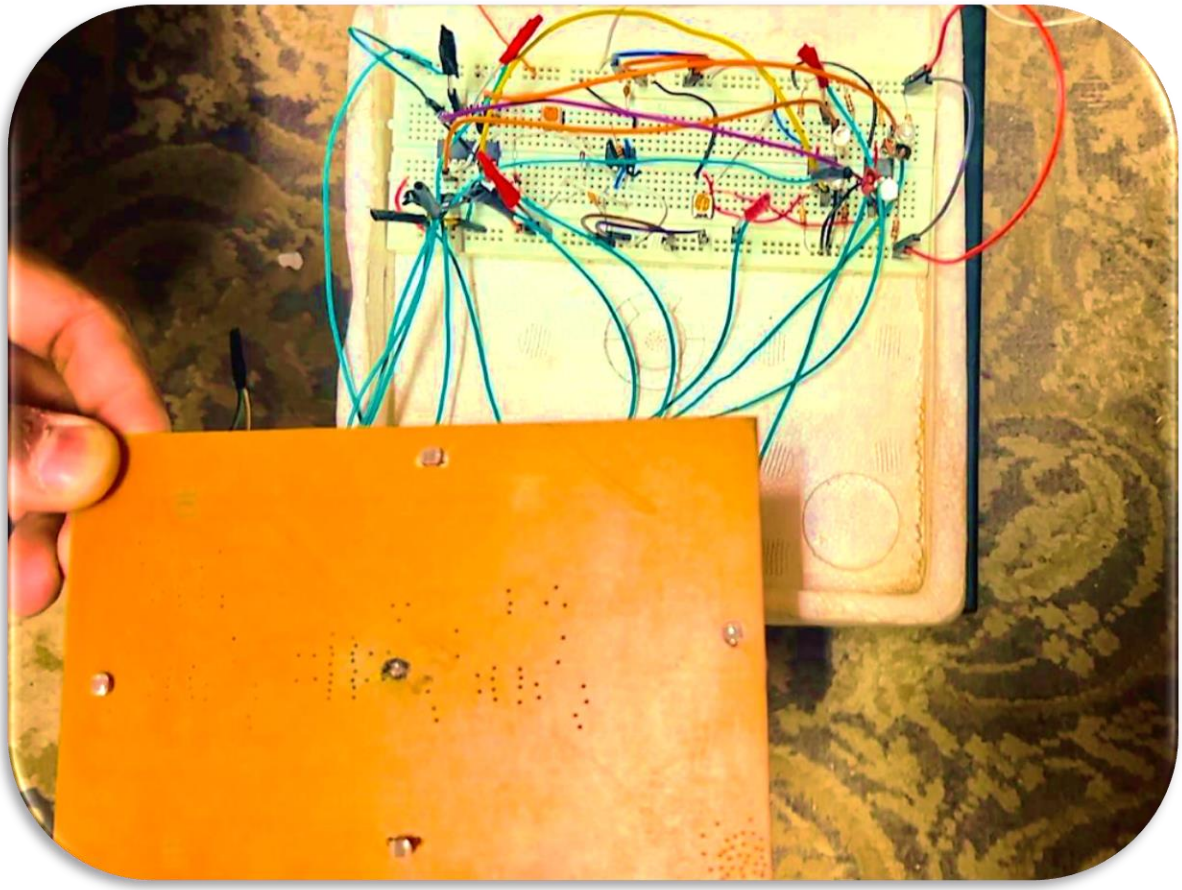

SOLAR TRACKING SYSTEM

EL-313 Linear Control System

GROUP MEMBERS

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FALL-2022

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I. Abstract

The goal of this project is to develop a prototype of a solar tracking system, which can enhance the performance of the photovoltaic modules in solar energy systems. The operating principle of the device is to keep the photovoltaic modules constantly aligned with the sunbeams, which maximizes the exposure of solar to the sun radiation. As a result, more output can be produced by the solar panel and the utilization of solar energy can be enhanced.

The main objective of the project is to harness the maximum amount of sunlight from the sun and convert it to electricity so that it can be easily used and transferred. This can be done by aligning the solar panel perpendicular to sun rays so that maximum sunlight can be converted into electrical form. As this system gives maximum efficiency.

The advantage of this project is to provide access to an everlasting and pollution-free source of energy. This project can be used in the form of decentralized generation. And when connected to big battery banks then can independently fulfill the needs of local areas.

II. Introduction

There is various form of energy which we are using in form of thermal, chemical, mechanical, electrical, etc. The most popular form of energy is Electrical Energy as it is easy to transfer with maximum efficiency. The demand for Electrical Energy is increasing day by day. We are mostly generating it through conventional sources like fossil fuels, nuclear fuels etc., but the conventional sources are limited and create pollution and exhaust one day. So, we are shifting to non-conventional sources like wind, solar, tidal, geothermal etc. Solar Energy is the biggest form of energy, all the other forms of energy depend on it only like wind is due to air currents which is due to expansion of air by solar energy only, fossil fuels due to life cycle which also depend on Solar Energy. So instead of taking it indirectly we can directly convert into electrical energy by using photovoltaic cell, or Solar cell. But we are not able to harness that much amount of energy. Solar energy can be converted to electrical energy through solar panels. They give maximum output when rays incident at 90 degrees.

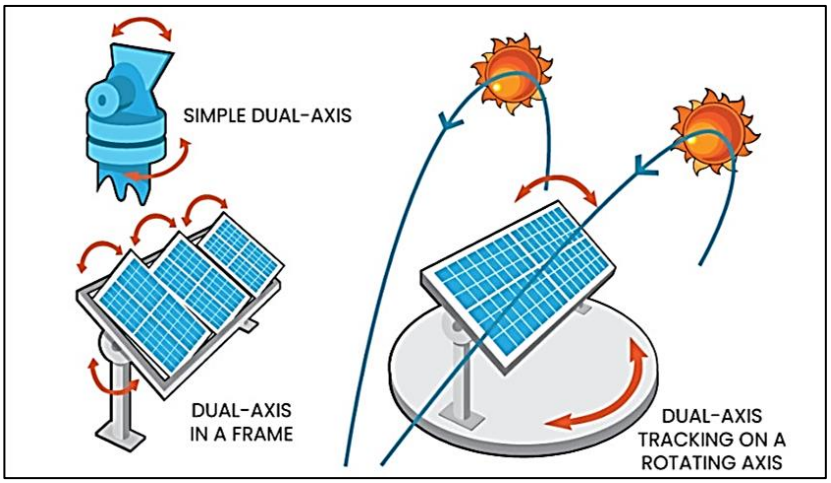

Figure 1: Solar Tracking System Tentative Output

III. Problems Statement

The main goal is to keep solar PV panel perpendicular to the sun throughout the day in order to increase energy generation. Dual axis solar tracking system can be an effective way to increase the efficiency of solar cells. The devastating problem on both biotic and abiotic components of our home (i.e., pollution) can be reduced by using solar energy as the major source for power generation. The natural gift like fossil fuels, woods, etc. which are limited in amount can be saved from crisis and extinction. For people, due to its more efficiency and less harmful impacts dual axis solar tracking system might be good decision for the intermediate future.

IV. Background

Fossil fuels have been facing reduction with passing time and generation of power is becoming a bigger challenge. Talking about renewable sources, the conversion of solar energy into electrical energy by using photovoltaic panels is prioritized. The watts delivered by the solar panel are directly proportional to the relative angle of the sun in reference to the earth. Thus, the delivery of the watts is reduced when tis relative angle changes. In this regard the efficiency of the PV panel can be increased by using solar tracking system. The payload is moved towards the sun by solar trackers throughout the day.

V. Objectives

- To design and fabricate a dual axis PV system that tracks the sun path.
- To study different solar parameters and methods of harvesting solar energy.
- To understand the working mechanism of PV module and tracking system.
- The solar panel tracks the sun from east to west mechanically for maximum intensity of light.
- To consume maximum solar energy through solar tacking panel.
- High performance and efficiency of Solar panel.

VI. Significances

- Solar tracking systems continually orient photovoltaic panels towards the sun and can help maximize your investment in PV system.
- One-time investment which provides higher efficiency and flexibility on dependency.
- Energy production is an optimum and energy output is increased year around.

VII. Limitations

- The reading taken will be compromised by the weather.
- The readings and tracking system are as good as the calibration of low-cost materials to be used in the system.

VIII. Hardware Specifications

In this project, there are some main components necessary for the execution. They are following:

A. Solar PV Panel

A PV module is an assembly of photo-voltaic cells mounted in a framework for installation. Photo-voltaic cells use sunlight as a source of energy and generate direct current electricity. A collection of PV modules is called a PV Panel, and a system of Panels is an Array. Arrays of a photovoltaic system supply solar electricity to electrical equipment.

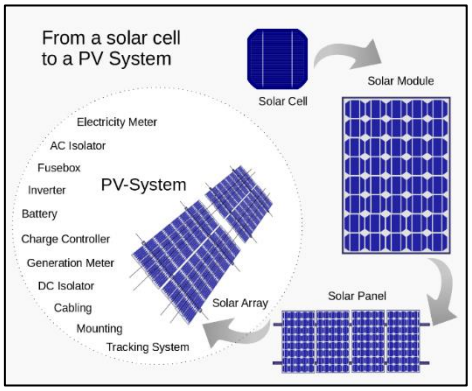

Figure 2: Solar Panel

B. LDR (Light Dependent Resistor)

A Light Dependent Resistor (also known as a photo resistor or LDR) is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called photoconductors, photoconductive cells or simply photocells.

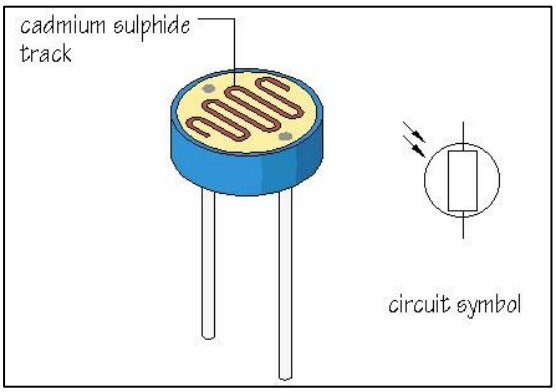

Figure 3: LDR

C. Servo Motor

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motors which run through servo mechanism.

Figure 4: DC Servo Motor

IX. Simulation

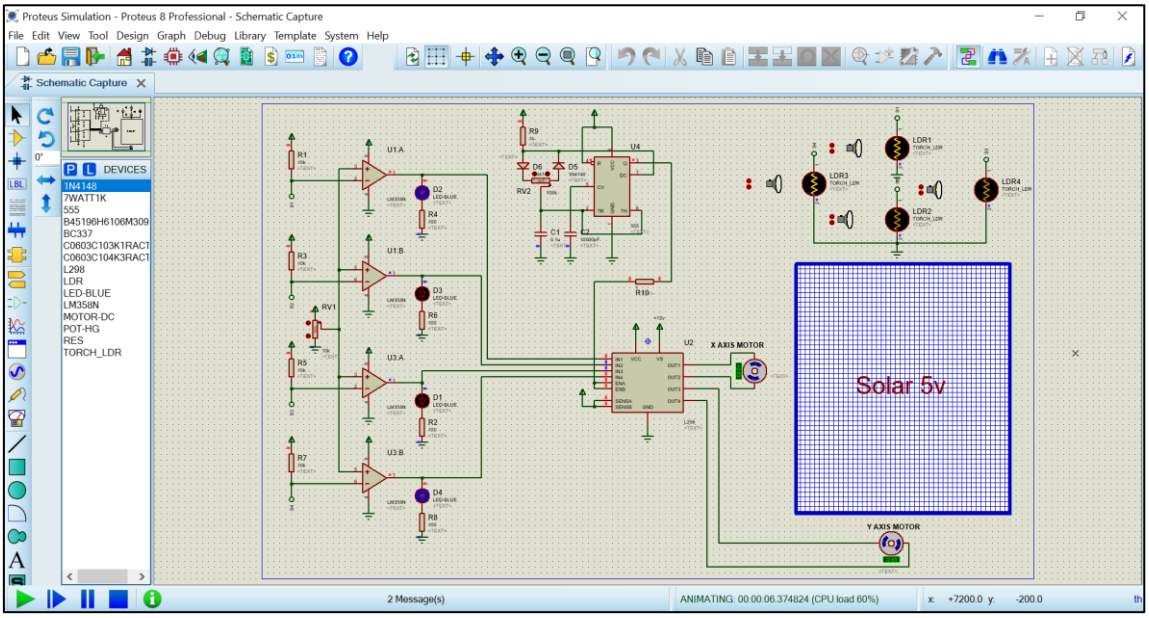

Figure 5: Proteus Simulation of Solar Tacking System

X. Wiring Diagram

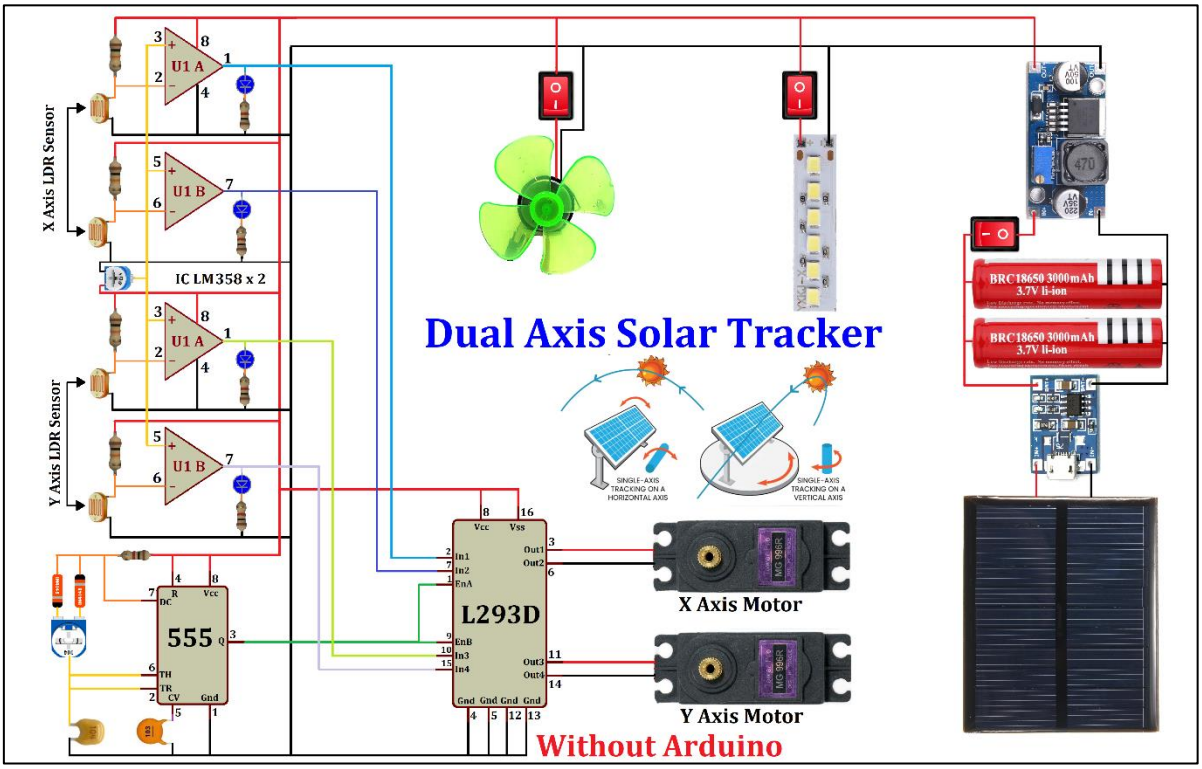

Figure 6: Wiring Diagram of Solar Tracking System

XI. Tentative Output

A. Hardware

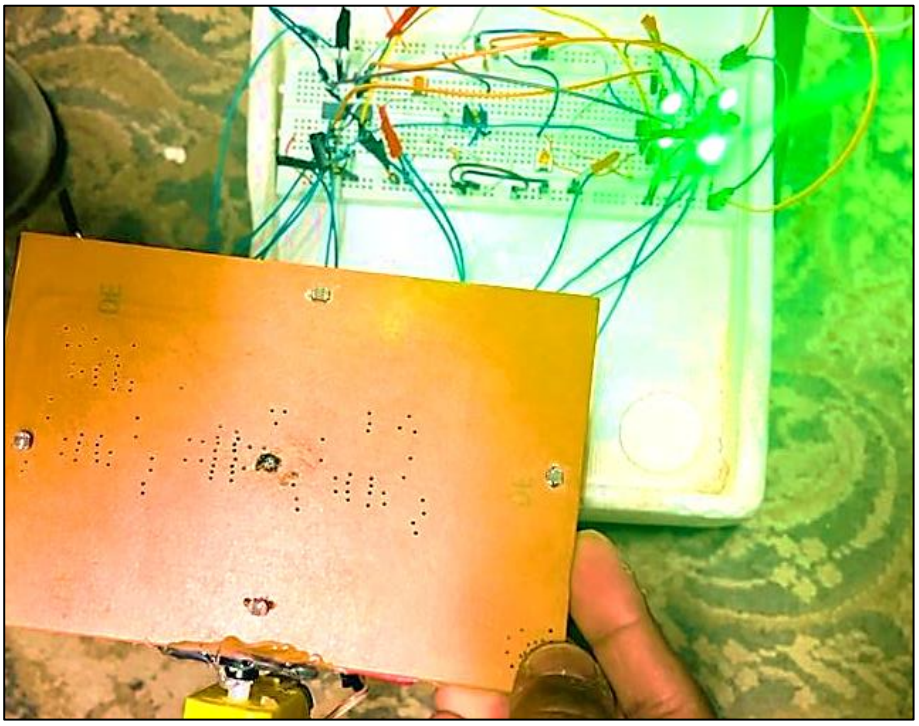

Figure 7: Hardware of Solar Tracking System

B. PCB Layout

1. Back Cu Layer

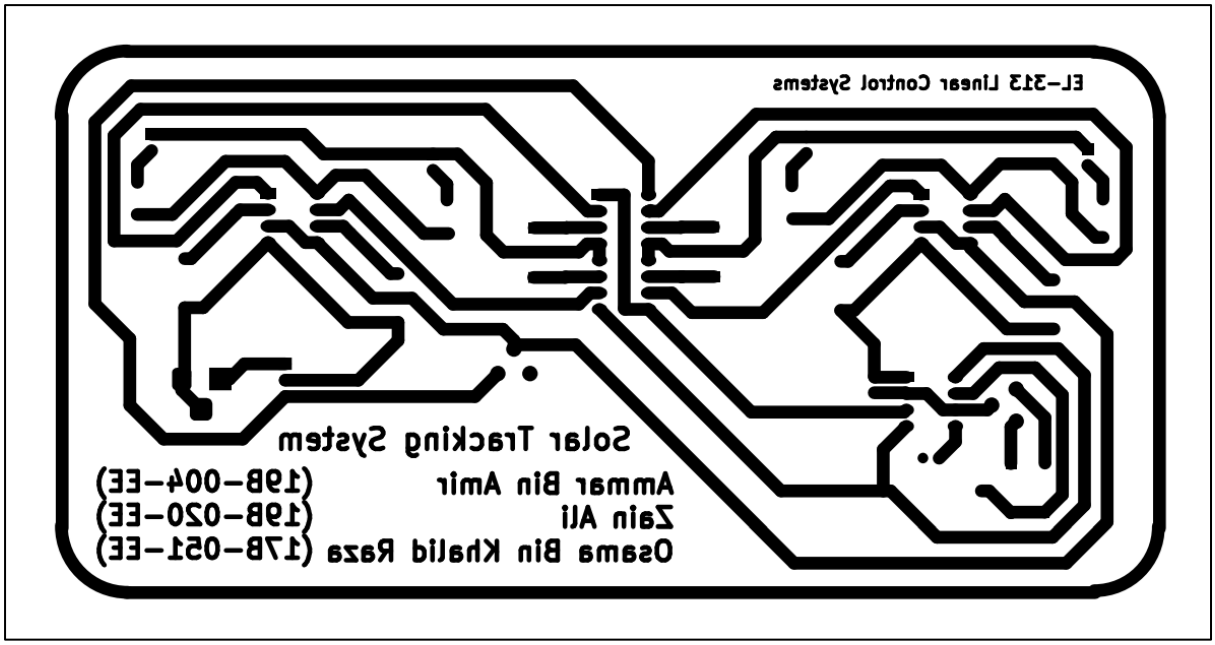

Figure 8: Back Cu Layer of Solar Tracking System

2. *Front Silk Screen Layer*

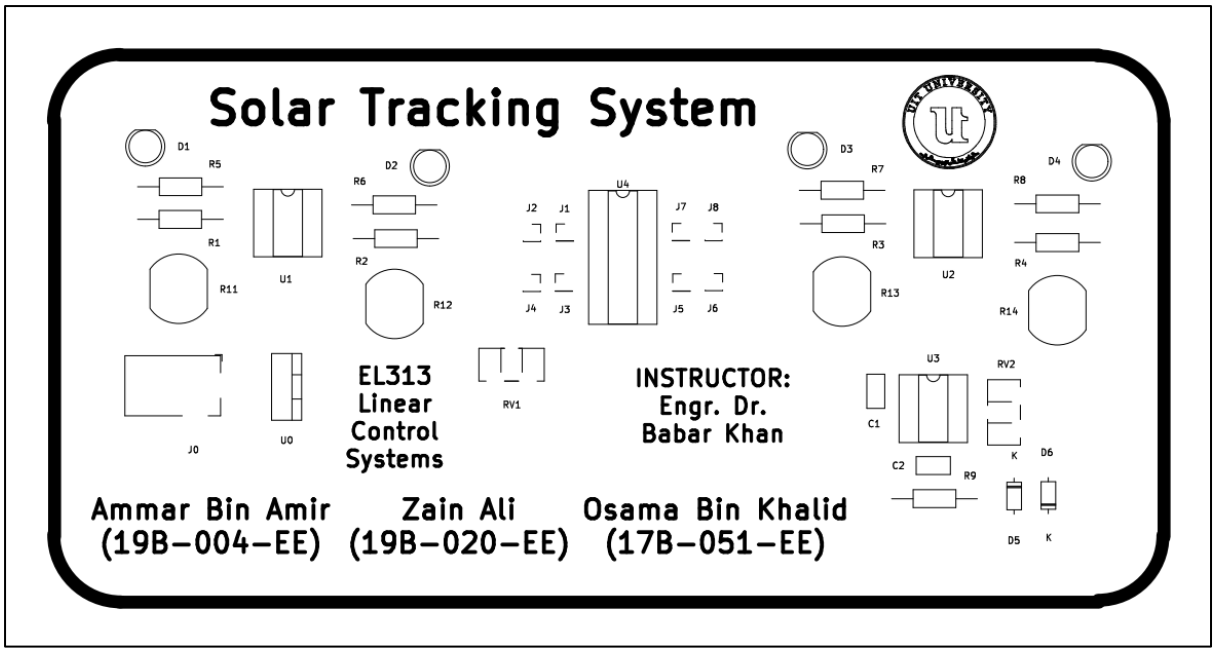

Figure 9: Front Silk Screen Layer of Solar Tracking System

3. *Drill Holes*

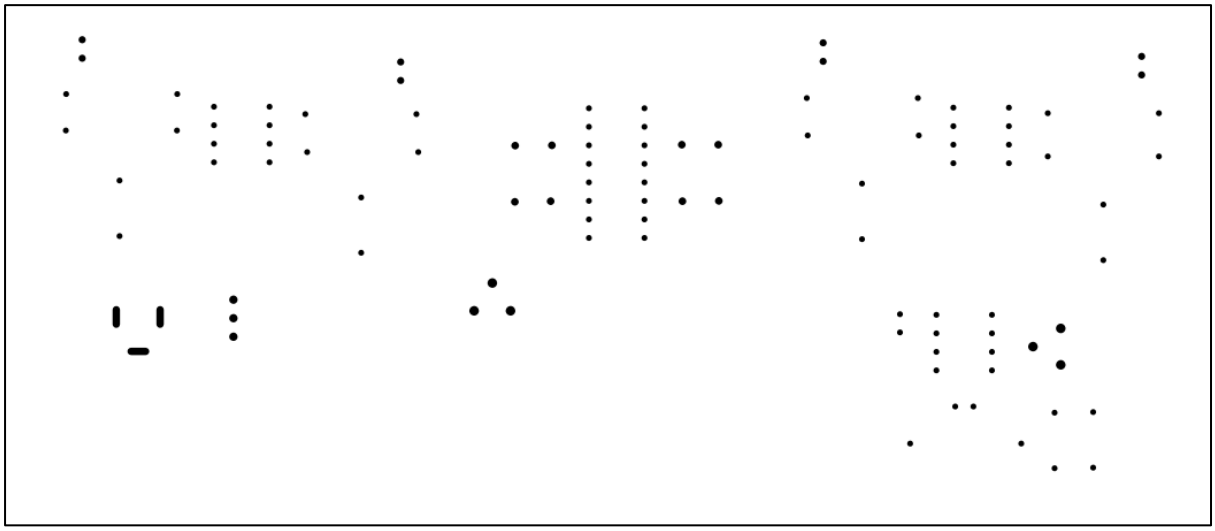

Figure 10: Drill File of Solar Tracking System

C. Outcomes

The outcome of the PCB to be fabricated or developed are as follows:

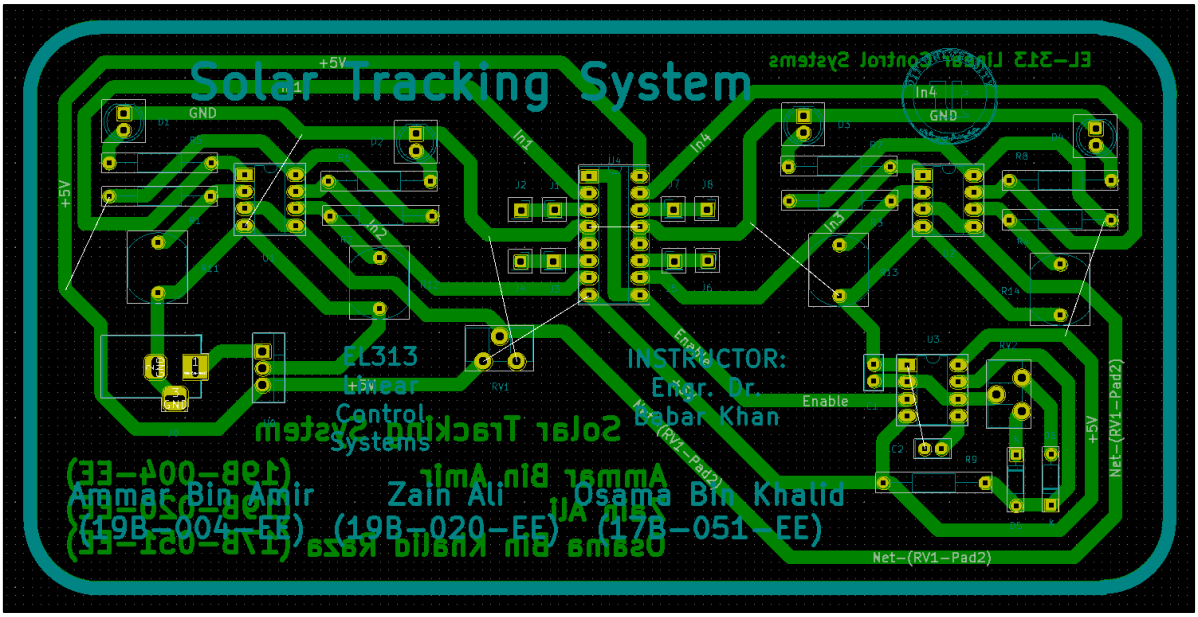

Figure 11: 2D View of Solar Tracking System

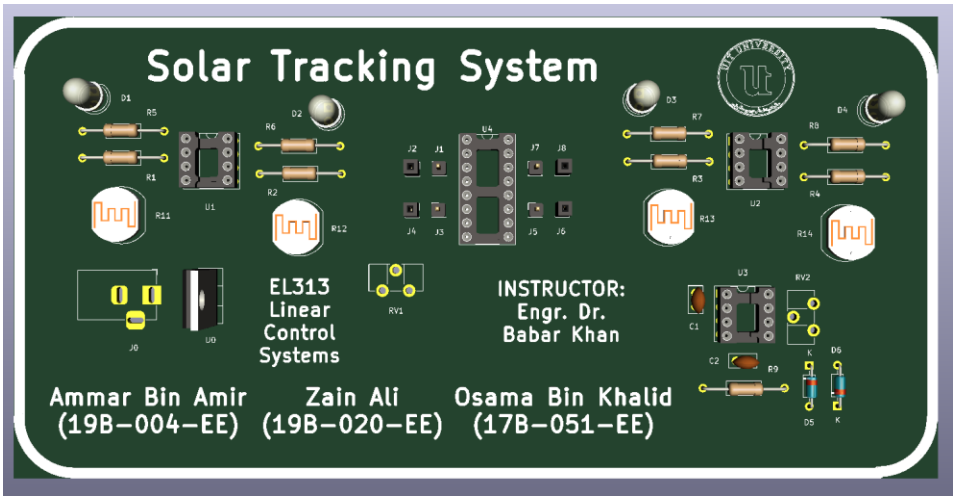

Figure 12: Front 3D View of Solar Tracking System

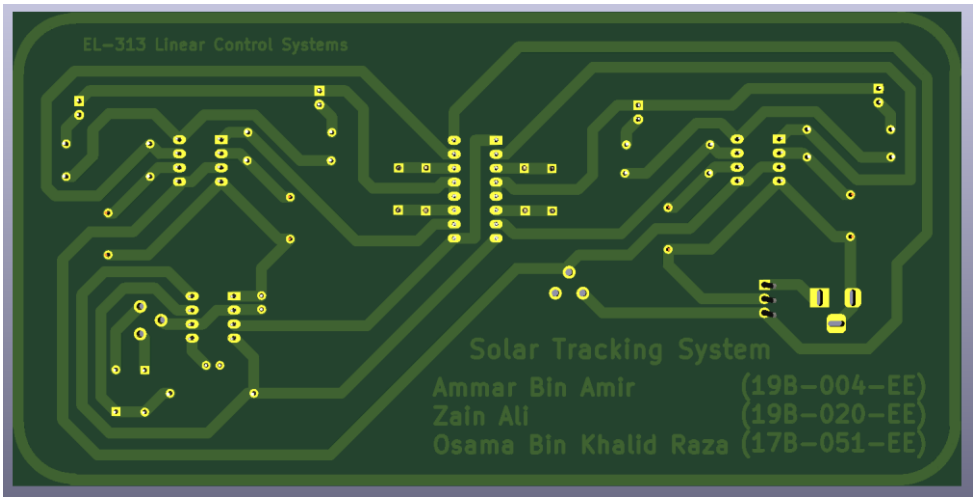

Figure 13: Back 3D View of Solar Tracking System

XII. Results

In our project, the hardware of solar tracking solar panel design and the implementation of the design has been proposed. Our result shows that the solar tracking system increases the efficiency of the solar panel. Solar tracking solar panel is completely automatic, and it ensures the minimum low cost.

2.134 watts is the average power obtained from solar panel without tracking and 3.18 watts power is obtained from solar panel with tracking. 41.64% is the improved efficiency neglecting the power consumption of motor. So, the proposed dual axis tracking system presents an efficient system to connect solar energy which ensures that consumption of energy is more than the fixed solar panel.

XIII. Conclusion

The project is based on tracking solar panels. These panels change their orientation in relation to solar radiation to increase the efficiency and results in maximum production of energy and help in getting full benefit of optimal angle between solar panels and solar radiations.

The main agenda of this project was to make simple machinery on low-cost basis. Trial and error methods help us in achieving our goal. We made use of our engineering knowledge in this project and were successful in developing and designing low-cost solar tracking system. Because the issue of global warming must be controlled by making use of alternatives that are environmentally friendly.

XIV. Future Recommendations

Though we have performed our work in much efficient way. There is still room for improvement for this system and it is hoped that further study can be carried out to further develop the system.

- ✓ Use higher motors with large torque value for larger panel size.
- ✓ It will be better to use geographical equation algorithm for the real timing tracking.
- ✓ Use diffused reflection phenomenon.

I. Group Members

Name of the Student	Roll Number of the Student
Ammar Bin Amir	19B-004-EE
Zain Ali	19B-020-EE
Osama Bin Khalid Raza	17B-051-EE

Table 1: List of Group Members of Solar Tracking System

II. Costing

Serial #	Components	Unit Price (PKR)	Quantity	Total Price (PKR)
1	DC 9V Battery	70.00	1	70.00
2	DC 9V Battery Cap	15.00	1	15.00
3	Jack Barrel Female	20.00	1	20.00
4	Jack Barrel Male	20.00	1	20.00
5	IC LM7805	15.00	1	15.00
6	IC LM358	30.00	2	60.00
7	IC LM358 Base	5.00	2	10.00
8	IC 555 Timer	30.00	1	30.00
9	IC 555 Timer Base	5.00	1	5.00
10	IC L293D Motor Driver	80.00	1	80.00
11	IC L293D Motor Driver Base	10.00	1	10.00
12	DC Toy Motor	150.00	2	300.00
13	Resistor 1kΩ	3.00	5	15.00
14	Resistor 10kΩ	3.00	4	12.00
15	Potentiometer 10kΩ	20.00	1	20.00
16	Potentiometer 100kΩ	20.00	1	20.00
17	Capacitor 0.1µF	5.00	1	5.00
18	Capacitor 0.01µF	5.00	1	5.00
19	Diode 1N4148	4.00	2	8.00
20	LDR	10.00	4	40.00
21	LED	5.00	4	20.00
22	PCB	70.00	1	70.00
23	Ferric Chloride	50.00	1	50.00
24	Miscllaneous	0.00	1	0.00

Table 2: Costing of Solar Tracking System

The total approximate cost for the Solar Tracking System is **900 PKR**.

III. References

- *https://www.slideshare.net/Reejasunil/solar-tracking-system-60035017*
- *https://www.academia.edu/26526209/Design_and_Development_of_Mechanical_Solar_Tracking_System*
- *https://www.researchgate.net/publication/4261290_On_the_Subject_of_Solar_Vehicles_and_the_Benefits_of_the_Technology*