*International Journal of Latest Engineering Research and Applications (IJLERA) ISSN: 2455-7137*

*Volume – 02, Issue – 05, May – 2017, PP – 46-53*

# Coin Based Cell Phone Charger with Solar Tracking System

Mr. C V Raja Reddy[1], Uzoigwe Daniel[2], Rupesh Rai[3], Balaji R[4]

[1234]*(Mechanical Department, Bangalore Technological Institute, India) )*

**Abstract:** This paper describes coin based cell phone charger using solar tracking system. Mobile phones have become a major source of business/personal communication. The need to provide a public charging service is essential. Many critics argued that a public mobile phone charging service is not a lucrative business because most users can charge their phones at home, in their office or in their cars. Coin based cell phone charger is essential because many people attending business conventions tend to forget their charger at home or in hotel rooms. Students and many people who use the public transportation tend to have a low battery are prospective customers for coin based cell phone charger service. Recommended locations include: hotels, conference centre, leisure centre, shopping malls, internet cafes, colleges, airports, train terminals, etc., so that the mobile phone users can reactivate a low or dead battery by simply plugging in and charging for one rupee. This is designed based on ATMEL 89S52 a 40-pin micro controller that does the countdown timings for a period of 1 minute with LCD displays showing the actual time left. During the timing period a relay output is latched and finishing timing in progress

**Keywords**: Detector Sensor, LCD Display, LDR, Microcontroller, Solar Panel.

## 1. Introduction

In the society today, the mobile phone as become a very important means of communication all around the world. The mobile phone as been a very helpful means of portraying information to people no matter the country you are. But there are certain people who tend to forget their mobile phone charger at home or in their place of work. This is where the coin based cell phone charger takes over, such that mobile phones can be charged in public places with the insertion of a coin. The need to provide a public charging service is essential. A mobile battery charger circuit is a device that can automatically recharge a mobile phones battery when the power in it gets low.

Nowadays mobile phones have become an integral part of everyone's life and hence require frequent charging of battery owing to longer duration usage. Battery chargers come as simple, trickle, timer based, intelligent, universal battery charger-analyzers, fast, pulse, inductive, USB based, solar chargers and motion powered chargers. These battery chargers also vary depending on the applications like mobile phone charger, battery charger for vehicles, electric vehicle batteries chargers and charge stations.

The uses of alternative sources of energies are becoming widely spread in all over the world. The sun is also a very good source of different energies; the light energy has a very remarkable value. The Solar panel converts the light energy into the electrical energy. The efficiency of solar panel can be maximized by aligning the solar panel with the sun. The sun tracking system is designed in this project, which offers a reliable and affordable method of aligning a solar panel with the sun. This project is based on microcontroller 8051 with a simple circuit and sun tracking software this power is stored in lead-acid battery and used for the coin based cell phone charger.

## 2. Literature survey

The design and implementation of solar tracking generating power system was analyzed by Y. J. Huang, where a tracking mechanism is integrated with an expert controller, sensors and input/output interface, that it can increase the energy generation efficiency of solar cells. In order to track the sun, cadmium sulfide light sensitive resistors are used. To achieve optimal solar tracking, a fuzzy algorithm is developed and implemented. A field programmable gate array is applied to design the controller so that the solar cells always face the sun in the day time. According to Robert Weissbach, the renewable energy is rapidly gaining importance as an energy resource, as fossil fuel prices fluctuate [3]. At the educational level, it is therefore critical for engineering and technology students to have an understanding and appreciation of the technologies associated with renewable energy. One of the most popular renewable energy sources is solar energy. Solar tracking enables more energy to be generated because the solar panel is able to maintain a perpendicular profile to the sun's rays. This system builds upon a prior senior design project where students built a solar-powered battery charger, thus making this system ideally self-contained.

  

According to Jigesh R. Shah optimum position for absorption perpendicular to the solar radiation during daylight hours, can increase the collected energy by up to 50% [4]. Commercially; single-axis and two axis tracking mechanisms are available. Usually, the single axis tracker follows the Sun's East-West movement, while the two-axis tracker follows also the Sun's changing altitude angle. A tracking system must be able to follow the sun with a certain degree of accuracy, return the collector to its original position at the end of the day and also track during periods of cloud over.

Daniel A. Pritchard experimentally investigated the working of Coin based cell phone charger with solar tracking system by peak power positioning [5]. Conventional sun trackers have a closed-loop control system function. These devices use operational amplifiers to operate the ON/OFF and directional functions of the structured five motors. The motors rotate the collector structure in two axes. The tracker's sun sensor is mounted on the structure. The four outputs of this device are used to determine how well the sensor is oriented toward the sun. If the outputs are all equal, the collector structure is nearly perpendicular to the sun and tracking error is minimal. A slight off-axis angle will cause an unequal output of one or both pairs of sensors. This imbalance is to be made. These movements are intended to keep the array close to the point at which the sun might later reappear. These periodic movements are continued until the cloud moves away or the sun sets, an event that creates another environmental condition with which the microcomputer must deal.

Gaurav V. Chamate said that solar energy isn't something new [6]. People have used sun to dry and preserve things. Vedic literatures in India even state the use of flying machines which were powered using the sun. Solar panels are simply solar cells lined up together in series and parallel so as get sufficient voltage and are p-n junction semiconductor devices with pure silicon wafer doped with 'n' type phosphorous on the top and 'p' type boron on the base. If the PV cell is placed in the sun, photons of light strike the electrons in the p-n junction and energize them, knocking them free of their atoms. These electrons are attracted to the positive charge in the n-type silicon and repelled by the negative charge in the p-type silicon. Connecting wires across the junction will have a current in them. Usually the solar panel faces only one direction, because of this reason it will not get sufficient ray of sun to generate energy. In this system the maximum power is optimization is done to get maximum energy from sun. LDR is used to sense the light & get maximum power optimization.

## 3. Basic assumptions

The design of coin based universal mobile battery charger is based on the following assumptions:

- Maximum solar energy is used for charging the lead acid battery inside the mobile battery charger to keep it charged fully all the time
- The charging current is up to 4.5AH at 6V DC and this takes care of the mobiles manufactured by Nokia, Sony-erricson, Blackberry, HTC and others of first and second generation mobiles.
- A single solar panel of size 635x550x38 mm, 37WP capable of supplying up to 2.0AH is used.
- Provision to charge maximum 10 different types of mobiles is provided.
- Insertion of a fixed, coin size for charging.

## 4. Proposed system architecture

### 4.1 Solar tracking system

Solar energy is one of the abudantly available renewable source of energy. Presently this field is having more demand and is likely to become integrated into more and more aspects of every day life.

Different mechanisms are applied to increase the efficiency of the solar cell. Solar tracking system is most appropriate technology to increase the output power of solar cell . The mechanical movement of the solar panel is controlled through the stepper motor, as shown in the Fig. 1.

As shown in the Fig.1 LDRs will be placed on edges of the solar panel or on a separate platform, so according to the Sun light intensity LDR resistance will be varied. Whenever the Sun light intensity is more LDR offers less resistance, the voltage across each LDR is given to ADC. According to this, ADC shows the equivalent digital output. Based on the received values from ADC, microcontroller makes the decisions in accordance with the algorithm designed and rotates the stepper motor to required position.

The ADC0809 data acquisition component **is** a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register. The 8-channel multiplexer can directly access any of 8-single-ended analog signals. The device eliminates the need for external zero and full-scale adjustments. Easy interfacing to microprocessors is provided by the latched and decoded multiplexer address inputs and latched TTL TRI-STATE outputs. The design of the ADC0809 has been optimized by incorporating the most desirable aspects of several A/D conversion techniques. The

  

ADC0809 offers high speed, high accuracy, minimal temperature dependence, excellent long-term accuracy and repeatability, and consumes minimal power. These features make this device ideally suited to applications from process and machine control to consumer and automotive applications.

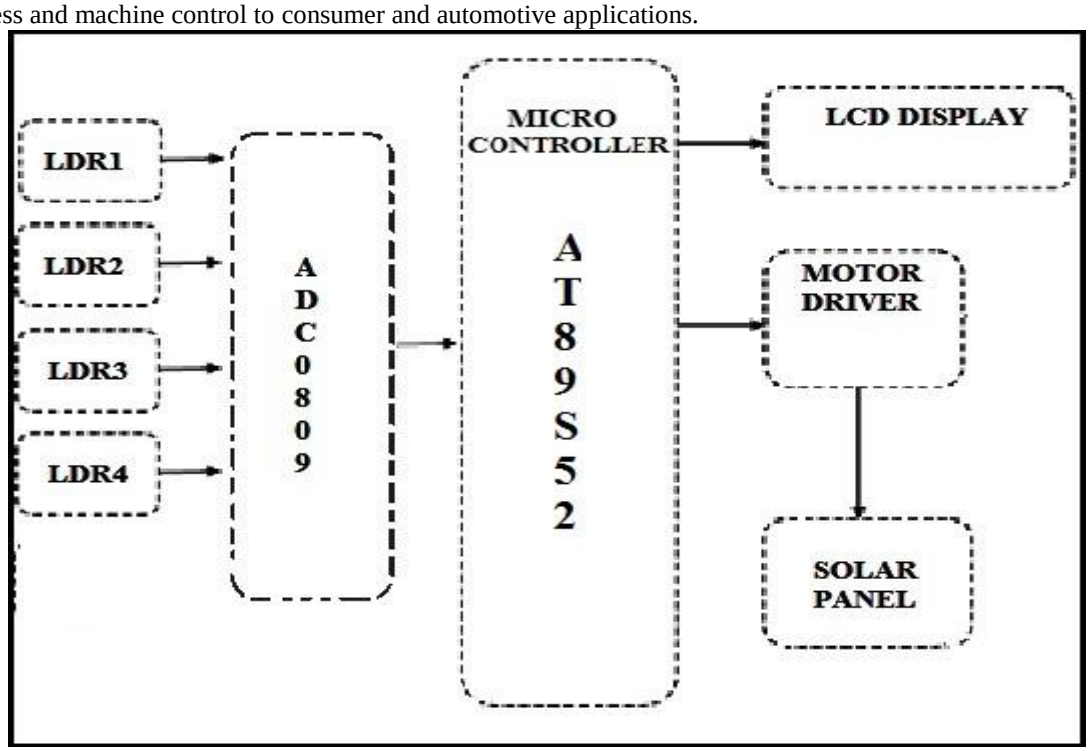


Fig.1 block diagram for solar tracking system

**4.2 Coin based cell phone charger**

The cell phone battery charger starts charging a mobile connected to it, when a coin is inserted at the insertion slot at the input stage. The type of coin will be displayed at the LCD display for the user, so as to ensure correct coin insertion, if the correct coin is inserted, the proximity sensor detects the coin and coin detection system sends a pulse to the control unit authorizing to start cell phone battery charging by enabling relay where it acts as switch, regulator is used to supply the required voltage and current for charging mobile.

Solar panel used to harness solar energy whereas four LDR and stepper motor is used to track the Sun to attain the maximum efficiency. The block diagram of the project coin based mobile charger using solar tracking system is shown in Fig. 2.

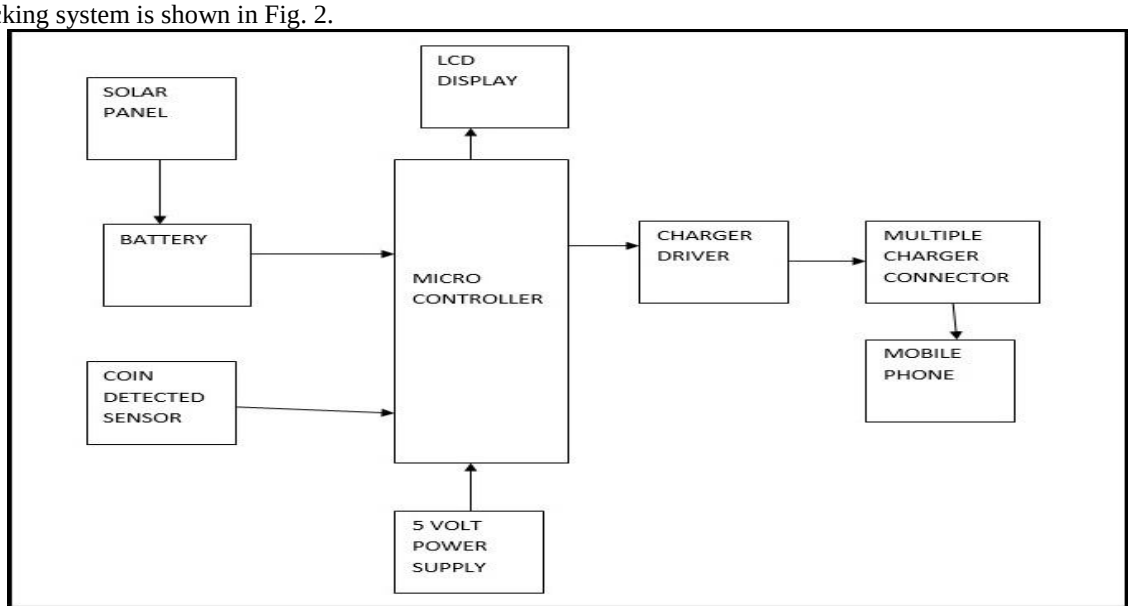


Fig. 2 block diagram of coin based cell phone charger using solar tracking system

  

**4.2.1. Input stage**

The mobile battery charger starts charging a mobile connected to it, when a coin is inserted at the coin insertion slot at the input stage. The type of coin and the size will be displayed at the LCD display for the user, so as to ensure correct coin insertion. Any other coin, if inserted in the slot will be returned to refund box. A mechanical slot is attached with electrical triggering in coin insertion slot, if the correct coin is inserted, it sends a pulse to the control unit authorizing the start of charging the mobile battery connected to the device. Then the coin insertion slot accepts the coin into the battery charging unit and start charging the mobile battery for a specific period controlled by the software of the microcontroller [1].

**4.2.2. Controller**

This section acts according to the input signal from the sensor circuit. Coin accepted or rejected is based on the diameter of the coin. This invokes microcontroller along with LCD interface displays the selection of mobile option if particular mobile is selected for charging the corresponding routine is activated and charge the mobile for a particular duration of time .When the routine completes, it indicates charge complete message through LCD display. Similarly the same procedure is followed for charging more than four different mobiles simultaneously [1].

**4.2.3 Output and display**

The LCD displays all the information to the customer as and when required. When the mobile battery is connected, it displays" Insert Coin". While charging it displays "Charging" and at the end of charging cycle it displays "Charge completed". For charging continuously the coin has to be inserted when the display shows "Charge Completed" The output has 10 terminals for connecting different types of mobile batteries and 7 of them are internally connected for charging mobile batteries of different make as shown in Table 1 below.

**4.2.4 Power**

The salient feature of the universal mobile battery charger is that it draws power from the solar energy during the day time for charging the internal battery of the controller. Only if additional power is required, then the grid power is used. A solar micro inverter, has been designed for supplying 230v, 50Hz so that both grid power and the solar power are connected in parallel with a switch to changeover from one to the other.

**Table 1: Charging Requirements of Mobile Batteries**

| S No. | Mobile Type | Maximum charging voltage (V) | Maximum charging current (mAh) |
|---|---|---|---|
| 1 | Samsung | 5.7 | 3400 |
| 2 | Sony Ericsson | 4.8 | 900 |
| 3 | Nokia | 4.8 | 1500 |
| 4 | LG | 5.5 | 2100 |
| 5 | HTC | 3.7 | 1200 |
| 6 | Black Berry | 3.7 | 1300 |

  

### 4.3 Flowchart of the system

The flowchart of the system is shown in Fig. 3

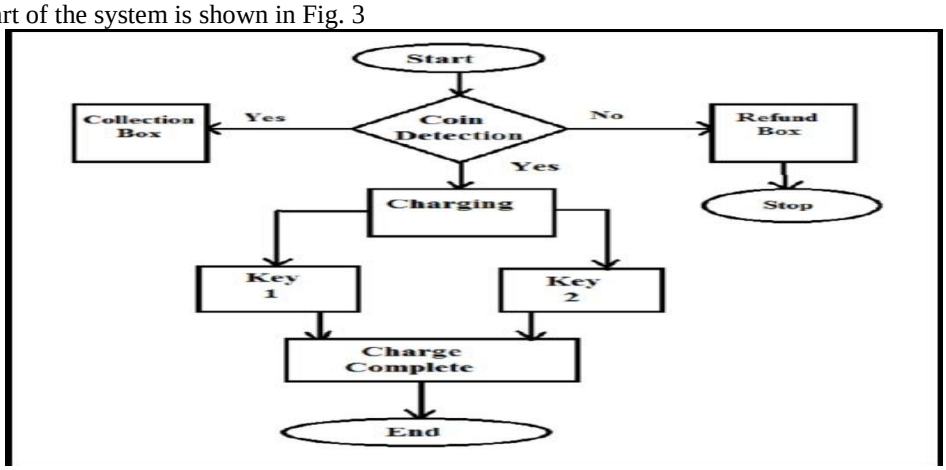


**Fig. 3 flow chart of the system**

## 5. Fabrication details

The fabrication details with assembled model are shown below:

### 5.1 3-D model of coin based cell phone charger by using solar tracking system

The Fig. 4 below shows the 3-D CAD geometry of the project having all required components in it. The 3-D view of the project gives an appropriate idea to fabricate the real model with more idea and less waste material.

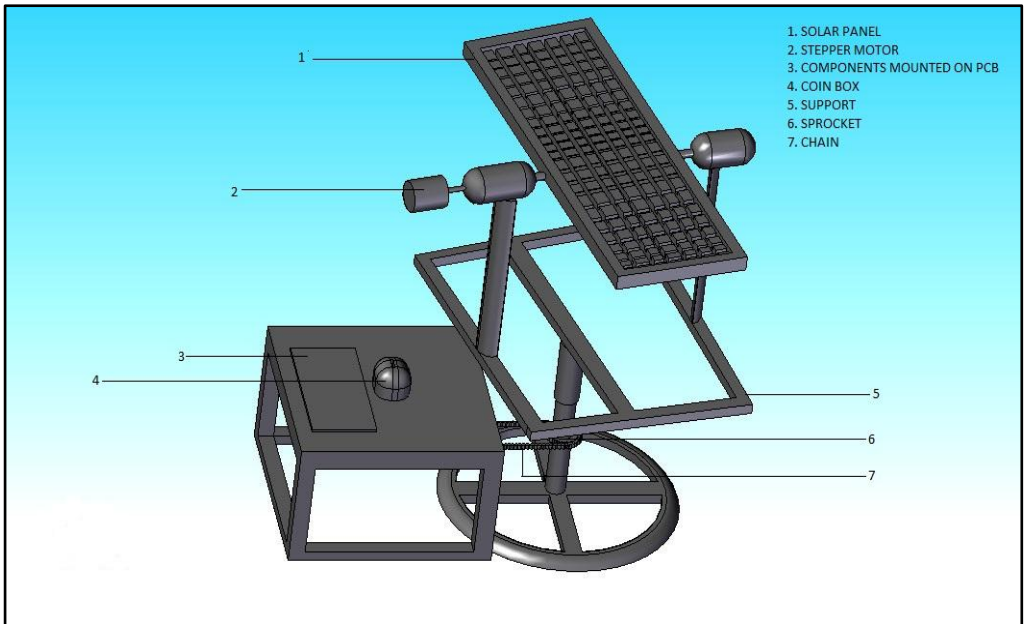


Fig. 4 model of the coin based cell phone charger by using solar tracking system

## 6. Experimental Results

The hardware setup for coin based mobile charger using solar tracking system shown below in Fig. 5. This setup contains following hardware parts.

- LDR 1
- LDR 2
- ATMEL 80C51 Microcontroller
- Stepper Motor
- LCD Display
- Motor Driver

  

- Solar Panel
- Battery
- Coin Detected IR Sensor
- Power Supply Unit

Fig. 5 assembled model of the coin based cell phone charger by usin solar tracking system

## 7. Experiments

Tests were conducted for two different cases at different battery percentage ranges.

1. Charging through the model.
2. Charging through the normal domestic electricity.

Experiment 1:- When the charge is in the range of 0% to 40%.

- Case 1:

**Table 2: Experiment 1 (Case 1)**

| **Mobile** | **Charge percentage before charging** | **Charge percentage after charging for 5 minutes** | **Charge percentage after charging for 10 minutes** |
|---|---|---|---|
| Samsung | 22% | 24% | 27% |
| Moto G4 plus | 29% | 30% | 31% |
| Oppo F1F | 14% | 16% | 18% |
| Nokia Asha 501 | 13% | 15% | 17% |

- Case 2:

**Table 3: Experiment 1 (Case 2)**

| **Mobile** | **Charge percentage before charging** | **Charge percentage after charging for 5 minutes** | **Charge percentage after charging for 10 minutes** |
|---|---|---|---|
| Samsung | 23% | 26% | 29% |
| Moto G4 plus | 27% | 29% | 33% |
| Oppo F1F | 17% | 19% | 21% |
| Nokia Asha 501 | 11% | 15% | 18% |

Experiment 2:- When the charge is in the range of 40% to 70%.

- Case 1:

**Table 4: Experiment 2 (Case 1)**

| **Mobile** | **Charge percentage before charging** | **Charge percentage after charging for 5 minutes** | **Charge percentage after charging for 10 minutes** |
|---|---|---|---|
| Samsung | 47% | 49% | 51% |
| Moto G4 plus | 43% | 45% | 46% |
| Oppo F1F | 46% | 47% | 48% |

  

| | | | |
|---|---|---|---|
| Nokia Asha 501 | 44% | 45% | 47% |

- Case 2:

**Table 5: Experiment 2 (Case 2)**

| **Mobile** | **Charge percentage before charging** | **Charge percentage after charging for 5 minutes** | **Charge percentage after charging for 10 minutes** |
|---|---|---|---|
| Samsung | 44% | 46% | 48% |
| Moto G4 plus | 49% | 51% | 52% |
| Oppo F1F | 43% | 45% | 47% |
| Nokia Asha 501 | 47% | 49% | 51% |

Experiment 3:- When the charge is in the range of 70% to 100%.

- Case 1:

**Table 6: Experiment 3 (Case 1)**

| **Mobile** | **Charge percentage before charging** | **Charge percentage after charging for 5 minutes** | **Charge percentage after charging for 10 minutes** |
|---|---|---|---|
| Samsung | 83% | 84% | 85% |
| Moto G4 plus | 92% | 92% | 93% |
| Oppo F1F | 85% | 85% | 86% |
| Nokia Asha 501 | 86% | 88% | 90% |

- Case 2:

**Table 7: Experiment 3 (Case 2)**

| **Mobile** | **Charge percentage before charging** | **Charge percentage after charging for 5 minutes** | **Charge percentage after charging for 10 minutes** |
|---|---|---|---|
| Samsung | 85% | 87% | 89% |
| Moto G4 plus | 96% | 97% | 98% |
| Oppo F1F | 87% | 89% | 90% |
| Nokia Asha 501 | 89% | 90% | 91% |

## 6. Advantage disadvantage and future scope of the proposed project

The advantages, disadvantages, applications and future scope of this proposed model are:

### 6.1 Advantages

The advantages are as follows:

- Effectively receive maximum energy from sun towards earth rotation.
- More useful to save energy from sun and intelligent tracking solar energy
- Simple and hand efficient.
- Less expensive.
- Reduced man power.
- Low power consumption.

### 6.2 Disadvantages

The disadvantages are as follows:

- Less effective during winter season.
- After the energy stored in the battery is finished during night time, it has to wait till the sun rises up for further charging

### 6.3 Future scope

- Railway station - This type of project can be used in railway station for public when they are in need.
- Shops - It can be installed in any shop and earn easy money.

  

- Rural areas - This project can be installed in rural areas where the power grid is not available at partial/full time.
- Home appliances - Like mobile phone this system can also be used for television in future.

## 7. Conclusion

In this project, the sun tracking system is developed based on 8051 microcontroller. The microcontroller 8051 based circuit is used in this system with a minimum number of components and the use of stepper motors enables accurate tracking of the sun. After examining the information obtained in the data table section, it has been shown that the sun tracking systems can collect maximum energy than a fixed panel system collects and high efficiency is achieved through this tracker, it can be said that the proposed sun tracking system is a feasible method of maximizing the light energy received from sun. This is an efficient tracking system for solar energy collection.

## References

[1] Gopakrishna. M. Raj, Coin Based Mobile Charger, *Journal of Research Innovations in Engineering and Technology, 2*, 2008, 189-190.

[2] Y. J. Huang, Member, T. C. Kuo, Member, IAENG, C. Y. Chen, C. H. Chang, P. C. Wu, and T. H. Wu, The Design and Implementation of a Solar Tracking Generating Power System, *IAENG, 17*, 2009.

[3] Robert Weissbach, Isaac Aunkst, A Microcontroller-Based Solar Panel Tracking System, *American Society for Engineering Education*, 2007, 12-64

[4] Jigesh R. Shah, V. S. Jadhav, Design Dual-Axis Solar Tracker using Microcontroller, *Indian Journal of Applied Research, 1*, 2012, 56-57.

[5] Daniel A. Pritchard, Sun Tracking by Peak Power Positioning for Photovoltaic Concentrator Arrays, *control systems magazine*, 2011, 1-2.

[6] Gaurav V. Chamate, Vishwanath Kommulwar, Jayant V. Wankhade, *International Research Journal of Engineering and Technology (IRJET), 4*, 2017, 1960.

  