Dual axis solar tracker using IOT

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Abstract— **This project aims to develop dual axis solar tracker with IOT monitoring system using Arduino that focuses on the purpose of portability and mobility. In this particular project, Light Dependent Resistors (LDRs) are used for sunlight detection. The solar panel is positioned where it is able to receive maximum light. As compared to other motors, the servo motors are able to maintain their torque at high speed. Dual trackers are more efficient because they track sunlight from both axes.**

Furthermore, this paper also contains additional features like weather sensor and optimal utilization of current source for drip irrigation and a home application. This project is designed for low power and portable application.

Keywords— ***Solar, Servo Motor, Arduino UNO, LDR Sensors, Drivers, ESP8266 driver.*** (key words)

I. Introduction (*Heading 1*)

In the past decade of years there is increase in demand for reliable and abundant electrical energy derived from renewable energy sources renewable energy plays important role in energy crisis of country. The government started to decrease the usage of conventional energy sources and encouraging people to use renewable energy sources like hydro and solar. One such example of renewable energy is solar power. Solar energy is a very large, inexhaustible source of energy. A solar tracker is a device used for orienting a photovoltaic array solar panel or for concentrating solar reflector or lens toward the sun. In this project, it's divided by two categories; hardware and software.

II. Literature Survey

Arduino Based Two Axis Solar Tracking by Using Servo Mechanism **"**V.Brahmeswara Rao, K.Durga Harish Kumar, N.V.Upendra Kumar , K. Deepak this paper mentions about the variation in the solar energy occur daily due to variation in day night cycle and also because of seasonal variations throughout the year. Population of the world is increasing very rapidly. From past decade of years, the non-renewable energy sources like coal and oil are extinguishing and so it become serious problem for providing he reliable energy to the world. But solar energy plays important source of primary energy. In this project we propose dual axis solar tracking system by which it is possible to catch maximum amount of solar energy by using Arduino as main processing unit. **"**Designing a Dual Axis Solar Tracking System for Maximum Power**"** Vijayalakshmi K Mentions The main purpose of this paper is to present a control system which will cause better alignment of Photo voltaic (PV) array with sun light and to harvest solar power. The proposed system changes its direction in two axes to trace the coordinate of sunlight by detecting the difference between position of sun and panel. Hardware testing of the proposed system is done for checking the system ability to track and follow the sunlight in an efficient way. Dual axis solar tracking system superiority over single axis solar tracking system is also presented. **"**The implementation of solar tracker using arduino with servomotor**"** P. Ramya1, R. Ananth The aim of this paper is to consume the maximum solar energy through solar panel. A Solar Tracker is a device onto which solar panels are built-in which tracks the motion of the sun ensuring that maximum amount of sunlight strikes the panels all over the day. Power output from a solar cell will be maximum when it is facing the sun i.e. the angle between its surface and sun rays is 90 degrees. Solar tracking allows more energy to be produced because the solar array is able to remain aligned to the sun. The components used for its construction are servo motor, Arduino and LDR. The active sensors continuously monitor the sunlight and alternate the panel towards the direction where the intensity of sunlight is maximum, **"**Solar tracker for solar panel **"**, Oloka Reagan Otieno this paper mentions in this project a single axis solar tracking system has been developed by which more energy from the sun can be harnessed. In this project, an Arduino Uno, which is an Atmel microcontroller-based board, has been used as the main controlling unit. To detect the position of the sun on the sky, two LDRs have been used and to rotate the orientation of the Solar PV panel a servo motor has been used. The sensors and servo motor have properly been interfaced with the Arduino board. The servo motor has been mechanically coupled with the PV panel. The driving program has been written using the Arduino IDE. The whole system has been assembled together and its performance has been tested. This tracker changes the direction of the solar panel based on the direction of the sun facing to the panel successfully. Single axis solar tracker tracks the sun on daily basis and makes the solar panel more efficient.

III. Methodology

In this article we are going to make a Sun Tracking Solar Panel using Arduino UNO, in which we will use LDRs to sense the light and a servo motor to automatically rotate the solar panel in the direction of the sun light. This project is that Solar panel will always follow the sun light will always face towards the sun to get charge all the time and can provide the supply the maximum power.

A. *Proposed System*

The Proposed System in this work on IOT based which make the Arduino start and when the current will be generated use for irrigation this will be also done using IOT. To get the efficient and improve the solar tracking we have use the sensors and RTC. Two types of irrigation are provided drip irrigation and Sprinkle Irrigation. If time provides we will manage soil testing for power consumption using soil moisture sensor.

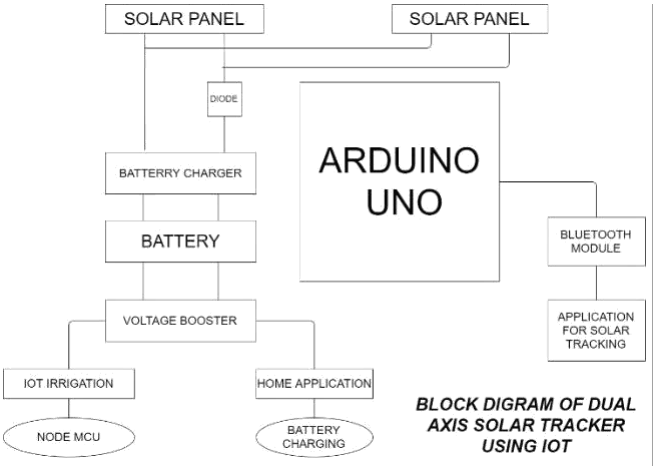


Fig 1. Architecture of the proposed system.

Arduino will be start using IOT then panel will be rotated using set directed in the coding using the embedded language. To get efficient output we have been used sensors and RTC in which number of tilts is set according to time. The Current which will be produce will be stored in the battery and that battery will be used for irrigation Voltage will be used for boost the volt. The Irrigation system will be handle using IOT (App and Wi-Fi Module). If time provides we will test soil and save the solar energy using soil moisture sensor.

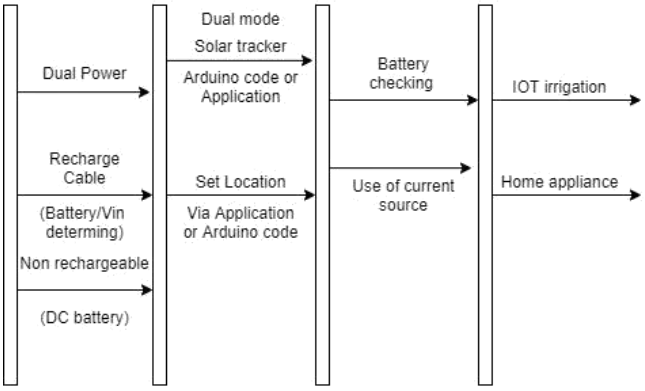
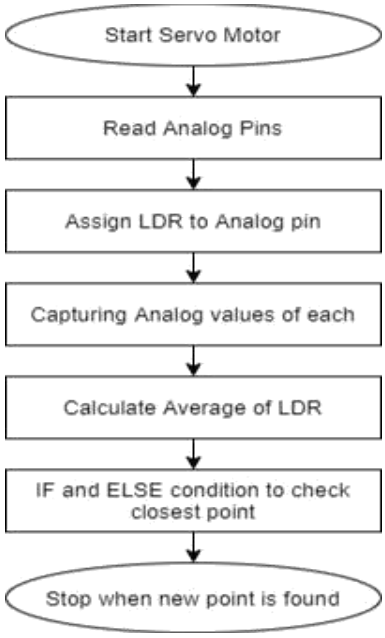


Fig 2. Sequential flow the Proposed System.

B. *Flowchart*



C. *Algorithm*

Input: Analog inputs (A1,A2,A3,A4)

Output: Tracking of

Sunlight Methods:

1. Calculate average top and bottom, left and right using max membership algorithm

Formula:

$$(A+B)/2$$

Ex:

$$Avg\_Top(Top1+Top2)/2$$

2. Calculate closest pair using divide and conquer method:

Division is done using same mentioned above and conquer is done using the following,

```
if( avg bop < avg bot)
{
servo_vi.write(servo_vi+1);
if(servo_vi>servo_vi Limithigh)
 {
servo_vi=servo_vi Limithigh
 }
}
```

Identify applicable funding agency here. If none, delete this text box.

D. Hardware required

- Arduino UNO
- Solar Panel using PCB
- DC motor
- Servo motor
- Sensors
- Cables and connectors
- LCD
- LDR
- Resistors
- Wi-Fi module

E. Software required

- Embedded C++
- Android Studio
- Arduino IDE

F. Hardware Development

Now we come to the hardware implementation of the proposed model. We have implemented the proposed system practically and final hardware model have been shown particularly in the figure 3 given below. According to connection and programming sensors will be connected to Arduino will be connected as per the time so number tilts will be more.

For dual mode solar tracker when is there cloud or any weather issue we will be using external power through a voltage divider and into an analog divider(inverter)

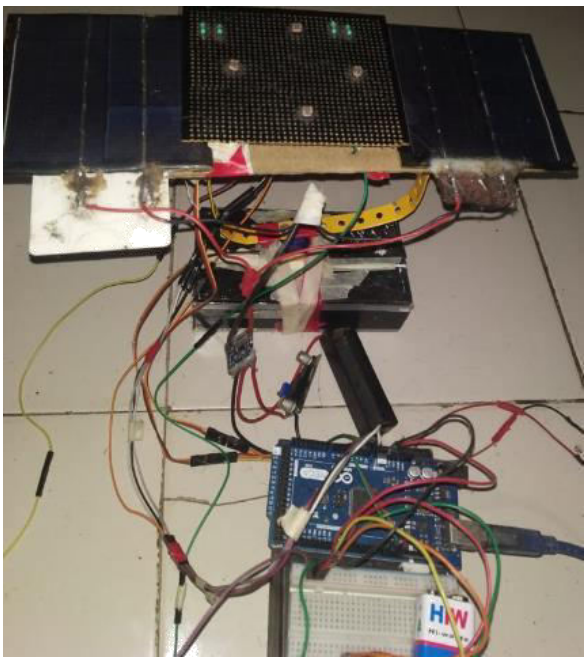


Fig. 3. Implementation of hardware

Post hardware implementation, for better understanding of the project and to check if the given particular system is working as desired or not we need to perform testing to know about its efficiency. To check whether the system tracks the suns position accurately, we had kept the solar tracking system in an open space where the sunshine was available throughout the day easily. Test was carried out separately in every 15 minutes as mention in the given below table.

Time	Battery volt	Voltage Booster
2.45	2.69	15.7
3	2.89	20-21
3.3	3.69	26-27
4.15	3.88	34-35
5.3	3.96	36

Fig. 4. Analysis of Solar charging

After observing the readings, we have concluded that the proposed system is more than efficient that the other.

The system is tested in the field conditions and results reveal that; system would be a best option for medium size agriculture field. Because of this automated system water wastage in the field could be reduced by 50% of normal irrigation wastage. Beside human involvement was reduced due to automation.

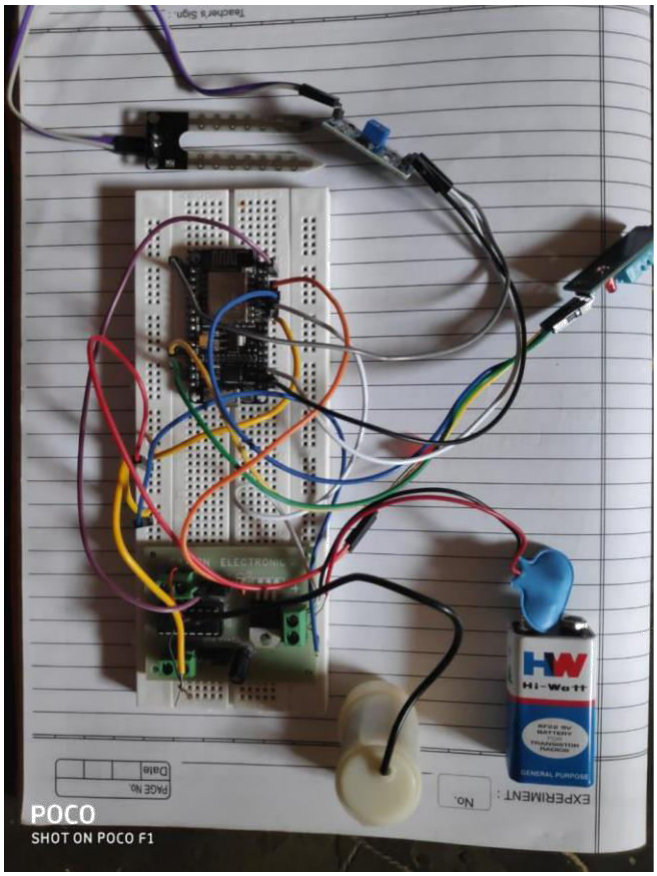


Fig. 5. Implementation of IOT based irrigation

Irrigation becomes easy, accurate and practice with the impression above shared and can be executed in agriculture fields in future to endorse agriculture to next level. The

output from moisture sensor and level system plays wide role in producing the output

G. Software Development

Now we come to the software implementation of the proposed model. We have implemented software development of one of the applications from the electricity generated. The Arduino Board is programmed using the Arduino IDE software. The function of the moisture sensor is to sense the water content present in the soil i.e., the moisture level in the soil. However, to classify the readings of the soil moisture sensor for different moisture level of the soil, the analog output value should be converted to digital value which will be displayed on the LCD screen.

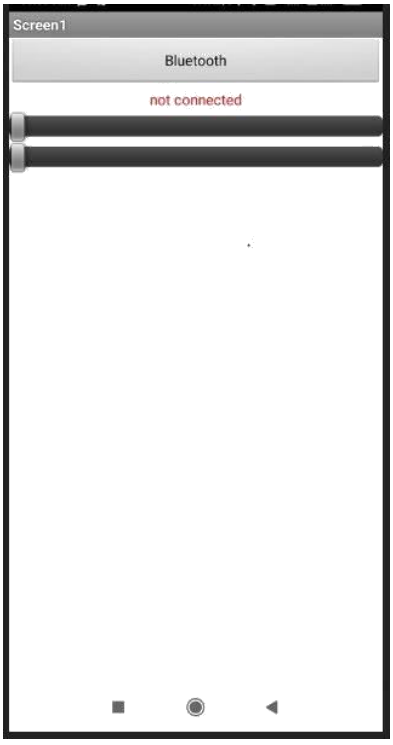


Fig. 7. User Interface of Solar Tracker Application using Bluetooth

When the moisture of soil is low that is soil is dry the water pump is on and if moisture is high that is soil is wet the water pump is off. The control unit is programmed in such a way that the pump will automatically turn ON if it satisfies the less moisture condition. For high moisture condition or after fulfilling the required amount of moisture in the soil the pump will turn OFF automatically. From table 1, we have found the sensor value for less moisture condition is greater than 700 which means the soil contains less water. After reading this value the controller will automatically drive the water pump. The soil moisture sensor keeps on sending the moisture content of the soil to the controller continuously at a regular interval of time. When the required level of moisture is attained or the sensor output reaches a value less than equal to 350, the pump will turn OFF automatically. The automated irrigation system developed is found to be feasible, sensitive and cost effective for optimizing water resources in agricultural production. This irrigation system allows cultivation in places with water scarcity and thereby improving sustainability. The use of solar power in this irrigation system is significantly important for organic crops and other agricultural products that are geographically isolated, where the investment in electric power supply would be expensive. In agriculture lands with severe shortage of rainfall, this model can be effectively applied to attain great result with most type of soil. The project can be extended to greenhouse to create completely automated garden and farmlands. In future, rain water harvesting can be done and this harvested water can be used to moisten fields. Hooters can be used so that it gives siren at various occasions such as interruption detection, flood etc. Using IR sensors any object passing into fields can be detected and warned.

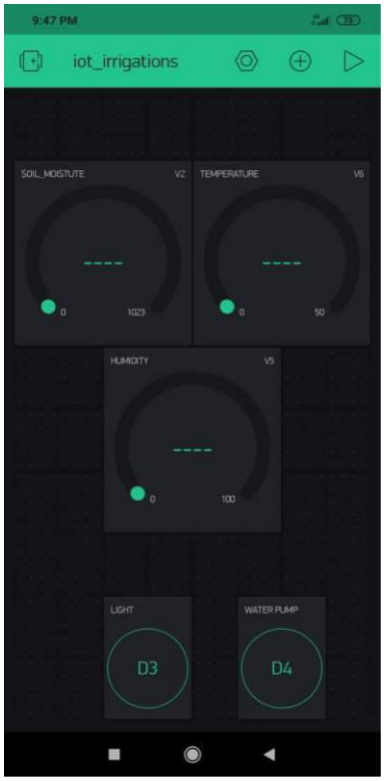


Fig. 8. User Interface of IOT Application using Wi-Fi module

IV. Result

We presented a means of tracking the sun positions with help of the Arduino, WIFI module, Sensors and application to handle it from the human. Current generation is free to use which does not do any harm to the environment which is used for the irrigation system. Analysis of the project shows that solar energy is used in better way and when some there is issue in tracking dual mode is provide to the system.

V. Conclusion

In this given particular project, we have developed a dual axis solar tracker with IOT monitoring system using Arduino that focuses on the purpose of portability and mobility, where, light dependent resistors (LDRs) were used for sunlight detection, solar panel was positioned where it was able to receive maximum light and as compared to other motors, the servo motors were able to maintain their torque at high speed. Therefore, from the particular research and

case study performed by us, we can successfully conclude that, Dual trackers are more efficient because they track sunlight from both axes.

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