Automatic Solar Tracker

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19CCE384 – Design and Innovation Lab

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1. **Motivation**:

The project of an Automatic Solar Tracker has been chosen due to its profound significance, technological intrigue, and potential for sustainable innovation. By optimizing solar panel efficiency through advanced algorithms and sensors, we aim to maximize solar power utilization and contribute to a greener future. Through the exploration of electronics, programming, and control systems, we seek to acquire valuable skills while developing a tangible solution applicable to residential homes and large-scale solar farms. Our motivation extends beyond personal growth as we aspire to make a positive impact, reduce dependence on non-renewable energy, and promote sustainability. This project combines innovation, technology, and sustainability to create a game-changing solution in the field of solar energy.

2. **Problem Statement**:

The objective of this project is to design and implement an automatic solar tracker using Arduino Uno. The project requirements and specifications agreed upon at the beginning include:

- The solar tracker should employ a reliable and accurate mechanism to track the sun's position throughout the day
- The system should be designed to work seamlessly with the Arduino Uno microcontroller board, utilizing its capabilities for data processing, control, and communication with peripheral devices.
- The solar tracker should continuously monitor the sun's position and adjust the orientation of the solar panels in real-time to maximize solar energy capture. This requires fast and efficient tracking algorithms to ensure optimal panel alignment.
- A user-friendly interface should be developed to provide relevant information about the tracker's performance, including tracking status and system diagnostics.

- Aim is to achieve the desired functionality within a reasonable budget. The choice of components, materials, and manufacturing methods should be cost-effective .

3. **Design Procedure**:

Components used:

1. Arduino Uno
2. 10 Ohm Resistors
3. Solar Panel
4. LCD(16*2)
5. LDR Sensors
6. Servo Motors
7. Switch
8. Connecting wires
9.

Algorithm:

1. Include necessary(Servo and Time) libraries.

2. Define necessary functions.

3. Define lcd pins

4. Calculate the calibrated value

5. Give a predefined value for start time

6. Set count to zero

7. Define Setup function

7.1. Attach servo motors to the digital pins of arduino board.

7.2. Write the initial values for servo motors.

7.3. Start Serial Communication

7.4. Start LCD

8. Define Loop function

8.1. Read the sensor input values(ldr inputs) and store in variables(s_T,s_B,s_L,s_R).

8.2. Calculate the average values of the sensor inputs.(avgT, avgB, avgL, avgR)

8.3. if any of the sensor input value is less than 200 then

8.3.1. check if current time is eqaul to start time(predefined).

8.3.1.1. Read the position of servomotor

8.3.1.2. update the position according to predefined values coressponding to the current time

8.3.1.3. print the servo value in serial monitor and lcd

8.3.2. else

8.3.2.1. Update start time by adding 3600 to it

8.3.2.2. Update count value

8.4. else

8.4.1. Compare the average values

8.4.1.1. Call the functions with sensor input values as arguments

9. Function

9.1. Read the position of servomotor

9.2. compare the average values of top and bottom

9.2.1. update the position of servo motor according to calibrated value

9.2.2. print the servo value in serial monitor and lcd

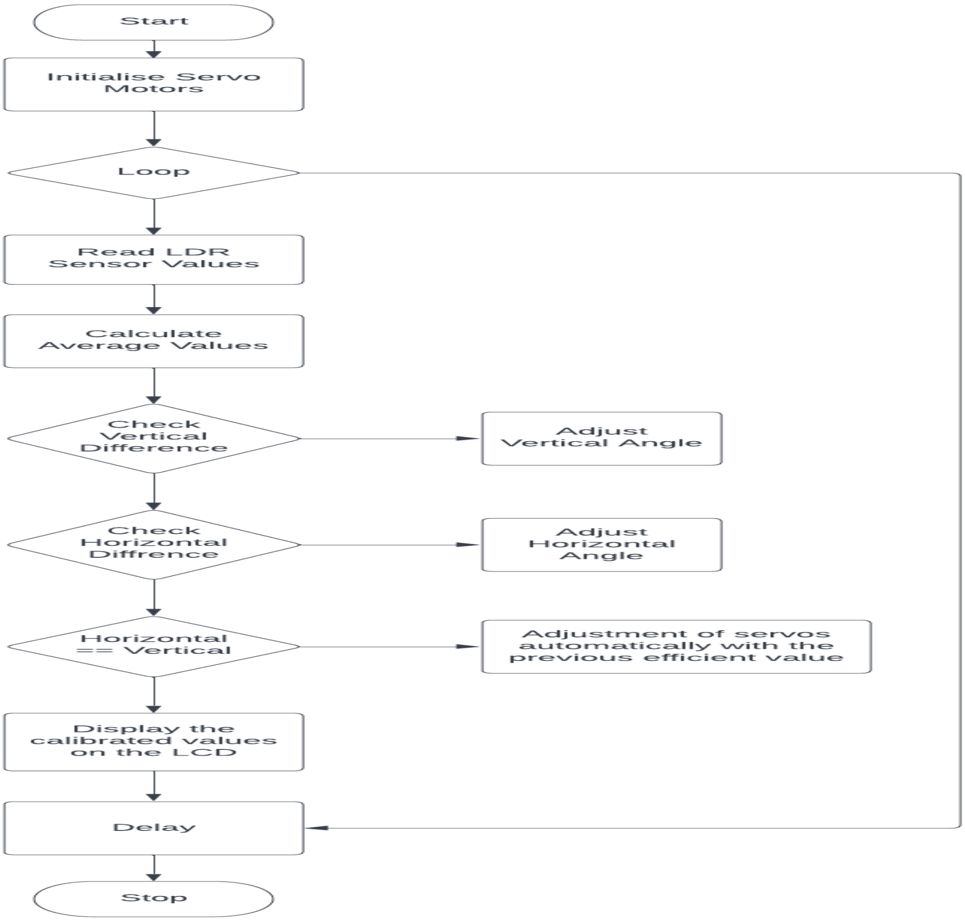
9.3.else

9.3.1. update the position of servo motor according to calibrated value

9.3.2. print the servo value in serial monitor and lcd

10. Repeat the same above function for average values of left and right.

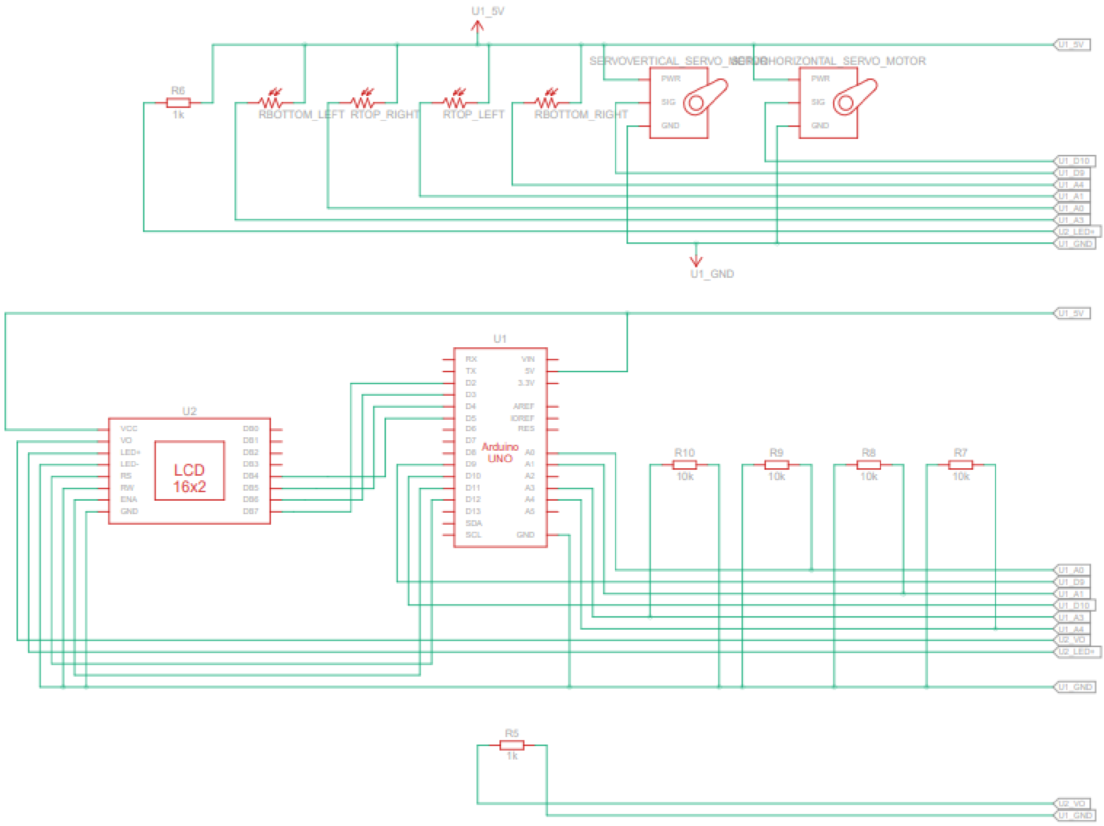
Flowchart:



4. **Budget**:

Component	**Price**
Arduino Uno	300
LDR Sensors	20
LCD(16*2)	200
Resistors (10k ohm)	10
Solar Panel	200
Switch	10
Servo Motors	160

5. **Circuit Diagram :**



6. **Simulation Results / Discussion:**

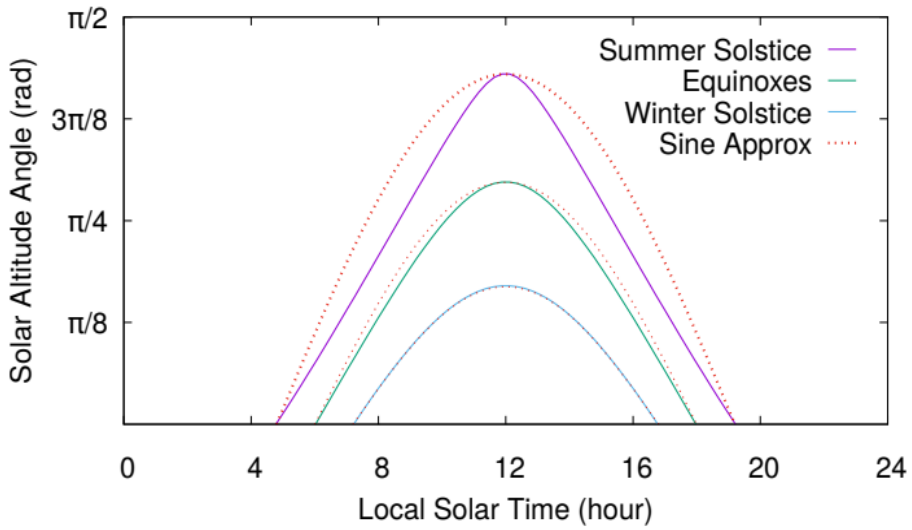


Fig1: Solar Altitude Angle Energy Predictor

```
Servo1:31
Servo2:149
Servo1:30
Servo2:150
Servo1:29
Servo2:151
Servo1:28
Servo2:152
Servo1:27
Servo2:153
Servo1:26
Servo2:154
Servo1:25
Servo2:155
Servo1:24
Servo2:156
Servo1:23
Servo2:157
```

Fig2 : Observed Angle Of Servo Motor

7. **Implementation and Prototyping results**:

The implementation and prototyping results of the Automatic Solar Tracker project have yielded promising outcomes. Through meticulous design and integration, we have developed a functional system that tracks the movement of the sun to optimize solar panel efficiency.

Our implementation involved utilizing sensors, such as light-dependent resistors (LDRs) , to detect the sunlight intensity and determine the sun's position. This data is then processed using algorithms and control systems, which drive the movement of the solar panel. By continuously adjusting the panel's orientation to face the sun perpendicularly , we ensure maximum exposure and energy generation throughout the day.

8. **Discussion & Conclusions:**

Automated Solar tracking system is developed and implemented the design system focusses on designing the control system part & inetgrated with necessary algorithms which are supposed to be able to control the DC Motor rotatory movements . The system is able to track and follow the sun light intensity in order to convert maximum solar power. The constructed systemn model can be applied in the residenstial area for alternative electricity generation especially for low power dependant applications.

Areas for further enhancement include power optimization techniques and expanding compatibility with various solar panel setups and communication protocols. By addressing these improvements, future iterations of the automatic solar tracker can enhance functionality, adaptability, and overall performance, contributing to the wider adoption of solar power and a sustainable future.