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IoT Based Control and Monitoring of DC Motor Fed by Photovoltaic System

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Abstract
Industries system uses variety of devices as a user interface. Internet of Things (IoT) makes the monitoring and controlling process become accessible everywhere and every time. The IoT can be used to control the speed of a DC Motor remotely through smartphones or from other devices. They can communicate with automation network through an Internet gateway, by means of low power communication protocols like Zigbee, Wi - Fi etc.The main advantage of IoT is that devices do not need to be connected to the public internet, they only need to be connected to a network and be individually addressable. The system uses solar panel with a tracking system and MPPT type charge controller to provide 12V DC to the motor. The speed of the motor can be controlled and monitored by multiple devices with the help of a webpage. The temperature of the motor can also be monitored and displayed.Switching of motors takes place when the temperature exceeds the threshold set value. Thereby the system automates the manual switching of DC motors in industries which increases efficiency of individual motor.

Keywords:*MPPT,Wi-F, IoT,Solar panel.*

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I. INTRODUCTION

Monitoring the real-time situation using IoT has begun to develop.Industries heavily rely on motors and drives.Motors in production and heavy industries mainly depends upon for, demands/needs a stable speed.So the controlling of speed is of great significance.IOT based speed monitor puts forward an effective way of speed control thereby improving motor efficiency. So ascheme was implemented in which speed and temperature control of motor is made with the help of web pages. Many industries require the continuous working of machines, namely dc motors.Continuous working of the motors will result in overheating which results in efficiency drop. So in order to avoid overheating and thereby increasingthe working efficiency of these motors an idea of sharing loads is made.Here with the help of a web page, we provide control commands to maintain, monitor, and vary the temperature and speed of motors.

Tabassumet al. (2017), says that in this study, a novel method is presented for maximum power point tracker (MPPT) system to increase efficiency.

K H Wibowoet al. (2018) saysabout IoT based speed control and monitoring of dc motor.

II. METHEDOLOGY

The main microcontrollers are Arduino UNO and Node MCU.The LDRs are connected to Arduino which are used to detect the light near the panels which helps to understand in which direction to rotate. An LCD screen is connected to Arduino to display the required details. The motor which is used to rotate the panel is also connected to Arduino which take the input from the LDRs. Solar panel is used to power the system and the energy is stored in a battery for better performance through solar charge controller. It is also used to provide steady voltage to the battery throughout its working even though the solar panel may not be able to provide the required power. It also avoids the discharge of battery to the panel. The temperature of the main motorsweresensed using thermistors and the value is send to the Arduino. All the input analog values are converted to digital values and send it to the node MCU. The main motors are controlled through a web page which is made possible through Node MCU. The commands are made through the web page and these commands are actuated by the node MCU.

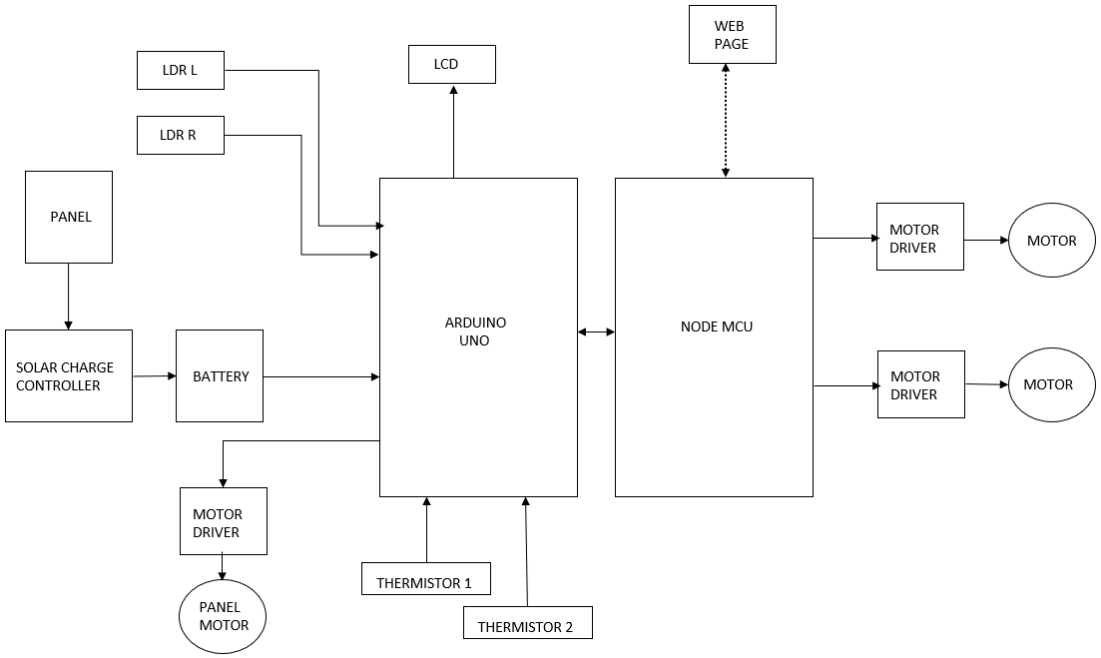

Figure 1: Block Diagram of Control and Monitoring of DC Motor

There are two LDRs-Left LDR and Right LDR. These LDRs measures the intensity of light and give signals to Arduino.If left LDR has more intensity than right LDR, the motor will turn left and otherwise it will turn right. If both LDR have same intensity of light then motor stops rotating. This is shown in the flowchart 2.

There is a temperature sensor which is placed on the surface of motor. It measures motor temperatureif temperature of motor 1 is lesser than a threshold value then the motor 1 will run. If temperature of motor 1 is grater than threshold value, it will check the temperature of next motor. If the motor 2 has temperature greater than threshold value. It will also not run. Hence both motors are at stationary. If it is less than threshold motor 2 will run. So the automatic switching between motors occur based on the temperature values. This shown in flowchart 2.

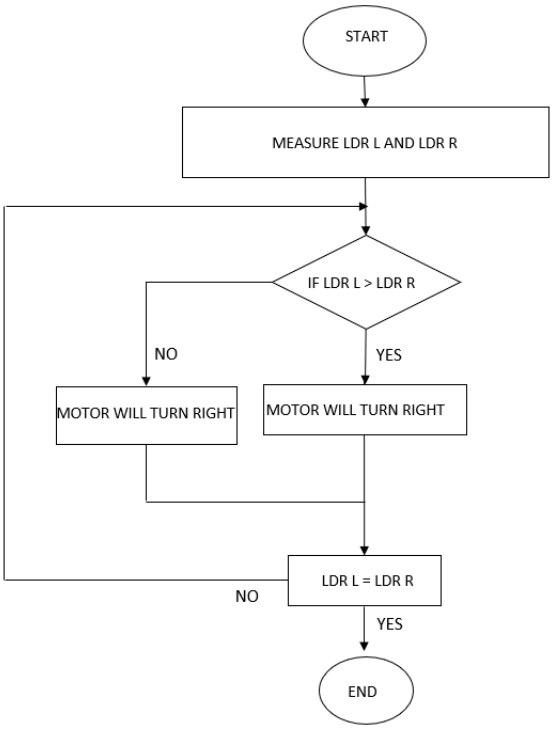

Figure 2:Flowchart ofPanel MotorAlgorithm

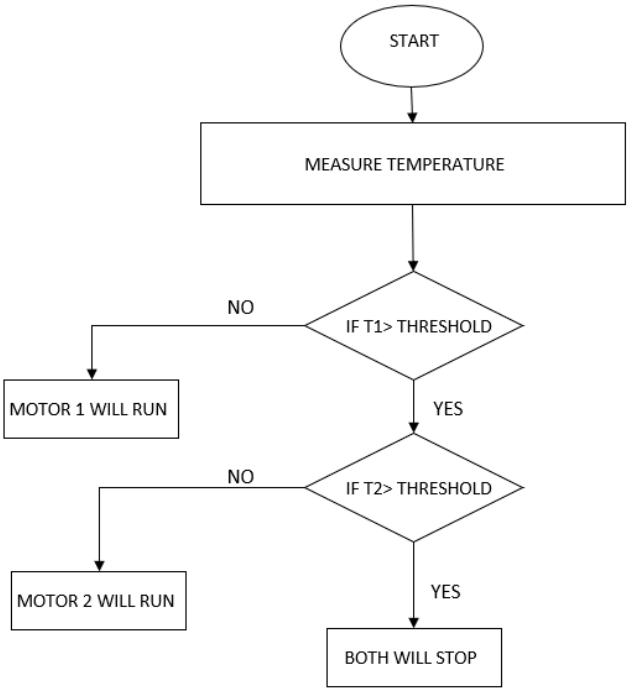

Figure 3:Flowchart of Motor Algorithm

III. THE SIMULATION

The Proteus software has been used to simulate the speed control of motor. An Arduino UNO board has been used for the simulation as the central microcontroller. The objective of the simulation design was to ensure that the speed control methodology adopted gave accurate results.The ease of programming using Arduino UNO made it a better choice for simulation purpose, as the results needed were independent of the microcontroller used. As it is difficult to implement a web page and solar panel in the simulation, it is excluded from the section and replaced by a switch. All the information can be seen through the LCD screen. The system is powered from a battery. A buzzer alarm is used to activate in a situation where both the motors exceed the temperature limit. In such case both the motor will stop and alarm will buzz. The motors will work only after the temperature falls below the predefinedthreshold value

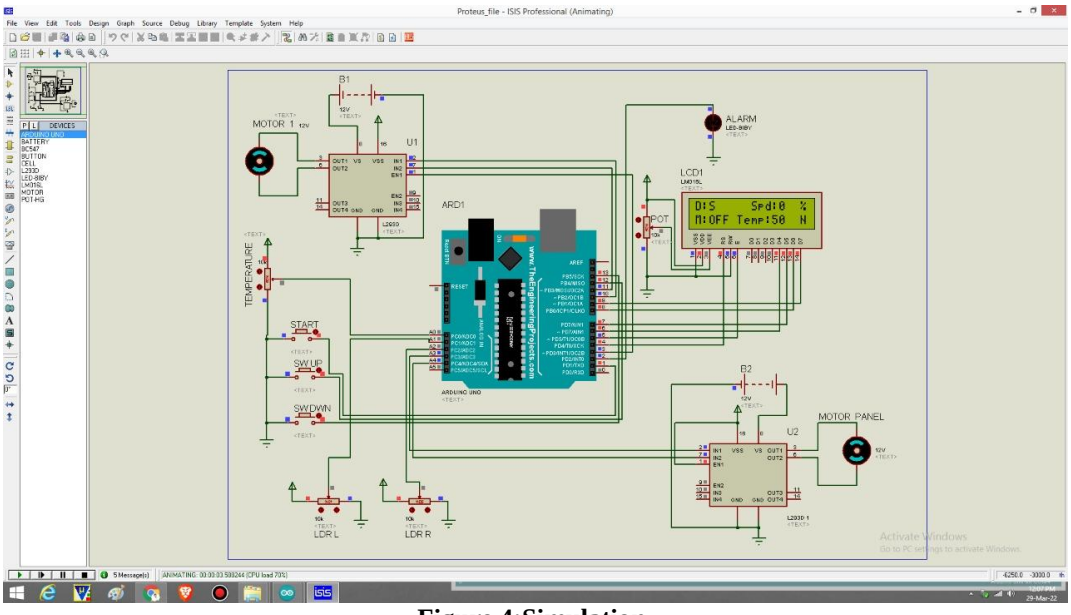

Figure 4:Simulation

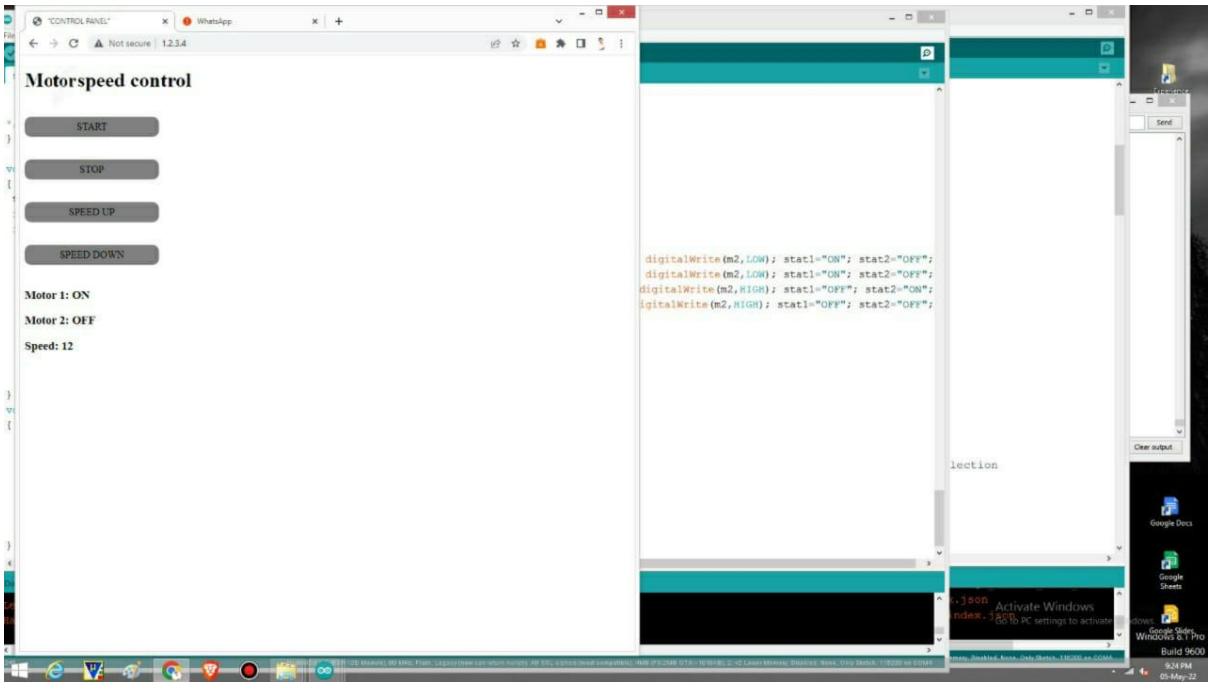

Figure 5:Web Page

IV. HARDWARE IMPLEMENTATION

The implemented hardware is as shown in the figure. The solar panel is fixed on a solid stand where it can move freely in one axis. The motor is placed at the center of the panel such that it will workproperly. All other connections are made on the hylem sheet. The battery is placed on the stand and solar charge controller is placed nearby it. A switch is provided to turn on and off the system. Two LDR's are placed on the solar panel as given in the figure such that it detects the intensity of light fallen to the LDR's. When left LDR have more intensity it gives corresponding signals to the Arduino. Arduino gives PWM signals to the gear motor and it tilts the solar panel to the left direction. If right LDR has more input the the motor rotates in other direction.The output of solar panel is given to battery through a charge controller. Battery supplies all components in the system. Node MCU gives access to webpage to control the speed of motor as desired. With the help of mobile phones, laptop or any other smart devices with Wi-Fi, can be connected to this system. It is possible to switch up or down the speed of motor by accessing the dedicated web page.

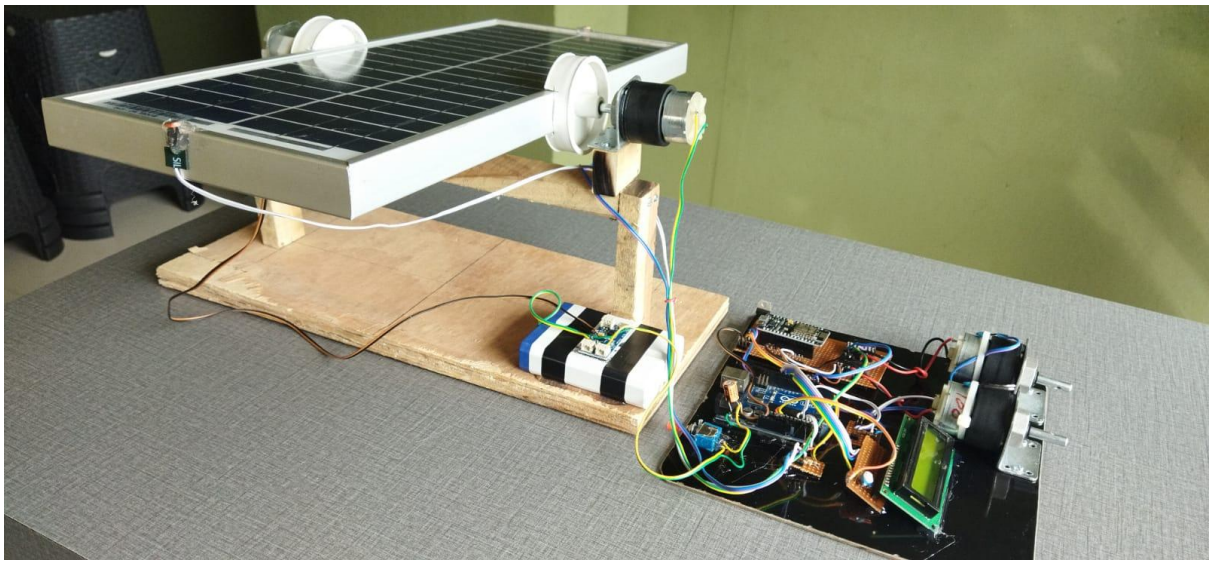

Figure 6:Hardware

V. CONCLUSION

The IoT based DC Motor control system which is powered by solar panel of 10Wp was designed and tested. With the use of MPPT type charge controller it is ensured that maximum energy is harvested from the solar panel. MPPT type charge controller helps to maintain the balance between over or under voltage conditions that may affect the batteries efficiency also it helps to avoid discharge of the battery to solar panel. Tilting of solar panel is accomplished with the help of two LDR sensors. Both LDR detects the amount of light falling on them and gives the signals to the Arduino. The Arduino processes the LDR output by comparing the intensity of light falling on both LDR and the panel orients in such a way that it gets maximum light. Load sharing is accomplished by switching the motors based on the temperatures. When thermistor temperature exceeds a certain predefined threshold value the motor under working is switched off and turns on other motor automatically. Speed of the motor can be adjusted using a web page which can be accessed using servers from either single or multiple devices simultaneously which makes the system more flexible and reliable.

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