REVIEW OF IMPLEMENTATION ARDUINO BASED DUAL AXIS SOLAR TRACKER

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ABSTRACT

Solar energy is rapidly advancing as an important means of renewable energy resource. It is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaic, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis. Trackers direct solar panels or modules toward the sun. These devices change their orientation throughout the day to follow the sun's path to maximize energy capture. The use of solar trackers can increase electricity production by around a third, and some claim by as much as 40% in some regions, compared with modules at a fixed angle. In any solar application, the conversion efficiency is improved when the modules are continually adjusted to the optimum angle as the sun traverses the sky. This paper presents the designing of a solar tracking system which is based on Arduino UNO and which provides movement of solar panel in the direction of maximum sun light incident. As a result of which we get more efficient system which is compact, low cost as well as easy to use.

Index Terms: Arduino UNO, Bluetooth module, Solar Panel, Servo Motor.

1. INTRODUCTION

Sun is an abundant source of energy and this solar energy can be harnesses successfully using solar photovoltaic cells and photovoltaic effect to convert energy into electrical energy. But the conversion efficiency of a normal PV cell is low. One of the main reason for this is that the output of PV cell is dependent directly on the light intensity and with the position of sun in the sky changing continuously from time to time, the absorption efficiency of an immobile solar panel would be significantly less at certain time day and year, for the solar photovoltaic cells are maximum productive when they are perpendicular to the sun and less productive otherwise. So to maximize the energy generation and improve the efficiency solar trackers are required.

Panel can response accurate and applicable to meet the power demands at different operational conditions. A solar tracking system designed with microcontroller and LDR's that actively track the sun and change its position accordingly to maximize the energy output. The LDR incorporated on solar panel helps to detect sunlight which in turn moves the panel accordingly [2] .The solar tracker described a more improved way to maximize the power consumption by solar panel from sun by just rotating the solar panel according to sun's position. By comparing the results it was discovered that direct beam of sun helps in generating energy than it is produced when solar panel is kept fixed. The studied have shown that efficiency of solar panels can be increased to a great extent if the solar panels continuously rotate in the direction of sun. Microcontroller and an arrangement of LDR

sensors can be used for the purpose of tracking the sun [3]. But the system was less efficient because of the low sensitivity and disturbance of light dependent resistors.

2. BLOCK DIAGRAM DESCRIPTION

The main aim of the proposed system is to develop a cost effective instrument using an Arduino Microcontroller based solar tracking system using Bluetooth module for detection of voltage and getting the result in android app. Block diagram of complete system is shown in Fig. 1 below which consists of power supply, Arduino Uno, LDR sensor, servo motor, and solar panel.[1].

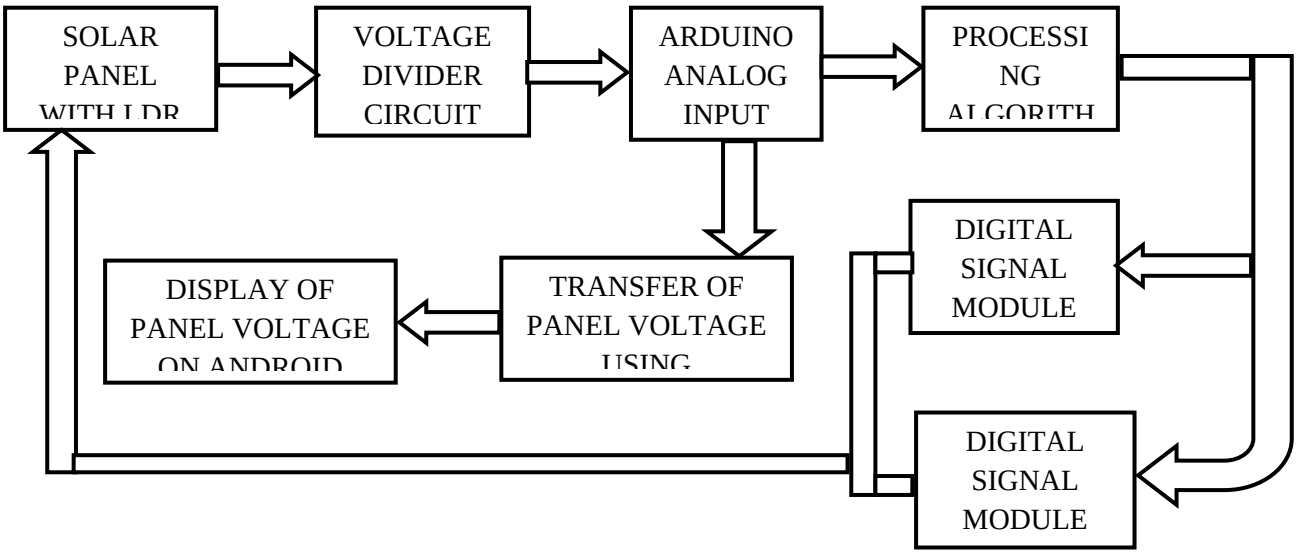


Fig 1. Block diagram of system

A. HC-05 Bluetooth to Serial Port Module the HC05 Bluetooth Module

HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. It can be used simply for a serial port replacement to establish connection between MCU and GPS, PC to embedded project. The HC05 module has 6 pins Vcc, GND, Tx, Rx, Key and LED. It comes preprogrammed as a slave, so there is no need to connect the key pin, unless it is needed to be changed to master mode. The major difference between Master and Slave modes is that, in Slave mode the Bluetooth module cannot initiate a connection; it can however accept incoming connections.

PIN NO	CONFIGURATION
Pin 1	STATE: NC (No Connection
Pin 2	Rx: Tx of Microcontroller
Pin 3	Tx: Rx of Microcontroller
Pin 4	GND: Ground
Pin 5	VCC: +5V
Pin 6	EN: NC (No Connection)

Table.1: Pin Description of HC05 Bluetooth Module

After the connection is established the Bluetooth module can transmit and receive data regardless of the mode it is running in. If we use mobile phone to connect to the Bluetooth module, we can simply use it in the Slave mode. . The module has a factory set pin of “1234” which is used while pairing the module to a phone. The HC-05 module can build a connection to the other module

B. Over View Of Arduino

Arduino is an open-source electronics prototyping platform, mostly based on small, easy-to-use hardware and software. It can affect devices, like lights, motors and other actuators by receiving input from sensor. All the action performed by Arduino is programmed to the microcontroller on the board via Arduino programming language and the Arduino development environment. Arduino projects can

be standalone or communicate with other software applications running on a computer and other types of hardware

Fig. 2: Arduino Uno Microcontroller Development Board

The Adruino Uno board as shown in Fig. 2. The Table.2 shows the specifications of Arduino Uno microcontroller board.

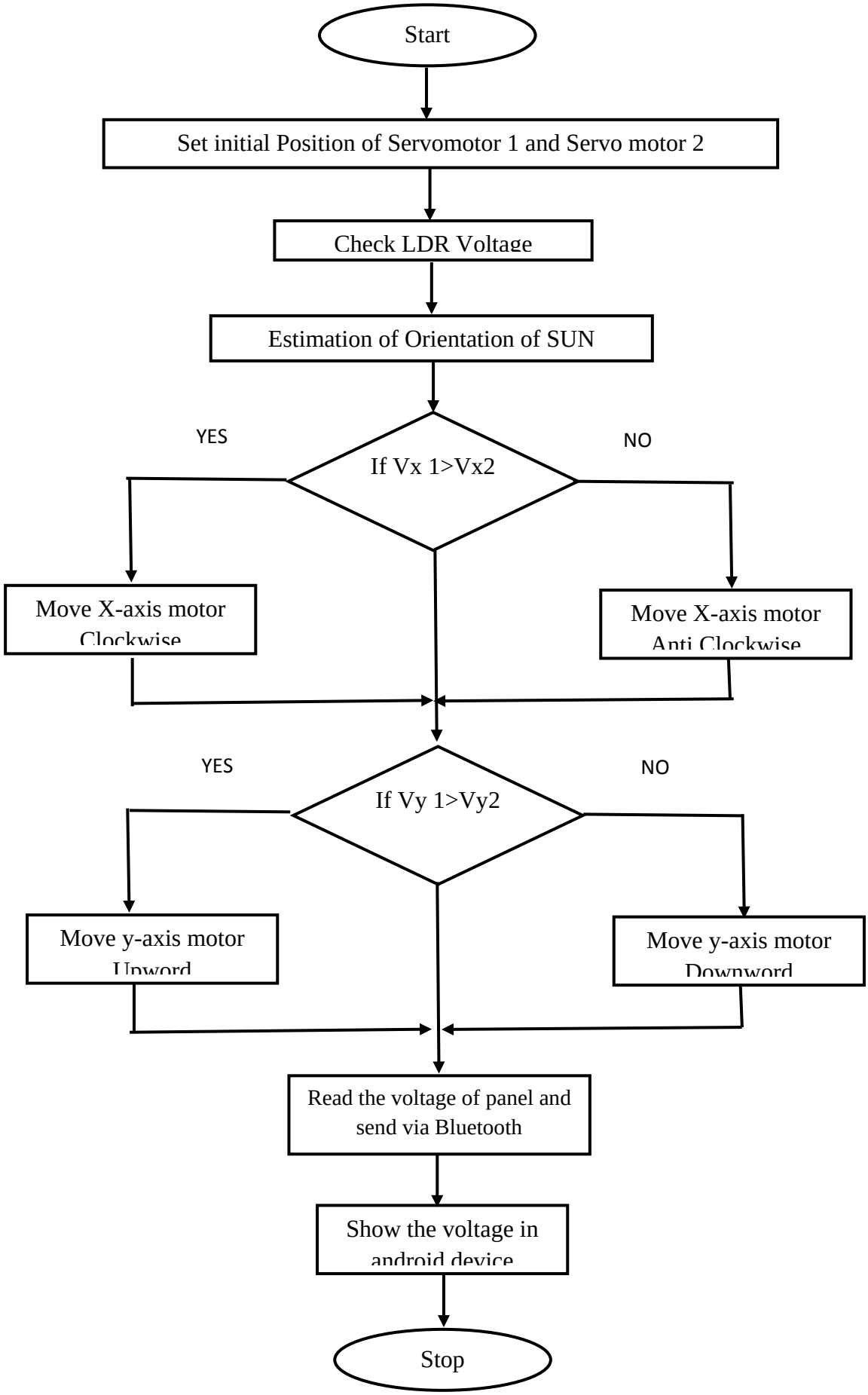
Microcontroller	ATmega328
Operating Voltage	5V
Supply Voltage (recommended)	7-12V
Digital I/O Pins	14(of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40mA
Flash Memory	32KB of which 0.5KB used by boot loader
SRAM	2KB
EEPROM	1KB
Clock Speed	16MHZ

Table.2: Arduino Uno specifications

3. FLOWCHART OF PROCES

The given flow chart shows the order of steps taken in the process for designing and working of solar tracking system. The system is designed in order to respond to the sunlight incident on the solar panel, according to which the movement of solar panel is done. Working of system is controlled by arduino microcontroller

From the flow chart it can be seen that initially the position of both the motors is being set after that the voltage of LDR is checked. After this process the orientation of sun is being estimated, according to which the sunlight falls on the LDR. There are four LDR used on four sides of solar panel at which sunlight falls, out of these two work for horizontal and two works for vertical movement of panel. The voltages of x axis sensors are compared as well as y axis sensors, as a result of which the panel moves in clockwise/anticlockwise or upward/downward direction. The direction of movement of panel is always in the direction of maximum sun light. So, the solar tracker provides higher efficiency [1]


Start
Set initial Position of Servomotor 1 and Servo motor 2
Check LDR Voltage
Estimation of Orientation of SUN
YES
If Vx 1>Vx2
NO
Move X-axis motor Clockwise
Move X-axis motor Anti Clockwise
YES
If Vy 1>Vy2
NO
Move y-axis motor Upword
Move y-axis motor Downword
Read the voltage of panel and send via Bluetooth
Show the voltage in android device
Stop

4. CONCLUSION

The aim of this project was to design a dual axis tracking system which can sense the incident solar light on the panel and move it in the direction of maximum solar light incident. Further the advantages and disadvantages were also studied. The disadvantages were the challenges that had to be overcome. From this study the main conclusions are:

i. Proposed system is low cost and compact as compared to the other tracking systems in use for same application.
ii. It is very easy to program and modify because it is Arduino based and no external programmer is required.
iii. The designed system is easy to use and provides better efficiency of the panel. iv. In the developed system real time data is retrieved on the android device.

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