Arduino Based Solar Tracking With Android App Controller

B.E. Dissertation

Submitted in partial fulfillment of the requirement of

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For the Degree of

Bachelor of Engineering
(Electronics and Telecommunication Engineering)

by

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Certificate

This is to certify that, the dissertation titled

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is a bonafide work done by

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Guide	Project Coordinator
Head of Department	Director

Certificate of Approval by Examiners

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Abstract

Sun is an abundant source of energy and this solar energy can be harnessed successfully using solar photovoltaic cells and photovoltaic effect to convert solar 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 the 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 of the 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 come into play. This paper presents the design and construction of an inexpensive active solar tracking system for tracking the movement of the sun so as to get maximum power from the solar panels as they follow the sun. It uses Light Dependent Resistors to sense the position of the sun which is communicated to a Arduino Uno microcontroller which then commands a set of two servo- motors to re-orient the panel in order to stay perpendicular to the sun rays. The design was constructed successfully and tested using Lab View to determine the improvements in efficiency. Evaluation results show that the new system performs 13.4percent better than the immobile solar PV system. Solar energy with solar tracking, will become possible to generate more energy since the solar panel depend on sun.Light Dependent Resistor(LDRs) are used for sunlight detection. To solve the electricity problem we uses solar and battery to save power which provide the user the availability of electricity. Here we are focusing on less power consumption and more performance device.

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Chapter 1

Introduction

1.1 Introduction

Grasping the concept of the suns movement will assist any hobbiest, technician, engineer or system developer to understand the formulas that one need to use in programming of micro-controllers to write a simple PC program that could automatically steer your solar tracking system.With the recent development of mobile devices (smart phones), its demand is increasing day by day and because of its multi dimensional functionalities and most enhanced technology, the demand for advance mobile applications in daily life has also increased. As today's generation is very busy, individuals sometimes may forget to switch off various home appliances or not sure about whether the devices are on or off. Sometimes, it is also desirable for individuals to turn on few devices such as air conditioners, few lights etc. to get a comfortable, pleasant atmosphere immediately after going back home. Person with physical disability may also wish to control the devices by voice recognition system. With the advent of Smartphone, android app and related technologies, it is now possible to practically implement all the desirable functions in a home automation system.An internet based home automation system focuses on controlling home electronic devices irrespective of whether someone is inside or outside of the house. The words appliance and devices have been utilized in this paper interchangeably. Automation is the current trend, where devices are being controlled automatically. The usual operation of a home automation system till now was focusedon the basic tasks of turning ON/OFF different devices either remotely or in close proximity. Technological enhancement has permitted researchers and developers to use Bluetooth or Wi-Fi technology to connect different devices in a home automation system. In earlier days, Home

Automation System was controlled Remotely The discussion around the movement of the sun is thus made within the context of orientating a solar tracker with respect to the sun at any location on the earth and on any given time of the day. This chapter is aimed at helping readers to conceptualise the movement of the sun and presents some basic theoretical models around the movement of the sun as it progresses through the sky during the day. The conceptualization of the movement of the sun (or rather relative and apparent movement of the sun) is of most importance in the development of solar tracking system and this topic intended to help the reader understand the basic principles behind the suns movement in simple and understandable terms.The increasing demand for energy, the continuous reduction in existing sources of fossil fuels and the growing concern regarding environment pollution, have pushed mankind to explore new technologies for the production of electrical energy using clean, renewable sources, such as solar energy, wind energy, etc. Among the non-conventional, renewable energy sources, solar energy affords great potential for conversion into electric power, able to ensure an important part of the electrical energy needs of the planet. The conversion of solar light into electrical energy represents one of the most promising and challenging energetic technologies, in continuous development, being clean, silent and reliable, with very low maintenance costs and minimal ecological impact. Solar energy is free, practically inexhaustible, and involves no polluting residues perpendicular to the sun so as to maximize the efficiency. To reduce the cost of the system. The IoT platform is a suite of components that enable: Deployment of applications that monitor, manage, and control connected devices. Remote data collection from connected devices. Independent and secure connectivity between devices. Device/sensor management. Internet makes our world as possible as connected together. Nowadays we almost have internet infrastructure wherever and we can use it whenever.

- Necessity: In general India has relatively 1 long sunny day for more than ten months and partly cloudy sky for most of the days for the rest two months. This makes our country, especially the desert sides in the west, involving Rajasthan, Gujarat, Madhya Pradesh etc. very rich in solar energy. Many projects have been done by using photovoltaic cells in collecting solar radiations and converting them to electrical energy. The proposed model of Dual Axis Solar Tracker is most compatible for obtaining maximum efficiency.

1.1.1 ERA of IOT

The Internet of Things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these objects to connect and exchange data.[1][2][3] Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure.Currently, the IoT applications in many aspects of our daily life are prosperous, and there is also a growing trend in the applications of health care which can gather and upload biometrics data to cloud. According to report, by 2020 connected devices across all technologies will reach to 20.6 billion The above chart displays the increase

YEAR	NUMBER OF CONNECTED DEVICES
1990	0.3 million
1999	90.0 million
2010	5.0 billion
2013	9.0 billion
2025	1.0 trillion

in the number of connected devices till 2025 The increasing demands in the IoT technology and future trends it has motivated us to contribute towards regulating and monitoring environment through internet.

1.2 Android

Android is the most used operating system on the planet. In fact, its almost omnipresent in the mobile ecosystem. Even the Android versions, like Nougat, Marshmallow, Lollipop, etc. have been able to build their individual fan following. Google is very punctual in releasing the market share of these Android versions on a monthly basis. This data gets uploaded to their developer portal and gives us a rough estimate of the most popular Android versions for the month. It helps the developers prioritize their resources for widely used Android versions, rather than wasting them on near out-of-date Android versions. In this project there are used

Android Name	Android Version	Usage Share
Nougat	7.0, 7.1	28.5%↑
Marshmallow	6.0	28.1%↓
Lollipop	5.0, 5.1	24.6%↓
KitKat	4.4	12%↓
Jelly Bean	4.1.x, 4.2.x, 4.3.x	5%↓
Oreo	8.0, 8.1	1.1%↑
Ice Cream Sandwich	4.0.3, 4.0.4	0.4%↓
Gingerbread	2.3.3 to 2.3.7	0.3%↓

Figure 1.1: Android usage

of android smartphone for load control.Android mostly used available smartphone it is biggest advantage in our project.Android is easy to access and easily understandable to user.Basically we are using bluetooth module to connect with load and get controls.

Chapter 2

Literature Survey

2.1 Paper Title

•Tarlochan Kauri,Shraiya Mahajan,Shilpa Verma,Priyanka and Jaimala Gambhir"Arduino based Low Cost Active Dual Axis Solar Tracker"(1st IEEE International Conference on Power Electronics, Intelligent Control and Energy Systems (ICPEICES October-2016)) Volume 1.

•Tarlochan Kauri,Shraiya Mahajan2,Shilpa Verma3, Priyanka4 and Jaimala Gambhir5 " Arduino based Low Cost Active Dual Axis Solar Tracker "1st IEEE International Conference on Power Electronics, Intelligent Control and Energy Systems (ICPEICES May-2016), Volume1.

•N. Mohammad; T. Karim; "Design and Implementation of Hybrid Automatic Solar- Tracking System," Solar Energy Engineering; vol. 135; pp. 11-15,2013.

•Pooja Jain; Tarlochan Kaur; " Optimization of Solar PV System and Analysis of Tilt Angle"; ACM Conference Proceedings eEnergy IS; 17 July 2015.

•Lipika Nanda,Prof..Dasgupta,Dr.U.K.Rout"Smart Solar Tracking System For Optimal Power Generation".3rd IEEE Intrenational Conference (IEEE-CICT May-2017)Volume47, Issues 1-4.

•Sukhen Das ,Sanjoy Ganguly ,Souvik Ghosh ,Rishiraj Sarker ,Debaparna Sengupta" A Bluetooth Based Sophisticated Home Automation System Using Smartphone"2016 International Conference on Intelligent Control Power and Instrumentation (ICICPI)October 2016.

2.2 Problem on Implement Project

•Movable part of tracking device.

•In Rainy season,solar panel will not available to work properly.

•The output form solar panel is low hence it take long time to charge battery.

•If load consume more power than it will make battery dischargeable faster.

•The security for accessing needed more.

2.3 Future Scope

Future aspect of this project is to incorporate various applications of servomotor, voice recognition module especially for the physically disabled individuals and auto sensing system to check the status of various devices, when individual is outside of his/her home.As in project we used bluetooth module to connect android app.But bluetooth module have caertain limited area to cover. In future we should use ESP8266 wifi module to connect android/computer instead of bluetooth module.It support long distance range for comunication.We can control our load at any where of world connected through internet.

Chapter 3

Methodology

3.1 Block Diagram

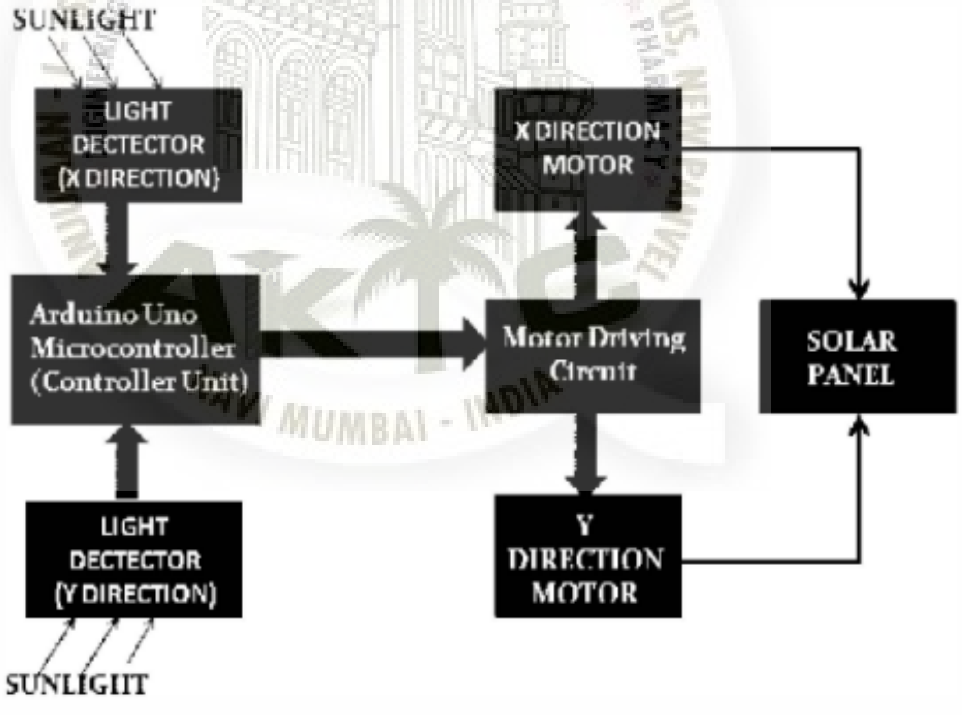

Figure 3.1: Block Diagram of Hardware Implementation of Dual Axis Solar Tracker

3.1.1 Hardware

- **The main component are:**

  1.Arduino Uno

  2.Solar Panel

  3.HC 0-5 Bluetooth Module

  4.L298 H-Bridge Motor Driver

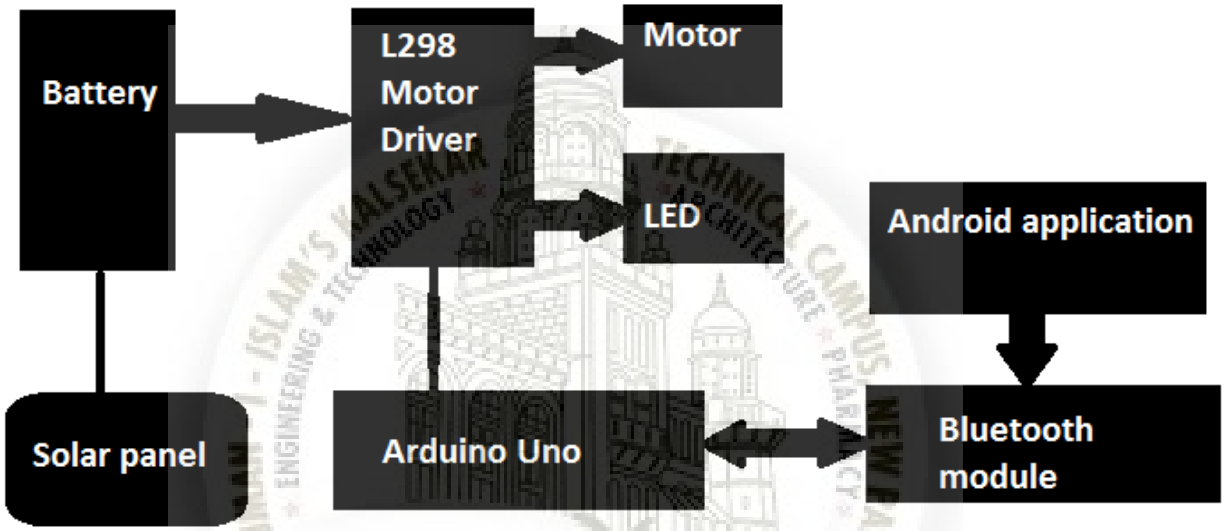

Figure 3.2: Block diagram Android application load control

3.1.2 Arduino Uno

Fig. shows an Arduino Uno microcontroller. It has 14 digital input/output pins (out of which, 6 pins are PWM outputs).The HC-05 Bluetooth Module has been used for wireless communication. The HC-05 Bluetooth Module has 6 pins- Vcc, GND, TX,

RX, Key, and LED. The Bluetooth module can work in two modes: Master and Slave. After the establishment of connection, the Bluetooth module can transmit and receive data regardless of the mode selected. The module has a factory set pin of 1234 which is used while pairing the module to a phone via. Ardudoid app. Ardudoid is a simple tool to control Arduino Uno from Android phone via the HC-05 Bluetooth serial module. The greatest advantage of Arduino microcontroller is its ready to use feature. As Arduino comes in a complete package with the 5V regulator, a software burner, a micro- controller, an oscillator, a serial communication interface, many LEDs and headers for the connections; the designer don't have to worry about the connections for programming or any other interfaces. The designer just need to plug the Arduino into USB port of the computer and that will serve the purpose of making a connection in between the computer and Arduino to write program and upload or store it inside Arduino. Another big advantage of Arduino is that , the Arduino website is a well designed, well organized and easy to use tool which serves as an Encyclopedia to the novice designers in this domain. Its' readymade library of sample programs present inside the Arduino software , provides the new designers a clear idea about the syntaxes and formation of programming language of Arduino. The language of Arduino is a higher level programming language formed by blending with C language. It's a user friendly language, easy to understand and use. Moreover, Arduino gives designers flexibility to use readymade programs by downloading them from the Arduino website and then transferring or storing them inside Arduino ,for making clones of already designed and implemented systems according to the need of the user. During coding of Arduino, it can be observed that some inbuilt functions of Arduino make the program writing very easy. Another advantage of Arduino is its automatic unit conversion capability. That's why, it can be said that during debugging we don't have to worry about the units conversions. Designer is therefore, capable of using his/her all force on the main parts of the project without worrying about the side problems. Another major advantage is community building. There are many forums present in the internet in which people are discussing and sharing their views about the Arduino. Engineers, hobbyists and professionals are making their projects through Arduino and they can easily access help from the forums about everything. Moreover, the Arduino website itself

explains each and every function of Arduino. Therefore, it can be concluded about the advantage of Arduino that, the designer needs to concentrate about his/her innovative idea only and the remaining part will be taken care

3.2 Specification

•. Microcontroller ATmega328

•. Operating Voltage 5V

•Input Voltage (recommended) 7-12V

•Input Voltage (limits) 6-20V

•Digital I/O Pins 14 (of which 6 provide PWM output)

•Analog Input Pins 6

•DC Current per I/O Pin 40 mA

•DC Current for 3.3V Pin 50 mA

•EEPROM 1 KB

•Clock Speed 16 MHz

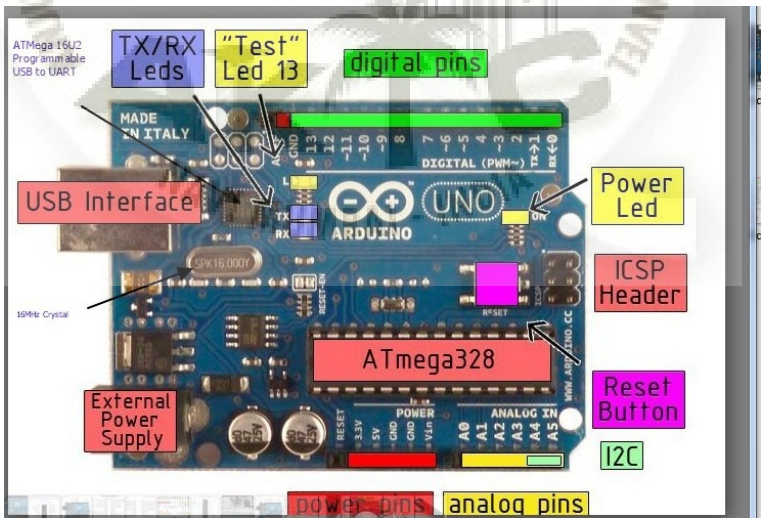

Figure 3.3: Microcontroller Arduino Uno

3.2.1 Solar Panel

Solar panels are devices that convert light into electricity. The word solar is used as they derive energy for operation from the sun. They are sometimes called photovoltaic which means "light-electricity". Solar cells or PV cells rely on the photovoltaic effect to absorb the energy of the sun and cause current to flow between two oppositely charge layers.A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically includes an array of photovoltaic modules, an inverter, a battery pack for storage, interconnection wiring, and optionally a solar tracking mechanism.Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells. The structural (load carrying) member of a module can either be the top layer or the back layer. Cells must also be protected from mechanical damage and moisture. Most modules are rigid, but semi-flexible ones based on thin-film cells are also available. The cells must be connected electrically in series, one to another. Externally, most of photovoltaic modules use MC4 connectors type to facilitate easy weatherproof connections to the rest of the system.

Module electrical connections are made in series to achieve a desired output voltage or in parallel to provide a desired current capability.

The conducting wires that take the current off the modules may contain silver, copper or other non-magnetic conductive transition metals. Bypass diodes may be incorporated or used externally, in case of partial module shading, to maximize the output of module sections still illuminated. Some special solar PV modules include concentrators in which light is focused by lenses or mirrors onto smaller cells. This enables the use of cells with a high cost per unit area (such as gallium arsenide) in a cost-effective way. A solar panel is a packaged, connected assembly of photovoltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. Several types of solar cells available in the market.

In this project we are using AMV energy system solar panel[AMV12V5W00526]which produce 12v/5w output.

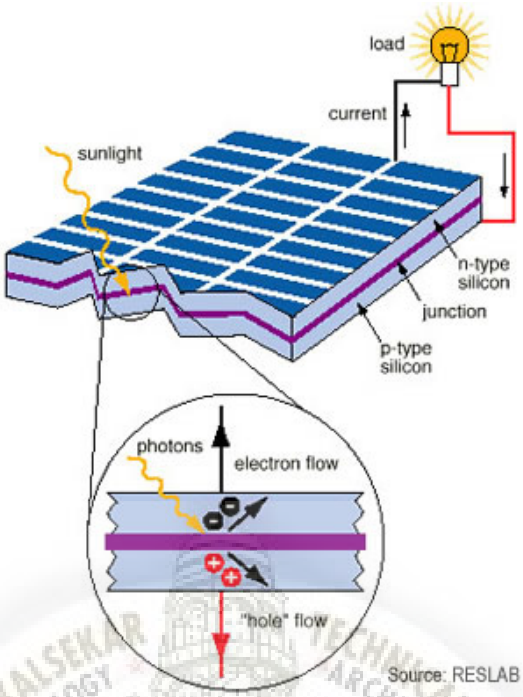

Figure 3.4: Solar Panel

3.2.2 L298H Motor driver

The dual bidirectional motor driver is based on the very popular L298 Dual H-Bridge Motor driver integrated circuit.The circuit will allow you toeasily and independently control two motors of up to 2A each.

It is deal for robotic application and well suited for connection to a microcontroller requiring just a couple of control lines per motor.It can also interfaced with simple manual switches,TTL logics gates,relays,etc.

The circuit incorporates 4 direction LEDs(2 per motor),a heat sink,screw-terminal,as well as eight schottky EMF-protection diodes. Two high-power currrent sense resistor are also incorporated which allow monitoring of the current drawn on each motor through your microcontroller.

An on-board user-accessible 5V regulator is also incorporated which can also be used to supply any additional circuits requiring a regulated 5V DC supply of up to about 1A.

Features of IC L298N

•Light weight, small dimension

•Super driver capacity

•600mA output current capability per channel.

•High noise immunity

•Power selection switch

•Motor direction indication LED

3.2.3 12v DC motor

60rpm 12v DC geared motors for robotics applications.Very easy to use available in standard size. Nut and threads on shaft to easily connect and internal threaded shaft for easily connectinh it to wheel.In this project,we used 12v dc motor which is connected to bluetooth and speed is control using android application.

Features

•125gm weight

•Same size motor available in various rpm

•6mm shaft diameter with internal hole

•2kgcm torque

.

3.2.4 HC 05 Bluetooth Module

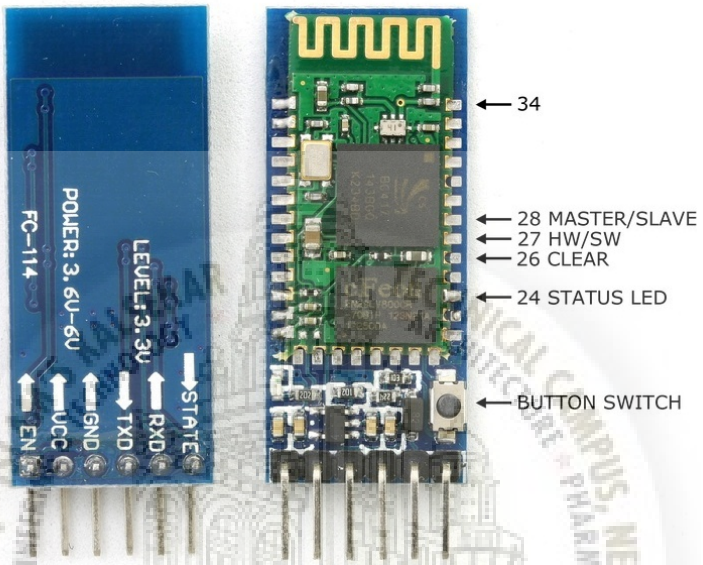

Figure 3.5: HC 05 Bluetooth Module

The figure of the Bluetooth module utilized in this project. If the module is set to the slave mode , it cannot initiate a connection to another Bluetooth devices rather than the intended Smartphone, but can accept connections. When it is in master mode, the module can initiate a connection to other devices. The module contains 2 parts, the back plane and the main Bluetooth board. The implemented system is designed to operate in slave mode. Thus the system can be connected to Arduino with smart-phone directly. Accordingly, the smart phone transmits the set of instructions to the Arduino through which the Arduino generates the set of output signals which, in turn, controls different devices via drives.This module enables you to wireless transmit and receive serial data. It is a drop in replacement for wired serial connections allowing transparent two-way data communication.You can simply use it for serial port replacement to establish connection between MCU or embedded project and PC for data transfer.This board operates on 5v.

3.3 Features

•5V power operation.

•UART interface.

•10 meters range.

•Minimum External Components.

•Status LED.

3.4 Applications

•Wireless Telemeter.

•Remote Data.

•Robotics.

•Sensor Network.

•Remote Programming

3.5 Specification

•Bluetooth Protocol v2.0.

•Range 10 meters.

•Frequency:2.4 ghz ISM(Industrial Scientific Medical)band

•Modulation:GFSK.

•Rate:2.1Mbps(Max).

•Authentication and encryption.

•Module only power supply: +3.3v DC 50ma.

•Operating Temperature: -20c to +55c.

3.6 12 Volt Automatic Cut Off Battery Charger Circuit

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. The relays switch connections are usually labeled COM(POLE), NC and NO: COM/POLE= Common, NC and NO always connect to this, it is the moving part of the switch. NC = Normally Closed, COM/POLE is connected to this when the relay coil is not magnetized. NO = Normally Open, COM/POLE is connected to this when the relay coil is MAGNETIZED and vice versa..The circuit is very simple and you can easily make it at your home.This circuit we will use a relay to cut off charging when the battery will be full.Friends in this circuit we will use two led's.The green led is charging indicator..When the green led will glow it means the battery is charging and the red led is battery full and cut off indicator..When the red led will glow that means the battery is fully charged and the circuit cut off the charging. when the 12 volt battery will be fully

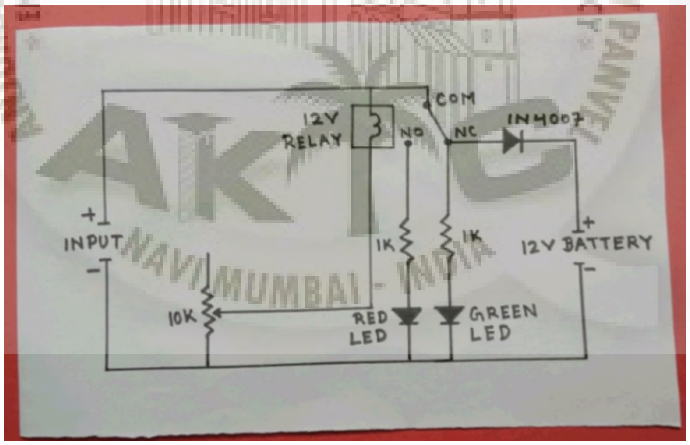

Figure 3.6: 12 Volt Automatic Cut Off Battery Charger Circuit

charged the relay will be activated and the green led will be off and the red led will start to glow.In this way the 12 volt automatic cut off battery charger circuit will work.The 12 volt automatic battery charger circuit diagram.

3.7 Arduino Motor Driver Shield

The Arduino Motor Shield is based on the L298 , which is a dual full-bridge driver designed to drive inductive loads such as relays, solenoids, DC and stepping motors. It lets you drive two DC motors with your Arduino board, controlling the speed and direction of each one independently. You can also measure the motor current absorption of each motor, among other features. The shield is TinkerKit compatible, which means you can quickly create projects by plugging TinkerKit modules to the board.

Specifications

•Operating Voltage 5V to 12V

•Motor controller L298P, Drives 2 DC motors or 1 stepper motor

•Max current 2A per channel or 4A max (with external power supply)

•Current sensing 1.65V/A

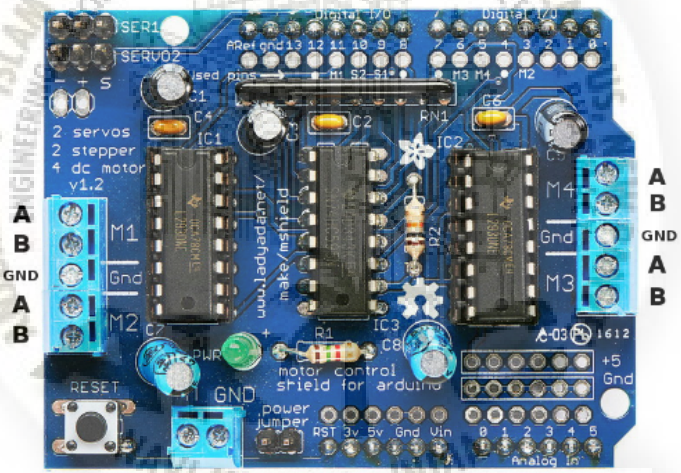

Figure 3.7: Arduino Motor Driver Shield

Chapter 4

Hardware Design

4.1 Circuit

- **Solar panel tracking**

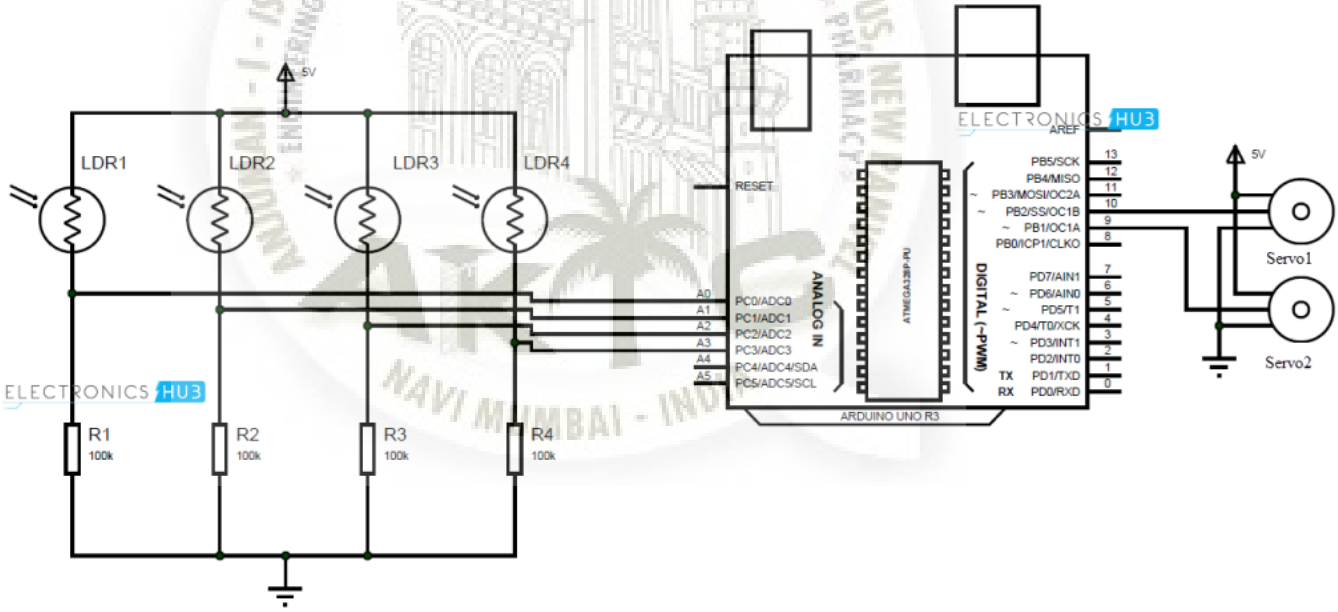

Figure 4.1: Solar tracking circuit

The circuit design of solar tracker is simple but setting up the system must be done carefully. Four LDRs and Four 100K resistors are connected in a voltage divider fashion and the output is given to 4 Analog input pins of Arduino. The PWM inputs of two servos are given from digital pins 9 and 10 of Arduino.L DRs are used as the

main light sensors. Two servo motors are fixed to the structure that holds the solar panel. The program for Arduino is uploaded to the microcontroller. The working of the project is as follows. LDRs sense the amount of sunlight falling on them. Four LDRs are divided into top, bottom, left and right. For east west tracking, the analog values from two top LDRs and two bottom LDRs are compared and if the top set of LDRs receive more light, the vertical servo will move in that direction. If the bottom LDRs receive more light, the servo moves in that direction. For angular deflection of the solar panel, the analog values from two left LDRs and two right LDRs are compared. If the left set of LDRs receive more light than the right set, the horizontal servo will move in that direction. If the right set of LDRs receive more light, the servo moves in that direction.

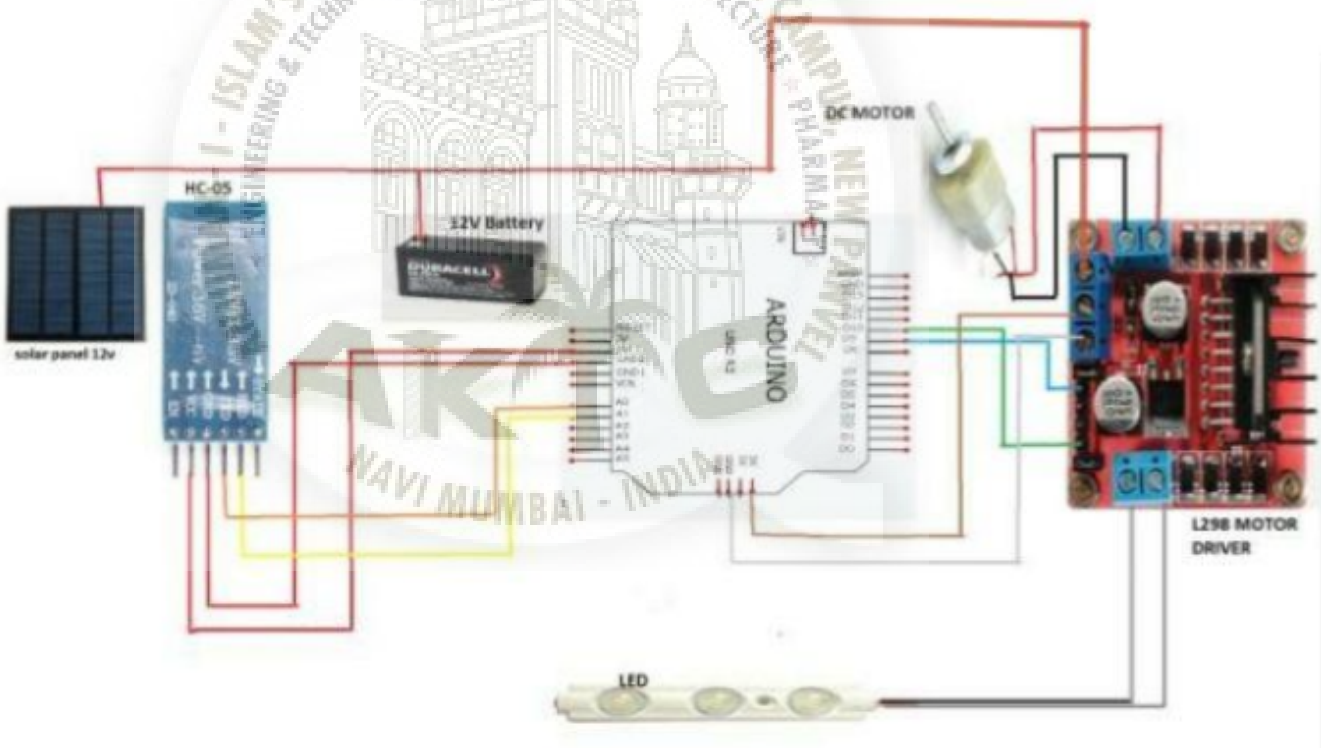

Figure 4.2: 2.Arduino load Intensity control

- **Energy:** The subjective motor is powered by arduino uno which acts as the energy source. batteries are used out of which one is used to drive the motors through

motor driver and other batteries.Solar panel output goes to battery as well as to L298 through which DC motor are connected.

- **Intelligence:** The concept of tracking freely moving around in the sunlight direction environment , the subjective LDR is able to make the decisions about moving direction of solar panel. Load is connected and intensity control with android application

- **Sensor:** The main impulsion is to design a high quality solar tracker. A sensor is a device that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument. Light Dependent Resistor: Light Dependent Resistor (LDR) is made of a high-resistance semiconductor. It can also be referred to as a photo-sensor. LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000 ohms, but when they are illuminated with light resistance drops dramatically. LDRs have low cost and simple structure. The behavior of LDRs with change in the intensity of light.

4.2 Hardware Interface

Connecting the module Make sure the arduino is switched off when connecting the various module. Connect the hc-05 bluetooth module to arduino and L298 motor driver. The module attaches to the arduino via a jumper wire. The main component is Arduino uno; single-board microcontroller. It has an open source physical computing platform and a development environment for writing software for the board and is inexpensive. The other main components are Light Dependent Resistors (LDRs); servo -motors; solar panel. Figure 1 depicts the methodology adopted. The solar tracking system is done by Light Dependant Resistor (LDR). Four LDR are connected to Arduino analog pin AO to A3 that acts as the input for the system. The analog value of LDR is converted into digital (Pulse Width Modulation) using the built-in Analog-to- Digital Converter. Solar output connected to 12v battery and to L298 motor driver.Through L298 one dc motor connected to port and at other port led are connected. Load(led and motor) control intensity through android

application with HC-05 bluetooth module which is connected to arduino.Android application control the load. [Connecting HC-05 Bluetooth Module With Arduino] HC-05 is a serial port module which makes it very easy to use. If you see the pin configuration of HC-05, there are total 6 but we only need 4 middle ones for our set-up.

[1]. Connect VCC with 3.3V of Arduino, please do not connect it with 5V as that can cook the module.

[2]. Connect GND with any GND of Arduino.

[3] .Connect Rx pin with Tx of Arduino

[4] .Connect Tx pin with Rx of Arduino

Now power-up the Uno using USB cable, a red light LED on HC-05 will start blinking, means we are ready to go forward.

4.3 Connect the LED /Motor and Control It Using Arduino Serial Monitor

Connect l298 motor driver to arduino pin 10 and 9,vcc and ground of motor driver are also connect to arduino vcc and ground rspectively.Power 0f 12v from battery are also connected to motor driver output(a) to run dc motor.And output(b) form motor driver are connected to leds as shown in figure3.2

4.4 Installing Software in Window XP,7,10

1. Go to www.arduino.com
2. Download file and install on window
3. Open arduino and quick setup as per requirement.
4. Select library"Arduino uno"
5. Select board: Arduino uno and Programmer"AVR ISP".
6. Add program and connect usb to arduino and select compiler to run program.

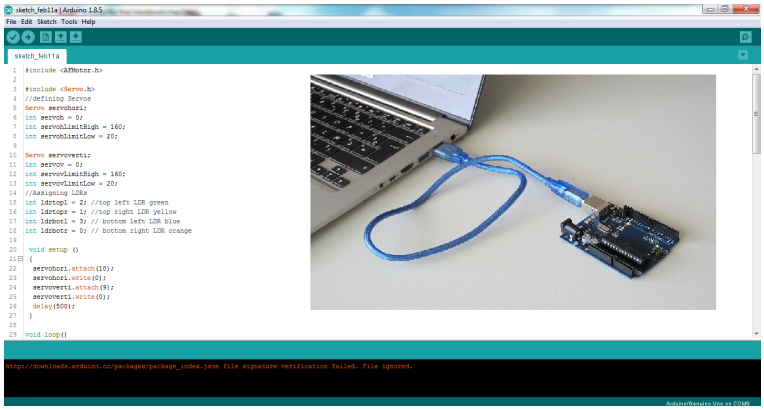

Figure 4.3: Arduino Software

4.5 Servo Motor SG90

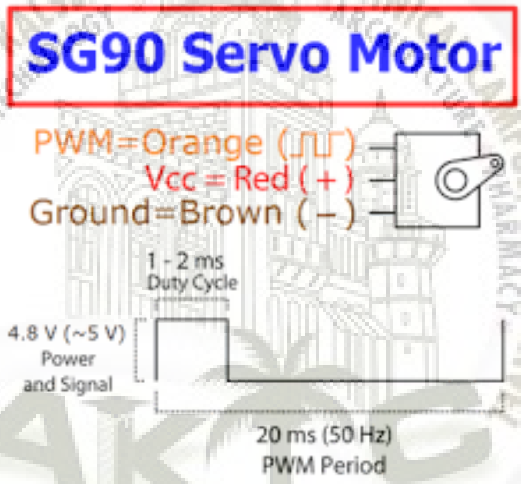

Figure 4.4: Servo Motor

4.5.1 Specifications

[1]. Weight: 9 g

[2]. Dimension: 22.2 x 11.8 x 31 mm approx.

[3]. Stall torque: 1.8 kgfcm

[4] Operating speed: 0.1 s/60 degree

[5]. Operating voltage: 4.8 V (5V)

[6]. Dead band width: 10 s

[7]. Temperature range: 0 C 55 C

You can use any servo code, hardware or library to control these servos. It comes with a 3 horns (arms) and hardware. As shown in fig3.1 we used two servo motor connecting to arduino pin 10 and 9.servo conected to pin 9 will move in Y direction and servo motor connected to pin no 10 will move in X direction.Two servo motors get power from arduino pin 5v and ground. Black,Red and yellow wires are ground,power and signal wires respectively.

4.6 12V DC Motor

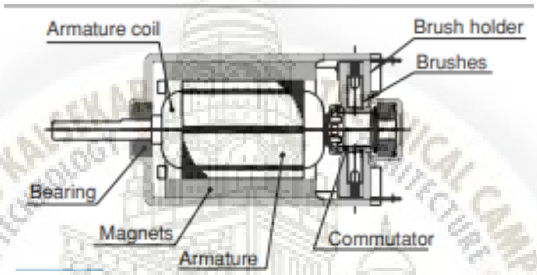

Figure 4.5: Servo Motor A and B

[1]. Brushes

The brush is an important part that serves as a commutating mechanism. The brush, s service life (in accordance with wear) will be the service life of the direct-current motor.

[2] Commutator

In general, copper is the material used, but to counteract how it softens at high temperatures, a small amount of silver is mixed with it.

[3] Armature coil

In general, electric wire known as magnet wire is used. Wire diameter is selected in accordance with the motor, specifications, and the wire is connected to the commutator bar by means of welding, soldering or other such methods.

[4]. Armature

For the armature, magnetic steel sheet is used to increase magnetic flux density.

[5]. Magnets

Broadly speaking, the magnets used in the motor can be classified in terms of whether they are ferrite, alnico, rare earth, etc. Magnets are selected in accordance

with usage purpose, based on their features.

[6] Bearing

There are ball bearings and sleeve bearings, and they are used in accordance with purpose. The ball bearing is the type that is appropriate for uses involving large bending loads.

As shown in fig 2.3 12vDC motor connected to L298 H-bridge motor driver.

4.7 Basics tools for constructing a base of tracking device

Construction tools are the things you use to fashion the frame and other mechanical parts. These include such mundane things as a screwdriver, a saw, and a drill

- Cardboard
- Screw Drivers
- Electric Dril
- Drill Bits
- Screw and Nuts
- Marker
- Glue

4.8 12 Volt Automatic Cut Off Battery Charger.

Battery charger circuit using LM311 and SCR .In this post let us see the circuit for recharging Lead-Acid battery using Solar panel. As non-renewable energy sources are decreasing, usage of solar energy is increased. This solar energy is not only used on the Earth but also used in space stations where no electrical power is available. Here is the simple circuit to charge 12V, 1.3Ah rechargeable battery from the solar panel. This solar charger has current and voltage regulation and also has over

voltage cut off facilities. This circuit may also be used to charge any battery at constant voltage because output voltage is adjustable.

4.8.1 Principle

Solar battery charger operated on the principle that the charge control circuit will produce the constant voltage. This circuit we will use a relay to cut off charging when the battery will be full..In this circuit we will use two led's[Green and Red]..The green led is charging indicator..When the green led will glow it means the battery is charging and the red led is battery full and cut off indicator..

4.8.2 Solar Battery Charger Circuit Design

Solar battery charger operated on the principle that the charge control circuit will produce the constant voltage. When the red led will glow that means the battery is fully charged and the circuit cut off the charging. When the 12 volt battery will be fully charged the relay will be activated and the green led will be off and the red led will start to glow.In this way the 12 volt automatic cut off battery charge

4.8.3 For Charging 12V Battery

Charging

[1].Charging current = Solar panel wattage/Solar Panel Voltage = 5 / 17 = 0.29A.
[2].Here LM317 can provide current upto 1.5A .So it is recommended to use high wattage panels if more current is required for your application.(But here my battery requires initial current less than 0.39Amps. This initial current is also mentioned on the battery).
[3].If the battery requires initial current more than 1.5A

Time taken for charging

Time taken for charging = 1.3Ah/0.29A = 4.44hours.

4.9 Arduino Motor Driver Shield

The Arduino Motor Shield allows you to easily control motor direction and speed using an Arduino. By allowing you to simply address Arduino pins, it makes it very simple to incorporate a motor into your project. It also allows you to be able to power a motor with a separate power supply of up to 12v The motor shield has 2 channels, which allows for the control of two DC motors, or 1 stepper motor.
It also has 6 headers for the attachment of Tinkerkit inputs, outputs, and communication lines. The use of these pins is somewhat limited, and therefor not covered in this tutorial.

With an external power supply, the motor shield can safely supply up to 12V and 2A per motor channel (or 4A to a single channel).

There are pins on the Arduino that are always in use by the shield. By addressing these pins you can select a motor channel to initiate, specify the motor direction (polarity), set motor speed (PWM), stop and start the motor, and monitor the current absorption of each channel. Plug the Arduino into your computer's USB

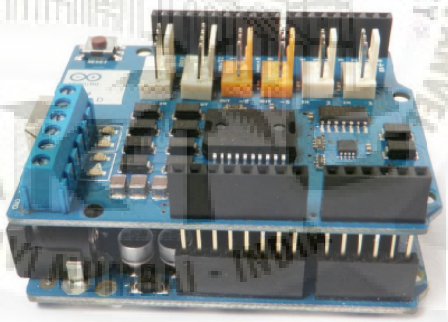

Figure 4.6: Adruino with motor driver shield

port and open the Arduino development environment.

In order to get the board to do anything, you need to initialize the motor channel by toggling three parameters:

First you need to set the motor direction (polarity of the power supply) by setting it either HIGH or LOW. Then you need to disengage the brake pin for the motor channel by setting it to LOW. Finally, to get the motor to start moving, you need to set the speed by sending a PWM command (analogWrite) to the appropriate pin.

Chapter 5

Software Design

- Installing arduino software on Window XP,7,10 There are common methods to get Software is to download from www.arduino.cc
- Installed arduino and quick setup After install of software we setup the system as per requirement.Select the board to arduino/uno.
- Execution of Coding After programming in arduino software first execute it to check error occur if no error then transfer the code.If error occur then check it and then transfer the code.
- Arduino uno
- USB cable connecting arduino with window/MAC
- Connect HC-05 bluetooth module
- Power Supply (USB Cable For Arduino UNO/MEGA (USB A to B)
- Automatic Software Reset. Rather than requiring a physical press of the reset button before an upload, the Arduino Uno is designed in a way that allows it to be reset by software running on a connected computer.

- USB overcurrent protection The Arduino Uno has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. Although most computers provide their own internal protection, the fuse provides an extra layer of protection.

If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

- The method of compiling

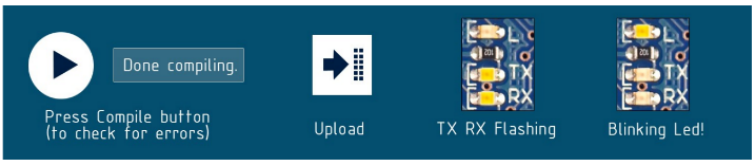

Figure 5.1: Compilier

5.1 Algorithm for solar tracker

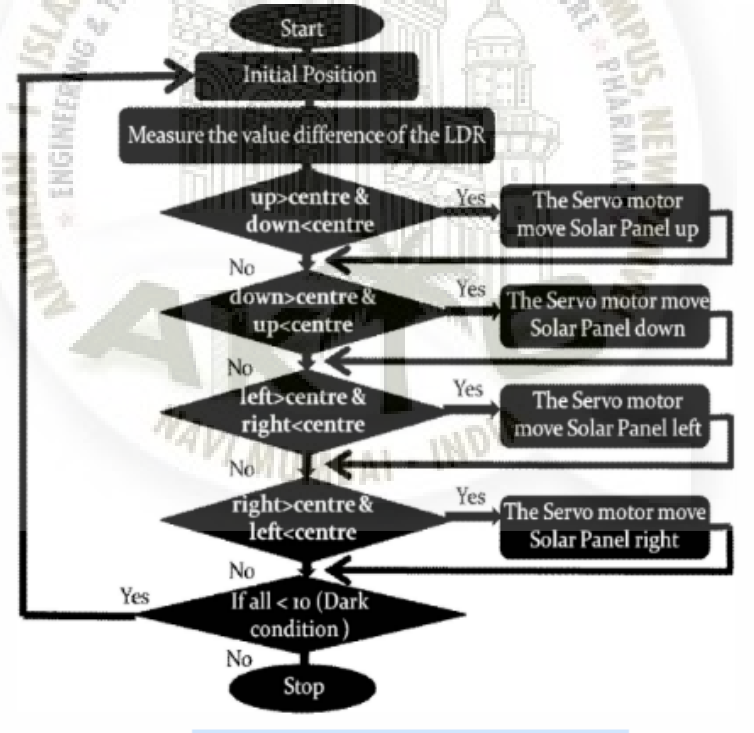

Figure 5.2: Flow chart for solar tracker

5.2 Android appication

[1]. Step for creating android application

[2] To get started, go to App Inventor on the web.

[3] Log in to App Inventor with a gmail (or google) user name and password

[4]. Start a new project.

[5] You are now in the Designer, where you lay out the "user interface" of your app.

[6] Add a Button and Connect App Inventor to your phone for live testing

[7] Get the MIT AI2 Companion from the Play Store and install it on your phone or tablet

[8] Get the Connection Code from App Inventor and scan or type it into your Companion app.

[9] See your app on the connected device and Change the Text on the Button

[10]. Switch over to the Blocks Editor and The Blocks Editor and Make a button click event

[11]. Program and Specify what the app should say when the button is clicked.

[12] Test the app in tablet or android mobile

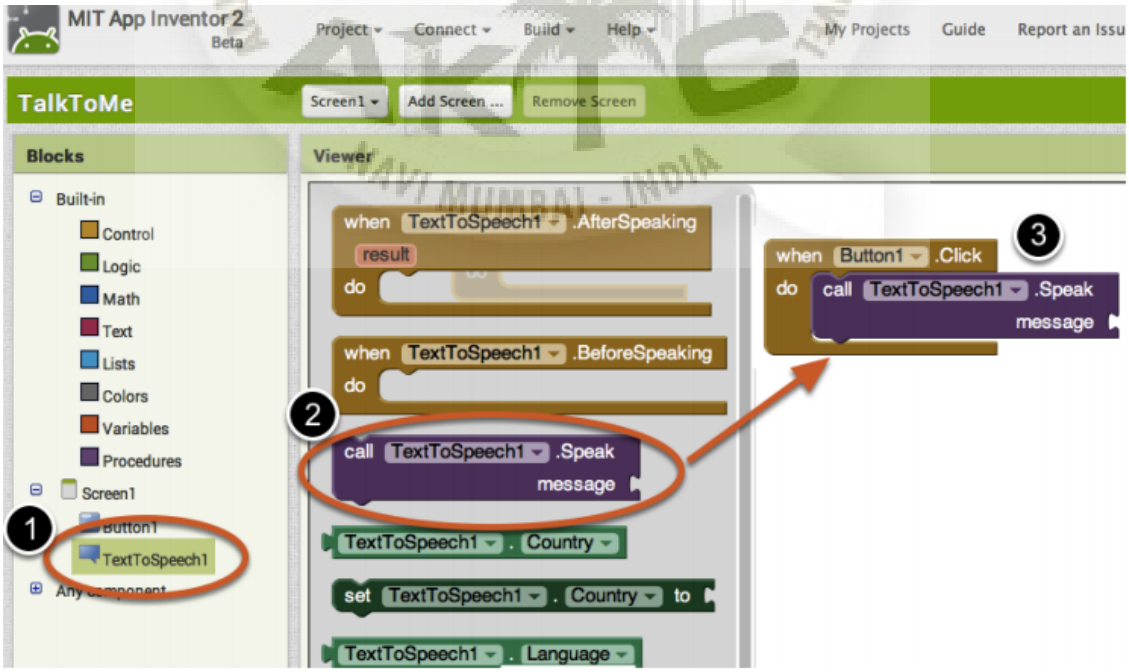

Figure 5.3: Creating application

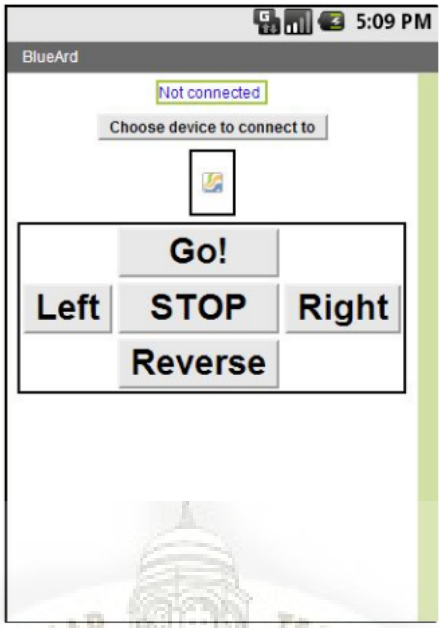

Figure 5.4: Android Application

[12]Download all source codes

Arduino Sketch, BlueArd.apk,BlueArd Source files (for editing my app with appinventor)

Chapter 6

Working of Project

6.1 Working of Project

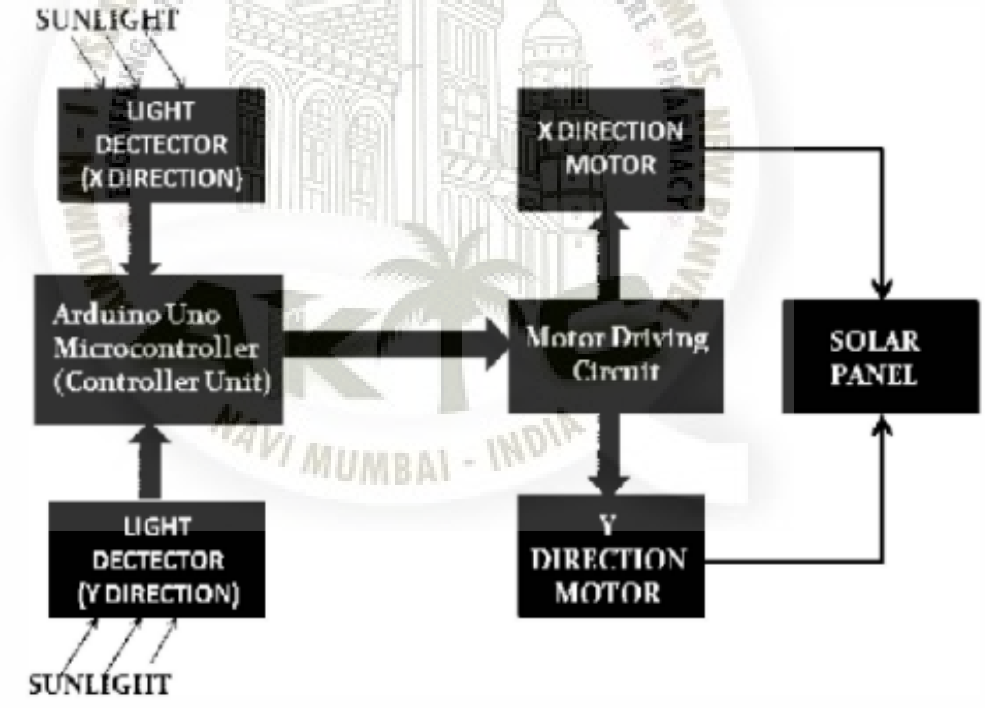

Figure 6.1: Block Diagram of Hardware Implementation of Dual Axis Solar Tracker

The above figure explains the Initial Commands require for the Working of the Project.

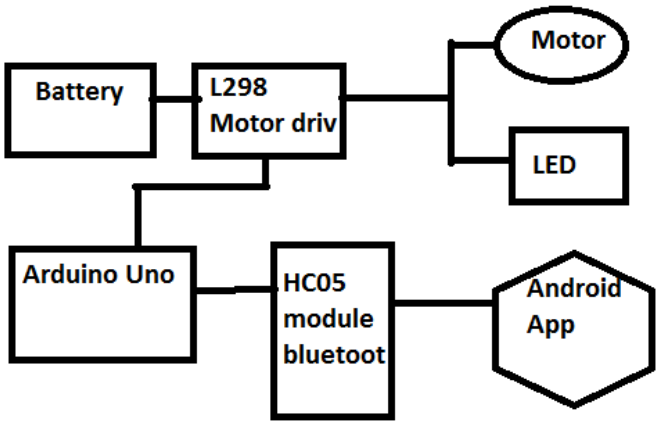

Figure 6.2: led and motot control

[1]. Connect four LDR around solar panel will be in top left,top right,bottom left,bottom right

[2]. Four wire of ldr are connect to arduino pin A0,A1,A2,A3

[3]. And servo motors are connected to Arduino pin no 9,10 and also to support solar panel for rotation

[4]. Start Check pin connections, Power up the system Arduino, Dc Motors etc,

[5]. HC-05 bluetooth module are connected and configur

[6]. Motion The movement of the motor is controlled by giving commands to it through the arduino. The motor driver drives the DC Motor and Led thereby making the move by giving commend using android application.

The above figure explains the bluetooth and Load working with intensity control. [1] HC05 module connect with arduino and android app connect to bluetooth through with we control the intensity of LED and motor.

[2] Sensor The main impulsion is to design a high quality solar tracker. A sensor is a device that measures a physical quantity and converts it into a signal which can be

read by an observer or by an instrument. Light Dependent Resistor: Light Dependent Resistor (LDR) is made of a high-resistance semiconductor. It can also be referred to as a photo-sensor. LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000 ohms, but when they are illuminated with light resistance drops dramatically. LDRs have low cost and simple structure. The behavior of LDRs with change in the intensity of light..

6.2 Movement of the servo motors

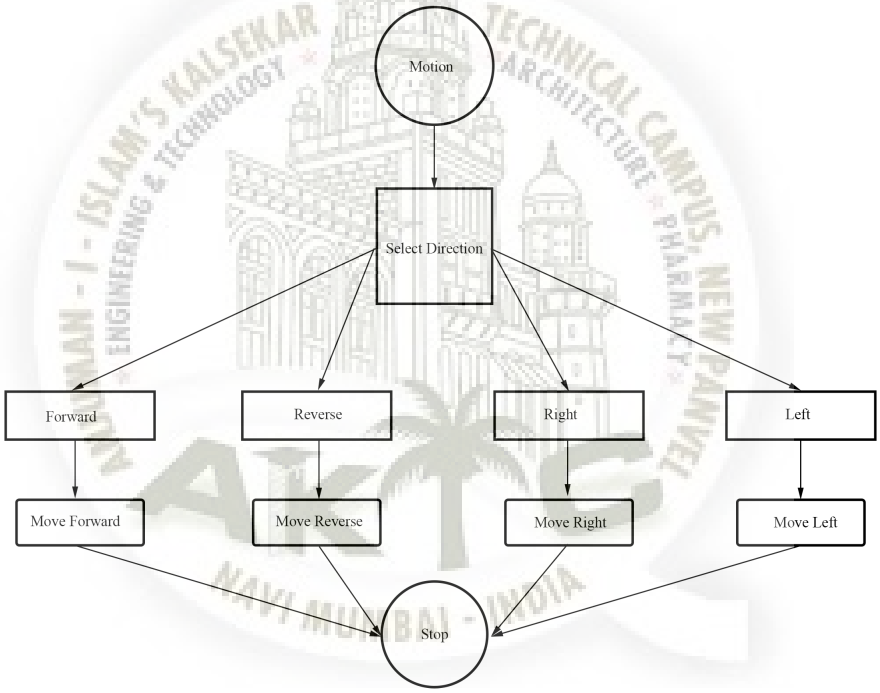

Figure 6.3: Motion of Servo motors

The above figure explains the movement of the motor in the required direction. Motion The movement of the motor is controlled through the arduino available. The required direction for the movement of motor are selected in which direction solar panel will move.

Select Direction The motor can move the panel holder through the in assigning directions in forward, reverse, right or left direction.

6.3 Controlling the intensity of motors and leds.

Android smartphones are undoubtedly the most popular gadgets these days. You will find various apps on the Internet that exploit inbuilt hardware in these mobile phones, such as Bluetooth and Wi-Fi, to control other devices. Presented here is a phone controlled robot that can be controlled via an app on your mobile. The control commands are sent via Bluetooth and the robot has such as:

•. It can be controlled from Android smartphones by touch or voice commands

•. The speed of the robot can also be controlled

•. The robot will sense and inform to the phone its distance from the nearest obstacle

•. It will also send information about the direction in which it is moving

Bluetooth module used in the project can be connected to any device, via built-in UART interface, to communicate with other Bluetooth-enabled devices such as mobile phones, handheld computers and laptops. The module runs on a 3.6V to 6V supply. Fig. 4 shows a picture of the Bluetooth module.

DC motor and led are connected to l298 and arduino through inensity are control.In Android app there are four button up,down,left and right.Up and down button is for motor speed control and left and right button are for Led intensity control

Power from battery are applied to load and control through android application

The Android App will be created using a free web application called MIT App Inventor. MIT App Inventor is a great place to get started with Android development, because it allows you to build simple apps with drag-n-drop.

Chapter 7

Result

7.1 Result

From the result, the existing methodology for maximum tracking faces an array for shortcoming like it cannot take into rapid change in the atmsopheric condition.Hence to overcome the above shortcoming enhanced maximum power point tracking is proposed.In this ,input voltage obtained from solar panel is 12v,which is tracked by incremental algoritm. The tracking system was successfully made and output of the same for the static as well as the tracker solar panel was validated by plotting the measured values of voltage; current and power.The output variation of voltage; current and power is limited between very small range of values; thus an almost constant value is obtained.

7.2 Discussion

The objective of the project was to design a system that tracks the sun for a sonal panel.This was acahieved through using light sensors that are able to detect the amopunt of sunlight that reaches the solar panel.

7.3 Advantages

1. Solar trackers generate more electricity than their stationary counterparts due to an increased direct exposure to solar rays.
2. There are many different kinds of solar tracker, such as single-axis and dual-axis trackers, which can help you find the perfect fit for your unique job site. Installation size, local weather, degree of latitude, and electrical requirements are all important considerations that can influence the type of solar tracker thats best for you.
3. Solar trackers generate more electricity in roughly the same amount of space needed for fixed tilt systems, making them ideal optimizing land usage.
4. Lowe amount of waste and pollution
5. The system can be used as in case of emergency power cuts. 6. ease of access

7.4 Disadvantages

1. Some ongoing maintenance is generally required, though the quality of the solar tracker can play a role in how much and how often this maintenance is needed.
2. Tracking systems are going to be more expensive than the opposing fixed mounted variety. This is largely due to having motorized and moving parts. Which leads way to another disadvantage.
3. System will get effect in monsoon.
4. There are various sensitive element and so may get damaged in extreme climatic condition.

Chapter 8

Conclusion

8.1 Conclusion

As a means to provide an efficient solar distributed generation system; this paper presented a scaled down active dual-axis solar tracker system design. In this paper, a reliable, compact, fast and low cost smart home system using Arduino and Android app. has been proposed,implemented and tested. The proposed system utilizes Bluetooth module for fast and reliable communications innbetween the remote user and home devices.The system was constructed and operated successfully. . The results show an average power gain of 13.44 compared to an immobile solar panel. The advantages of the proposed dual axis tracker are (i) it uses servomotors; a high performance alternative as the driving device for the solar panel and consumes less power as compared to stepper motor magnet d.c motors with gears. (ii) The proposed tracker is cost effective; simple and efficient; operates automatically. The rest position of the tracker is also defined. (iii) The controlling unit used is an inexpensive Arduino Uno; a single-board microcontroller; an open source electronics platform based on easy-to-use hardware and software. The developed solar tracker can be used for small scale solar PV power generation at remote places. It can also be used in solar street lighting system or any other stand alone solar PV application. The running efficiency of the solar PV panel can be further enhanced by developing an automatic dust sensor wiper for maintaining absorption of solar radiations by the solar PV panel.

8.2 Future work

With available time and resource, the objective of the project was met.The project is able to implemented on a much larger scale.For future,one may consider the use of more efficient sensors,but which are cost effective and consume little power.This would further enhance efficiency while reduce costs.If there is possibility of further reducinh the cost of this purposed topic,it would help great deal

8.3 Future scope

As in project we used bluetooth module to connect android app.But bluetooth module have caertain limited area to cover. In future we should use ESP8266 wifi module to connect android/computer instead of bluetooth module.It support long distance range for comunication.We can control our load at any where of world connected through internet.

Chapter 9

Reference

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9.1 Certificate

•Participated in "National Level Paper Presentation" at Universal College of Engineering."

•Participated in "National Level Cum Poster Presentation" at Universal College of Engineering."

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