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GOOGLE CLOCK LINKED SOLAR TRACTOR USING IoT

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Abstract - *As the non-renewable energy resources are decreasing drastically, use of renewable resources for producing electricity is increasing. Solar panels are becoming more popular day by day. Fossil fuels have taken off since the Industrial Revolution in the 18th century, and until today still considered as an essential and ideal source of energy globally. The previous solar related researches are dealt with the sensors. In this paper it is proposed that the solar panel is continuously rotating in the direction of sun by the help of Wi-Fi module. The observed solar energy can be utilized and stored into the battery. The battery will be connected to the Arduino Uno which is interfaced with the driver module and the Wi-Fi module. Google Clock Time will be automatically, updated by the Wi-Fi module with the help of Internet of Things (IoT). This time is used for the step by step rotation of the solar panel which depends on the current position of the sun and also with respect to the time. The proposed system implements the angle deviation of the solar panel roofed tractor where the maximum power can be generated. The angle will be changing automatically with the interval of every 10 seconds by the help of dc geared motor. The Blynk app is connected through the IoT platform, it is used to control the solar tractor manually with the help of using driver module is used to run the tractor is smoothly and safely. The system achieves better efficiency compared to the solar vehicles which uses MPPT algorithms for tracking the solar energy.*

Key Words: Arduino Uno, Wi-Fi module, Driver module, Battery, DC geared motor, Blynk app, IoT.

1. INTRODUCTION

Lot of studies have revealed the supply of fossil fuels such as coal; natural gas and oil are limited. Researches have also identified the impacts of using fossil fuel energy on global climate change. The demand for energy is increasing a lot as the world population grows and the economic growth in most of developing countries as well as in developed countries.

The energy crisis can be anticipated in the near futures. Alternative energy or renewable energy opposed to fossil fuels ought to be actively explored earlier rather than late. Renewable energy such as solar energy can provide a long term solution and minimize climate change. Historically, agricultural electric tractor systems [1], [2] were developed and employed nearly a hundred years ago but vanished with the increasing availability of fossil fuels and the progress in the development of combustion engines. Today, due to the perspective of locally available renewable electric energy there is a completely different scenario for rural areas, which justifies the efforts to resume the development of electric tractors for agriculture.

In this paper, some of the technologies advanced technologies has been proposed to design and build an solar tractor. It is expected that IoT will play a crucial role in the proposed system. The system is designed to maximize the output power by constantly adjusting the solar cell surface to follow the sun's path with respect to the Google Clock time. The status of the solar cell system consists of a voltage battery, amp (ampere) of current charging from solar panel into a battery and (ampere) of current loading from a battery to a solar tractor system. The PV panel movement is a step by step rotation with respect to the sun's position depends on the google clock time.

2. RELATED WORKS

Internet of Things is an internet application which involves three kinds of technologies; they are 1) perception, 2) transmission and 3) intelligent processing [3]. Internet of Things combines sensor technology, communication networks, internet technology and intelligent computing technology to achieve reliable intelligent processing [4]. The protocol commonly used for the internet of things is MQTT. MQTT (Message Queuing Telemetry Transport) is a broken-based publishing/subscribing, instant messaging protocol. It's designed to be open, simple, lightweight, and also easyto implement. The advantage of the MQTT protocol is that it solves the problem of instantly pushing various messages from the server to the mobile devices.

NodeMCU is an open source IOT platform. It includes firmware which runs on the ESP8266 WI-FI SoC (System-on-chip) from Espressif Systems Company (from Shanghai, China). It is a 32 bit Microcontroller. In this research NodeMCU used an ESP-12 module or NodeMCU version 2. NodeMCU is similar to the Arduino which has built in input and output ports. NodeMCU is compatible with Arduino IDE where programming C++ can be written. Compiling and flashing programming codes can be done by using [5] micro USB.

Blynk is a platform service to connect the NodeMCU and the mobile app [6]. There are 3 main services of Blynk. 1) Mobile app, it is used to monitor data from NodeMCU on the mobile app. In this research, the data from the solar cell charger and solar cell loader from NodeMCU can be monitored in real-

time on the mobile app. 2) Cloud service, it is used to store the data from the NodeMCU and historical information can be retrieved on the mobile app as a CSV. In this research, historical data of the solar cell charger and solar cell loader can be retrieved as a CSV. A CSV is used to analyze the solar cell system to management. 3) Library, it provides a connection for NodeMCU and Blynk cloud services. In this research, NodeMCU connecting with voltage and current sensors were used to observe the balance of the charger and loader from the solar cell system. Blynk provided the library to connect between NodeMCU and those sensors and Blynk app (on android).

Solar cell or Photovoltaic (PV) cell is a device that converts sunlight directly into electricity [7]. In this research, 2 solar panels with 40 watts are connected together in parallel for the purposes of increasing the output current. The solar cell system consists of solar panels, a solar charger, and a battery. Solar cells produce direct current (DC).

Large penetration of EV can lead to increase in the peak demand on the grid and possible overloading of distribution network assets [8], [9]. Secondly, the current electricity grid is mostly powered by fossil fuels like coal and natural gas [10]. When EVs are charged from such a grid, a large part of the emissions are merely moved from the vehicle to the power plant. This makes EVs not truly green as one would expect. Hence it is important for the future that EVs are charged from [11]–[14] sustainable sources of electricity like solar or wind.

3. PROPOSED SYSTEM

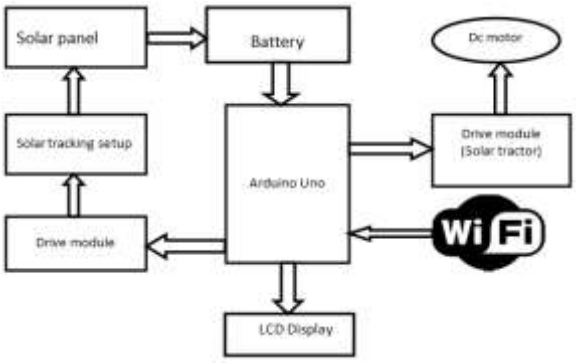

Fig -1: Block diagram of the proposed system

The solar energy is obtained from sun via the solar panel. The Google clock time is easily updating with the Arduino Uno with the help of Wi-Fi module. The Wi-Fi module is used to update the Google clock time with the help of coding and then interfaced with the Arduino Uno. The driver module is interfaced with Arduino Uno and to the solar panel. The Google clock time is updated on the Arduino Uno and command the instruction through the driver module, then the driver module is connected on the solar panel is moved to the current position of the sun with respect to time without any time delay.

Solar panel position is varied and controlled with the help of driver module with respect to the time. The solar panel absorbs the solar energy. The energy will be stored on the battery which is used to run the solar tractor. The block diagram shown in the figure 1.

3.1 Arduino Uno

Arduino is a microcontroller board based on the ATmega328P. It has 14 digital input and output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything need to support the microcontroller. Arduino Software (IDE) was the reference versions of Arduino, now evolved to new releases. The Uno board is the first in a series of USB Arduino board, and the reference model for the Arduino platform. Arduino is a single-board microprocessor to make using electronics in multidisciplinary projects more accessible. Arduino is shown in Figure 2. The hardware consists of an open-source hardware board designed around an 8-bit Atmel AVR microprocessor, or a 32-bit Atmel ARM. The software consists of a standard programming language compiler and a boot loader that executes on the microcontroller.

Fig -2: ARDUINO UNO

3.2 Solar panel

Photovoltaic solar panels absorb sunlight as a source of energy to generate electricity. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications.

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.

Fig -3: Solar panel

3.3 LCD display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs.

The reasons being:

- LCDs are economical;
- Easily programmable;
- They have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

Fig -4: LCD display

3.4 Lead Acid Battery

The lead–acid battery was invented in 1859 by French physicist Gaston Plante and is the oldest type of rechargeable battery. Despite having a very low energy-to-weight ratio and a low energy-to-volume ratio, its ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio. These features, along with their low cost, make them attractive for use in motor vehicles to provide the high current required by automobile starter motors. This project is using dual 6v battery on the solar tractor; the lead acid battery is shown in the figure 5.

Fig -5: Lead Acid Battery

3.5 DC Geared motor

It is a classical motor and has been used in motor control for a long time. All the power involved in electromechanical conversion is transferred to the rotor through stationary brushes which are in rubbing contact with the copper segments of the commutators. It requires certain maintenance and has a shorter life time. However, it is suitable for low power application. It has found applications in electric wheel-chair, transporter and micro-car. Today, most of the golf-carts are using DC motors. In this project, by using Geared motor on 12v, 60 RPM rating is shown in the figure 6.

Fig -6: DC Geared motor

3.6 Relay Module

The Relay is an electrically operated switch. Relays are used to control a circuit by a low- power signal (with complete electrical isolation between control and controlled circuits), or where several circuits need to be controlled by single signal. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the contact of the switch. The rating of relay is 12V/5A.

Fig -7: 2 Relay module

3.7 Wi-Fi Module

The ESP8266 Wi-Fi Module is a self SOC with integrated TCP/IP protocol s that can give any microcontroller access

to your Wi-Fi network. The ESP8266 is capable of hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module come pre-programmed with an AT command set firmware. The ESP8266 module is an extremely cost effective.

Fig -8: Wi-Fi Module

4. SOFTWARE IMPLEMENTATION

4.1 Internet of Things

The Internet of Things (IoT) is a new revolution for Data Transfer and Storage. Objects that make themselves recognizable and they obtain intelligence by making or enabling context related decisions to the situations. They can transfer information about themselves. They can access information that has been used by other things, or they can be components of other services. The three factors that makes IoT look forward are Sensing Nodes, Embedded Processing and Communication. This transformation is accompanied by the emergence of cloud computing capabilities supported by an increased storage capacity and high- end data processing and the Machine-to-Machine communication for data transport with complete security for data. By introducing cloud computing, we can make a full call to the storage resource pool and computing resource pool in the cloud computing architecture, and provide high reliability for IoT cloud storage service and efficient cloud computing services to users. This Machine-to-Machine service layer will provide the needed services like data transport, security, devices, management and device discovery in a harmonized manner across a vertical domain to the application layer.

4.2 ARDUINO IDE

The Arduino Integrated Development Environment (IDE) contains message area extension of '. ino'. The editor has features for cutting/pasting and for saving/replacing text. The message area gives feedback and displays errors. The console displays text output by the Arduino software (IDE), including complete error message and other information. The configured board and serial port are displayed in the right hand corner of the window. The toolbar buttons permit to verify and upload programs, create, open, and save sketches, and open the serial monitor. The text console and text editor for writing code, a toolbar with buttons for common functions and a series of menus. It connects to Arduino and genuine hardware upload programs written using the Arduino software (IDE) are called sketches. The programs are written in the text editor and are saved with the file

4.3 Blynk App

Blynk is a new platform that allows you to quickly build interfaces for controlling and monitoring your hardware projects from your iOS and Android device. After downloading the Blynk app, you can create a project dashboard and arrange buttons, sliders, graphs, and other widgets onto the screen. Using the widgets, you can turn pins on and off or display data from sensor.

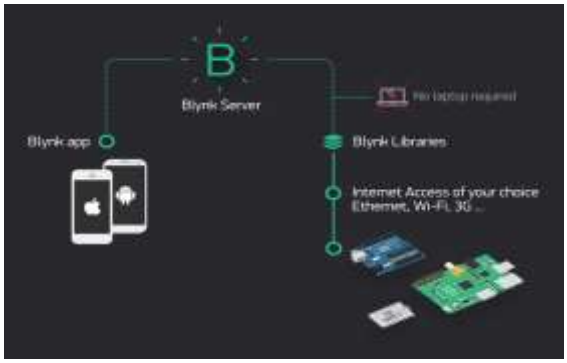

Fig -9*:* Architecture of Blynk IoT platform

5. EXPERIMENTAL SETUP

The Google clock time is updating with the help of Wi-Fi module and displayed through the LCD display. The Google clock time is used to update time with respect to step by step rotation of the solar panel tracking system. So, the efficient energy is consumed on the battery and also smoothly run the solar tractor. Then the hardware setup is shown in Figure 10.

Fig -10: Prototype of Solar Tractor

5. RESULT ANALYSIS

Although many assumptions occurred, the results can be judged as rational and realistic. From a technical aspect, this system is composed from matured and relatively simple technologies such, as PV panels, batteries and dc motors.

The modern technology like Google clock time makes the system more feasible. The Google clock time readings are updated on the clouds for every 10 seconds through Wi-Fi module. The LCD display is the notification module through the Google Clock Synchronization and it is connected to Wi-Fi. This is very important when it comes to applicability in real time conditions. Financially this system is feasible under certain conditions it will be profitable. This system can be very effective and needed solution in the field of agriculture purposes to reduce the dependency of fossil fuel cost.

Fig -11: Google clock synchronized notification module

6. CONCLUSION AND FUTURE SCOPE

The development of the Google clock linked solar tractor is efficient than the previous solar related systems which uses maximum power point tracking algorithms. This device may be considered as important for its eco-friendly nature and low cost involvement. A solar panel of 500mW is used to charge the battery to operate the solar tractor. The power generated through solar panel is stored in a battery for the effective functioning of system the during the absence of sunlight. The Wi-Fi module is interfaced with ARDUINO and LCD display. The time is updated on the LCD display as per the Google clock. The Program is dumped into ESP8266 Wi-Fi module to synchronize the time in the Blynk platform. The Blynk server provides many applications in which the real time is fetched. The fetched time is dumped into Wi-Fi module. The time is automatically updated for every 10 seconds. The angle of solar panel is deviated 36 degree for every 10 seconds. The program is set for 6 deviations where the first 5 deviations are moved gradually according to the sunrise and it is direction. At last solar panel is deviated to its initial position after the sunset.

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