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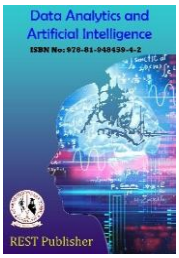

IoT Based Dual Axis Solar Tracking System

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Abstract: *Renewable and green energy sources are need of the hour and are gaining much consideration then other conventional sources for generation of electrical energy. Amongst these renewable, electricity generation through solar energy plays a pivotal role. Different techniques including concentrated solar thermal collectors and Photovoltaic cells are being used for generation of electricity from solar energy. The efficiency of these systems depends purely upon the amount of received solar radiations. To increase efficiency, these solar surfaces can be made to track the sun during the whole solar day maximizing the collection of solar irradiance.*

Keywords: *Arduino UNO, power supply, ESP8266, Solar Panel, LDR'S Motors , Motor driver ,accelerometer sensor ,Current sensor ,Voltage Sensor, Temperature humidity sensor, Battery or power supply.*

1. INTRODUCTION

An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function. An embedded system is not a computer system that is used primarily for processing, not a software system on PC or UNIX, not a traditional business or scientific application. High-end embedded system - Generally 32, 64 Bit Controllers used with OS. Examples Personal Digital Assistant and Mobile phones etc. Lower end embedded systems - Generally 8, 16 Bit Controllers used with a minimal operating systems and hardware layout designed for the specific purpose. An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today. Ninety-eight percent of all microprocessors are manufactured as components of embedded systems. Examples of properties of typical embedded computers when compared with general-purpose counterparts are low power consumption, small size, rugged operating ranges, and low per-unit cost. This comes at the price of limited processing resources, which make them significantly more difficult to program and to interact with. However, by building intelligence mechanisms on top of the hardware, taking advantage of possible existing sensors and the existence of a network of embedded units, one can both optimally manage

FIGURE 1: Embedded Chip

2. BLOCK DIAGRAM

A block diagram is a diagram of a system in which the principal parts or functions are represented by blocks connected by lines that show the relationships of the blocks. Block diagrams are typically used for higher level, less detailed descriptions that are intended to clarify overall concepts without concern for the details of implementation. The block diagram for our developing project "IOT based solar tracking" is shown in Figure 2 This consists of Arduino UNO, power supply, ESP8266, Solar Panel, LDR'S (Light Dependent Resistor) Motors ,Motor driver ,Current sensor ,Voltage Sensor, Temperature humidity sensor, Battery

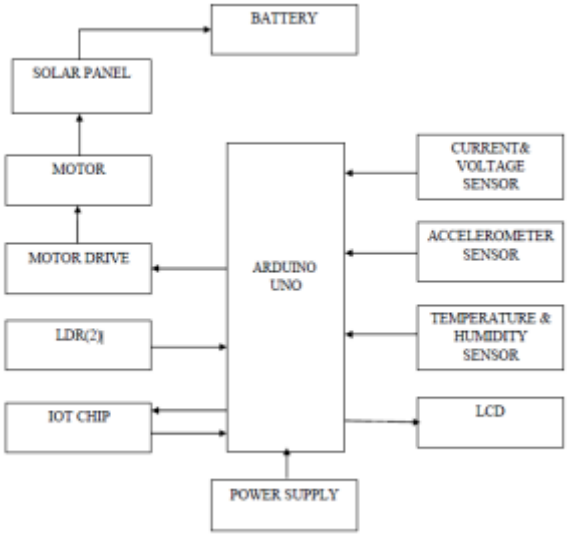

FIGURE 2. Block Diagram

3. ARCHITECTURE DIAGRAM

The process of defining a collection of hardware and software components and their interfaces to establish the framework for the development of a computer system is known as architecture design. The software that is built for computer-based systems can exhibit one of these many architectural styles. In our project we have use solar panel to convert the light energy into the electrical energy. The Sun change its position throughout the day that's why we can't able to utilize the whole light energy so we have made a tracking system in which solar panel can be rotate as per the sun changes its position.

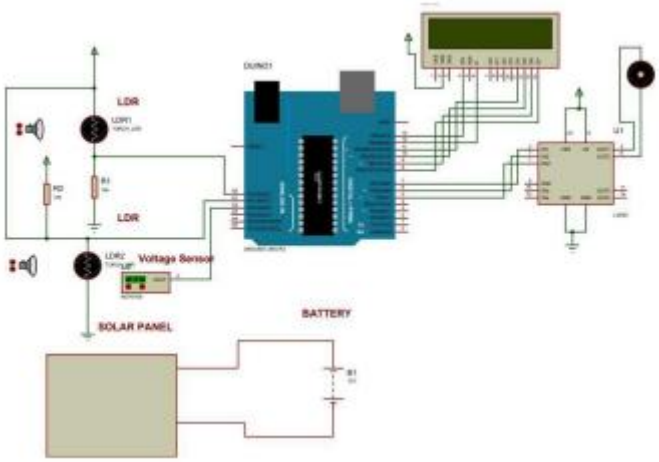

FIGURE 3: Circuit diagram

4. HARDWARE REQUIREMENTS

The hardware required in our project are Arduino UNO, power supply, ESP8266, Solar Panel, LDR'S (Light Dependent Resistor), Motors , Motor driver ,accelerometer sensor ,Current sensor ,Voltage Sensor, Temperature humidity sensor, Battery or power supply.

Pin Description: Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode (), digital Write (), and digital Read () functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 k Ohms.

Input and Output: Each of the 14 digital pins on the Arduino Uno can be used as an input or output, using pin Mode (), digital Write (), and digital Read () functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 k Ohms. In addition, some pins have specialized functions.

PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog Write () function.

Serial: Pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

External interrupt: Pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt () function for details.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.

LED: There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off. The Uno has 6 analog inputs, labelled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference () function. Additionally, some pins have specialized functionality.

TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library. There are a couple of other pins on the board.

AREF: Reference voltage for the analog inputs. Used with analog Reference ().

Reset: Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

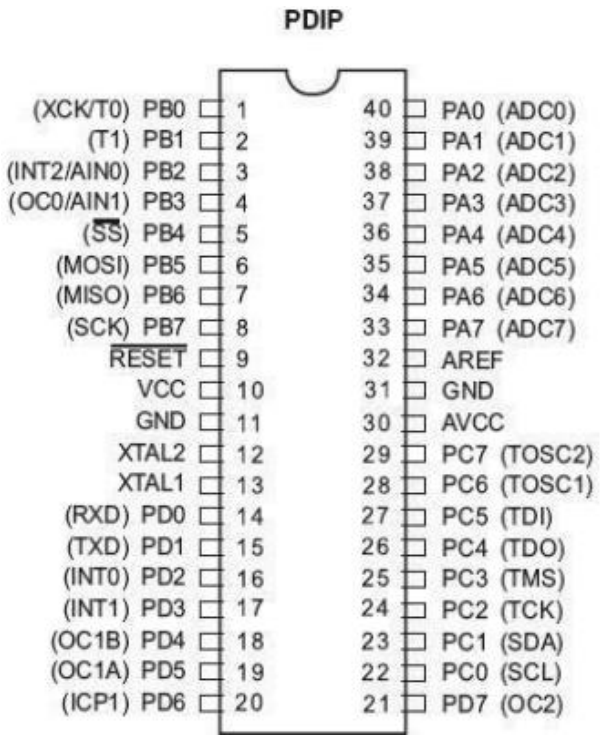

FIGURE 4. ATmega328 Microcontroller Pin Descriptions

IOT CHIP: The ESP8266 Wi-Fi module is a self contained with integrated TCP/IP protocol stack that can give any microcontroller access to Wi-Fi network. It is a low cost WiFi module. ESP8266 uses serial transceiver (TR/RX) to send and receive data and serial command.

FIGURE 5. ESP8266 Wi-Fi Module

The Chip Specifications: ESP8266 (presently ESP8266EX) is a chip with which manufacturers are making wirelessly networkable microcontroller modules. More specifically, ESP8266 is a System on a Chip (SoC) with capabilities for 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2), General Purpose Input/output (16 GPIO), InterIntegrated Circuit (I^2C), Analog to Digital Conversion (10-bit ADC), Serial Peripheral Interface (SPI), I^2S interfaces with DMA (sharing pins with GPIO), UART (on dedicated pins, plus a transmit only UART can be enabled on GPIO2), and Pulse Width Modulation (PWM). It employs a 32-bit RISC CPU based on the Tensilica Xtensa L106 running at 80 MHz (or overclocked to 160 MHz). It has a 64 KB boot ROM, 64 KB instruction RAM and 96 KB data RAM. External flash memory can be accessed through SPI.

FIGURE 6. ESP8266

Motor driver: This L293D Motor Driver Shield for Arduino is probably one of the most versatile on the market and features 2 servo and 4 motor connectors for DC or stepper motors. That makes it a great shield for any robotic project. This Arduino compatible motor Driver shield is a fullfeatured product that it can be used to drive 4 DC motor or two 4-wire steppers and two 5v servos. It drives the DC motor and stepper with the L293D, and it drives the servo with Arduino pin9 and pin10.

FIGURE 7. L293D Motor Drive

5. CONCLUSION

We proposed solar tracking angles for maximizing the efficiency of solar thermal collectors. The main aim is to track the maximum electricity that has been generated by solar and photovoltaic cell. This system is more reliable and efficient than fixed one, because the panel will tilt its position according to the direction of sun movement and will generate maximum power, but in the fixed panel solar system, maximum power cannot be generated due to the movement and direction of sun the panel cant able to track the sun.

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