Developing Dual Axis Solar Tracker and Monitoring System Using IoT

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ABSTRACT - The generation of power from the reduction of fossil energies is the biggest challenge for the coming partial century. The idea of converting solar energy into electrical energy using photovoltaic panels holds its place in the frontal row compared to other renewable sources Photovoltaic panels must be vertical with the sun to order to get maximum energy. The methodology employed in this work includes the perpetration of an Arduino grounded solar shadowing system using iot. Light Dependent Resistors (LDRs) are used to smell the intensity of sun and hence the PV solar panel is acclimated consequently to track maximum energy. The medium uses servo motor to control the movement of the solar panel. The microcontroller is used to control the servo motor grounded on signals entered from the LDRs. Proposed system can be used IoT. This report represents the design of a smart solar shadowing system which is grounded on the Arduino Microcontroller which provides movement of the solar panel in binary axis mode in direction where maximum sun is incident. The data which is collected from the system is stored in a pall. So as it's observed, a two- axis solar shadowing system generates further power. It's easier to maintain, no electricity needed, no energy cost and easy to install with long operating life.

Keywords: Solar Energy, Photovoltaic Panel, Solar Tracker, Azimuth, IOT Module

I.INTRODUCTION

A solar cell is a device which convert light energy to electrical energy through photovoltaic effect. Solar cells are the structure blocks of photovoltaic modules known as solar panels. In solar shadowing system, the module's face track the position of the sun automatically as the day runs by. The position of the sun varies as the sun move across the sky. For a solar powered outfit to work stylish, it must be placed near the sun and the solar tracker can increase the effectiveness of that outfit at any fixed position. Grounded on complication, costs and performance. One common type of tracker is the heliostat, a portable glass that reflects the position of the sun to a fixed position. A solar trackers delicacy depends on the operation. Concentrators, especially in solar cell operations, bear a high degree of delicacy to make sure that the concentrated sun is directed exactly to the powered device, which is close to the focal point of the glass or lens. Without shadowing, concentrator systems won't work at each, thus single- axis shadowing is obligatory (4). Non-concentrating operations bear lower delicacy, and numerous are likely to work without any shadowing. Still, tracking with great effect can ameliorate both the quantum of total affair power produced by a system and that produced during critical system demand ages (generally late autumn in hot climates) (5). Inquiries have been done to ameliorate the energy product of solar panels. These inquiries include; double- sided panels (6), conversion stages enhancement (7), erecting panels integration geometrically (8) and so on. Maximum energy is produced by a solar PV panel when it's deposited at right angle to the sun. For this reason, several inquiries developed different types of solar panel tracking systems (9 and 10). Thus, the primary purpose of this work is to develop a solar panel tracker grounded on Arduino advances so as to enhance the energy product of solar panel.

2.1R. Wan hade- This paper shows the benefits of binary axis solar shadowing system using parabolic solar panel. We're using this system for adding the power collection effectiveness of system. In this system we're developing a device which will tracks the sun and will keep the solar panel vertical to sun's position. For solar shadowing in binary axis we're using servo motor and LDR detectors. The sun tracking system that lets Parabolic Dish or PV board orthogonal to the sun radiation during the day, can raise the concentrated sun radiation by over to 30- 40. The structure craft and test study and strategy are appeared.

2.2 A.R. Amelia- Solar energy is abundantly in nature and sustainable energy coffers around the world. The main challenge with the solar field is less quantum of sun energy captured by using photovoltaic (PV) systems. The great performance of the PV systems can be achieved if the panel is kept vertical to the direction of the radiations of sun. Hence, solar tracker system is the system to keep the optimum position of the PV panel for always vertical to the solar radiation. This paper aims to review on colorful technologies of solar shadowing to determine the stylish PV panel exposure. The colorful types of technologies of solar shadowing system have been bandied which includes unresisting solar tracker, active solar tracker and chronological tracker system. The movement degrees of solar shadowing system

also have been addressed which conforming single- axis solar shadowing system and binary- axis solar shadowing system. This paper is also overviews the shadowing ways performance, construction, performance, advantages, and disadvantages of being solar shadowing system. The limitations of solar shadowing systems are also stressed for unborn action enhancement. Through this exploration studies, the most favorable solar shadowing system was linked as active solar tracker with the binary axis gyration.

2.3 Nadia AL- Rousan- Artificial Intelligence is extensively used in solar operations. Adaptive Neural Fuzzy Conclusion System (ANFIS) principle is one of the intelligent ways that's sufficient to be used in control systems. This paper proposes two new effective intelligent solar shadowing control systems grounded on ANFIS principle. The end of this paper is to design and apply effective single and binary- axis solar shadowing control systems that can increase the performance of solar trackers, prognosticate the line of the sun across the sky directly, and minimize the error, thus, maximize the energy affair of solar shadowing systems. Experimental data are used to train and test the proposed solar shadowing regulators by using month, day and time as input variables to prognosticate the optimum positions for solar shadowing systems (Tilt/ exposure angles). The proposed ANFIS models have been estimated to find its capability and robustness in tracking the optimum angles that gain the maximum solar radiation. It's set up that the proposed regulators are optimum to control solar shadowing systems with high vaticination rate and the low error rate. Either, the named variables along with the named armature could successfully prognosticate the optimum Tilt and exposure angles. The proposed models give superior results with five class functions, and it could gain high performance for both single- axis and binary- axis solar shadowing systems.

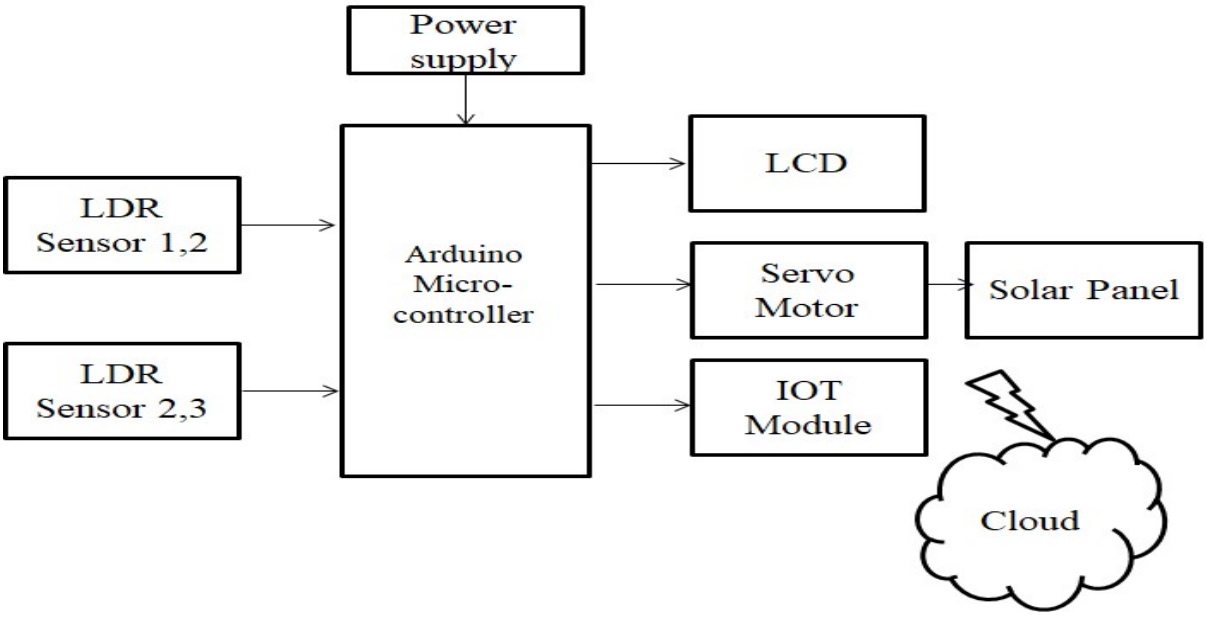
II. EXISTING SYSTEM

The solar shadowing system comprises of a solar panel, Arduino microcontroller and detectors. For this system to operate there must be emigration of light through the sun. The LDRs serve as the detectors to descry the intensity of light entering the solar panels. The LDR also sends information to the Arduino microcontroller. The servo motor circuit is also constructed. The servo has 3 legs of which the positive side is connected to the 5v of the Arduino microcontroller. The negative servo is connected to the ground. The data point servo is connected to the analog point on the microcontroller. A potentiometer is connected to regulate the speed of the servo motor

III. PROPOSED SYSTEM

A study on Optimization of Tilt Angle of the Solar Panel using Soft- Computing and Solar Tracking system is presented in this paper. Radiations being of different types give different power labors from the panel at different Tilt angles. Therefore the Tilt angle, if optimized can yield further power from the same panel. An analysis on the optimization of the Tilt angle was done. In the first phase, the Tilt angle was optimized on a yearly base using inheritable algorithm and it was set up that a significant power gain can be attained. In the alternate phase of this study, a binary axis solar tracker was developed following the soft computing grounded result. During the operation of this tracker a noteworthy power gain was achieved, when compared to the panel kept at no Tilt with respect to the ground. The tracker provides a fresh safety to the panel from murk reducing the possibility of the hot- spot effect significantly

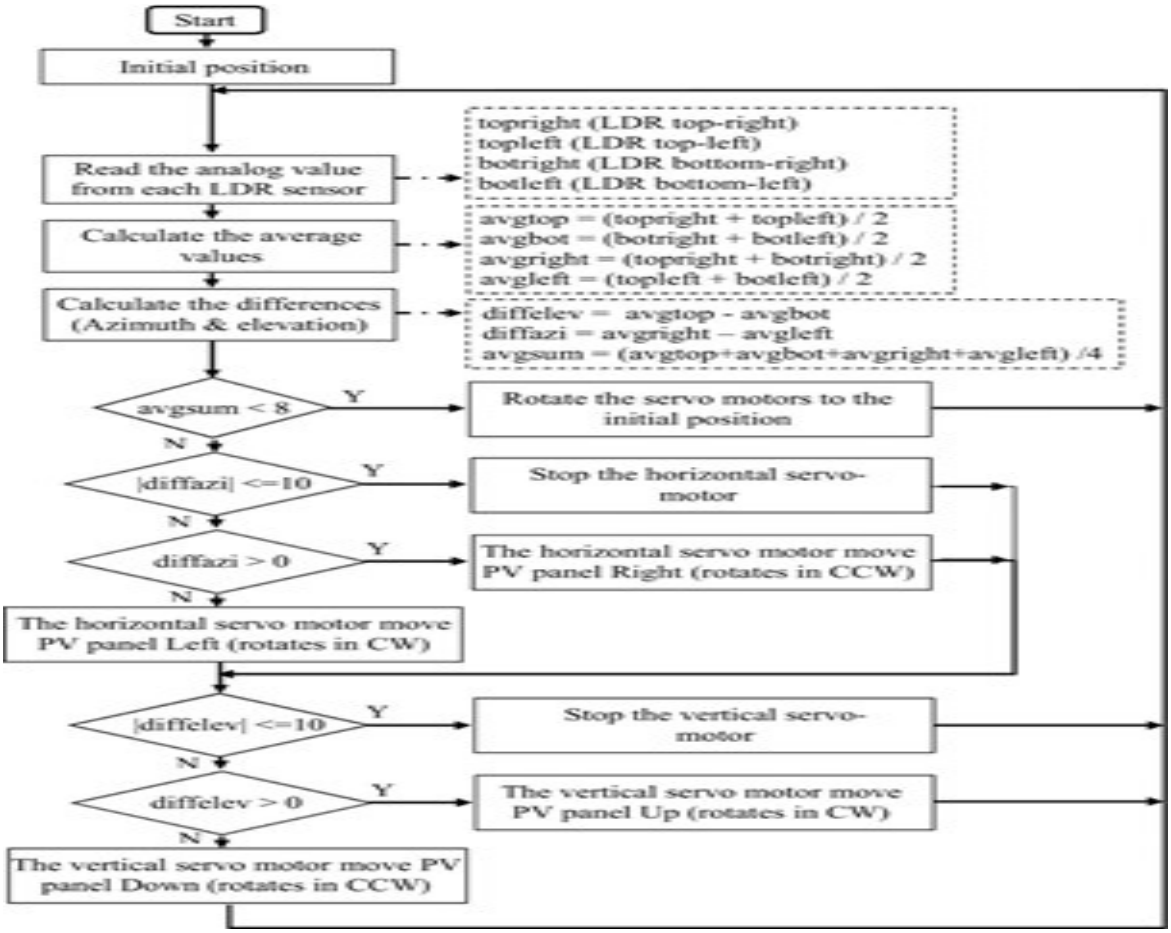
4.1 BLOCK DIAGRAM



THEORETICAL OVERVIEW

The shafts from the Sun are direct, diffused and reflected. The direct and diffused are readily utilized by the panels, the reflected part depends on the Albedo of the face. Further, the Sun doesn't stay at a particular place due to the gyration and revolution of the Earth. For this reason, tracking the sun is more salutary when it comes for energy product compare to fixed panel. The Albedo of a face has been bandied further as follows. Solar Photovoltaic and Solar Tracking has been talked about. Albedo Albedo is defined as the reflective quality of a face. Chance of reflected insolation to incoming insolation and zero percent is total immersion while 100 is total reflection is known as albedo. The sun movement also impacts albedo value and lower sun angles produce lesser reflection because the energy coming from a low sun angle isn't as strong as that arriving from a high sun angle. Solar Photovoltaic Solar power is the conversion of sun into electricity, either directly using photovoltaic (PV), or laterally using concentrated solar power (CSP). Using the photoelectric effect, solar cells produce direct current (DC) power which fluctuates with the sun's intensity. For practical purpose, power inverters are used for conversion to certain asked voltages or interspersing current (AC). Solar Tracking Solar radiation data is generally measured in the form of global and verbose radiation on a vertical face. Flat- plate solar collectors are listed to capture the maximum radiation and the problem of calculating solar radiation on a listed face is in determining the relative quantum of ray and verbose radiation contained in the measured horizontal global radiation. The flat plate solar collectors are always deposited at an angle to the horizontal plane so to find optimum Tilt angle is necessary to get maximum quantum of energy. Different shadowing systems are used to gain optimum Tilt angle. However, maximum ray radiation can be collected, if the tracker follow the sun as it moves each day. It's possible to collect 40 further solar energy by using a two- axis shadowing system and it's estimated that in good atmospheric condition, a flat- plate collector moved to face the sun twice a day can block nearly 95 of the energy collected using a completely automatic solar shadowing system. In practice, the collector plate is generally acquainted south facing and at a fixed Tilt which is set to maximize the average energy collected over a time.

FLOW CHAT



IV. SYSTEM REQUIREMENTS

HARDWARE DESCRIPTION

5.1 NODE MCU

Fig 5.1 Node MCU

Node MCU is an open-source Lua based firmware and improvement board uniquely focused on for IoT based Applications. It remembers firmware that runs for the ESP8266 Wi-Fi SoC from Expressive Systems, and equipment which depends on the ESP-12 module.

5.2 LCD Display

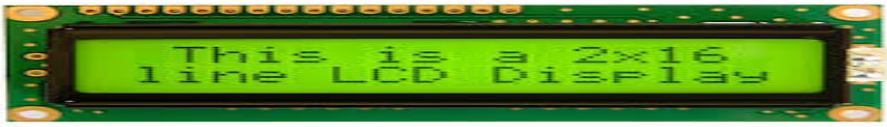


Fig 5.2 LCD

LCD can show numbers, characters and designs. The showcase is interfaced to I/O port of microcontroller (P0.0-P0.7). The presentation is in multiplexed mode. Inside 1/tenth of a second the following showcase turns on. There show will bring about constant showcase of tally because of industriousness of Vision.

5.3 servomotor

A servomotor (or servo motor) is a rotary selector or direct selector that allows for precise control of angular or direct position, haste, and acceleration. (1) It consists of a servo motor coupled to be a detector for position feedback. It also requires a fairly sophisticated regulator, frequently a devoted module designed specifically for use with servomotors. Servomotors aren't a specific class of motor, although the term servomotor is frequently used to relate to a motor suitable for use in a unrestricted- circle control system. Servomotors are used in operations similar as robotics, CNC ministry, and automated manufacturing.

5.4 LDR

A photo resistor (also known as a photocell, or light-dependent resistor, LDR, or print- conductive cell) is a unresisting element that decreases resistance with respect to entering refulgence (light) on the element's sensitive face. The resistance of a photoresist decrease with increase in incident light intensity; in other words, it exhibit photoconductivity. A photo resistor can be applied in light-sensitive sensor circuits and light- actuated and dark- actuated switching circuits acting as a resistance semiconductor.

5.5 Power Supply

The AC supply is applied to 12V advance step down transformer. The transformer is the 12V AC which is corrected utilizing a diode connect. The yield of Diode Bridge of 12V DC is separated by capacitor.

5.6 ARDUINO UNO R3 MICROCONTROLLER

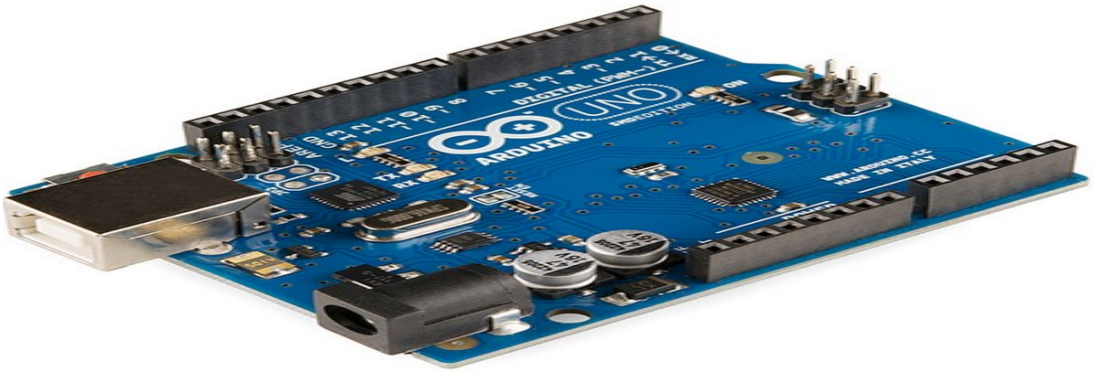


Fig 5.6 Arduino Board

The Arduino Uno R3 is a microcontroller board based on the ATmega328 IC. It has been 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contain everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

V. CONCLUSION

As a conclusion, the binary axis solar tracker has been developed successfully. The monitoring system is equipped with ESP8266 WIFI module and order to transfer the data from solar panel to IOT covering system. The system can work in one condition which is the binary axis solar tracker must work within the WIFI content so that the stoner can attach the system with ESP8266 WIFI module and access the solar panel parameter via IOT covering System. The other success part is to develop the solar tracker to have two angle. There are 2 movements in this solar tracker that can be classifies as vertical and perpendicular. Both of the movements are used two servo motor 180- degree angle. In order to determine the functionality of the system, and trial done to determine either the detector will operate duly when the tracker is testing in out-of-door. The labors in storehouse of IOT system can ameliorate in the future by ameliorate or change the platform. Incipiently, the solar tracker can have made a game changer to our world and it safe more to use because it doesn't have any pollution.

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