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Voltage Stability Monitoring Using Iot

K. Rajasekhara Reddy[1], K.C. Ramaiah[2], P. Saifali Khan[3], A. Naga Venkata Mohan[4],S. Ravi Kiran Kumar[5],G. Harish[6]

[1] *Associate Professor, Department of EEE, Santhiram Engineering College, Nandyal, A.P,*
2,3,4,5,6, UG Student Scholar, Department of EEE, Santhiram Engineering College, Nandyal, A.P,

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ABSTRACT
The project's automated solar tracker system will use photovoltaic conversion panels and be operated by a microcontroller [1]. Our effort aims at creating solar tracker systems that can run on either a single or double axis. The tracker monitors the sun and changes the angle at which it rises to maximize energy generation. Two geared DC motors are used to drive the solar panel so that it is constantly towards the sun. In the experimental model, a tiny photovoltaic panel is moved by a DC motor that is intelligently managed by a dedicated drive. Two simple but efficient light sensors are also present to receive commands from the device's internal microprocessor[3]. Experimental investigations are done into the efficiency and characteristics of the solar tracker system.

I. INTORDUCTION

Fossil fuel reserves will inevitably run out, which has sparked interest in renewable energy alternatives among scientists, engineers, bankers, and policymakers worldwide. Alternative energy sources that are gaining popularity include hydroelectricity, bio fuel, solar, wind, geothermal, tidal, and wave energy. They are appealing fossil fuel alternatives due of their renewability. One of the most accessible of these power sources is solar photovoltaic (PV) electricity. Solar cell performance and cost have increased thanks to research and development, therefore this technology is now more extensively used in homes. Data from the International Energy Agency (IEA) reveals that from the early 2000s, the yearly growth in global PV capacity has averaged 49%. Numerous experts predict that during the next few decades, the use of solar photovoltaic electricity will rise dramatically. Despite these advantages, photovoltaic (PV) solar energy has not yet become widely used. The effectiveness of PV systems in areas with little sunlight still has to be improved. Enhancing system design and module construction is a practical method to increase solar PV power's efficiency and make it a more reliable option for consumers, even though more cutting-edge technology from producers is required to raise PV materials' potential[13]. This endeavour was undertaken to promote the development of such an exciting technology.

A typical method for doing this is to spend as much time as possible in the sun. Tracking systems ensure that PV solar panels are always looking directly towards the sun's beams to achieve this. Although the goal of this project is to build a scaled-down prototype of a light tracking system, the underlying architecture can be used in any viable solar energy configuration. This investigation should provide an accurate review of the tracking system's performance in comparison to the fixed mounting solution.

The network of physical items, or "things," that are implanted with sensors, software, and other technologies for the purpose of communicating and exchanging data with other devices and systems through the internet is referred to as the Internet of Things (IoT) [3]. These devices include everything from common domestic items to complex industrial tools. Today, there are more than 7 billion connected IoT devices, and according to analysts, this number will increase to 10 billion in 2020 and 22 billion in 2025. Oracle has a network of hardware partners.

IoT has emerged in recent years as one of the most significant 21st-century technologies. Continuous communication between people, processes, and things is now possible because of the capacity to connect commonplace items—such as household appliances, automobiles, thermostats, and baby monitors—to the internet via embedded devices. Physical things can share and gather data with little assistance from humans thanks to low-cost computers, the cloud, big data, analytics, and mobile technologies. Digital systems can record, monitor, and modify every interaction between connected things in today's highly connected environment[10]. The physical and digital worlds collide, but they work together.

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II. LITERATURE REVIEW

Microcontroller-Based Automatic Solar Tracking System with Mirror Booster, Protik Kumar Das1, Mir Ahasan Habib1, Mohammed Mynuddin, DOI: 10.11648/j.ijrse.20150404.11. In this paper, we present the design of a microcontroller-based solar tracking system that makes use of a mirror booster. Rapid global growth is being seen in the utilization of solar energy as a supplemental source of electricity. Maximizing solar energy's efficiency is essential for its widespread application. Solar array power output can be increased through the use of a sun-tracking system. In this paper, we explore the use of a stepper motor, a gear motor, and a photo diode to create a solar tracking system. The reflected surface of a mirror functions as a boost, increasing output. The entire enclosure will spin in a circle, while the mirror swings from south to north and back again. As a whole, the prototype is centred on a microcontroller that has been programmed to manage the system through the exchange of data with the sensors and motor driver in accordance with the path of the sun[3]. The solar tracker's functionality and properties are evaluated experimentally.

'An Analysis of Automatic Dual Axis Sun Tracking Solar System,' Neenu Sharma and Brijbhushan Sharma, International Journal of Innovative Research in Electrical, Electronics, Instrumentation, and Control Engineering, Volume 4, Issue 12, December 2016; ISO 3297:2007 Certified. Electricity, which powers our modern lifestyles at home and at work, is crucial to the advancement of our society. The expanding global population has the potential to considerably raise the demand for nonrenewable energy sources like coal and oil. As the effects of global warming and energy scarcity grow, it is vital to control and utilize natural resources. Most developed countries are making investments in renewable energy. The sun is unparalleled in terms of renewable energy sources. A sun-tracking solar system that can house photovoltaic modules and function as a p-n junction has been created to harness the power of the sun. This system increases the amount of solar power that can be produced. Increased efficiency and output are the primary motivations for the widespread adoption of sun-tracking solar systems. More energy can be harvested from the sun using a dual-axis solar tracking system, the focus of this paper. The solar tracker's dual axis design allows for a range of adjustment in the horizontal plane while the vertical plane is locked in place. A dual axis solar system constantly tracks the sun's location.. This paper analysed how optimal solar panel tilt and orientation affects power output.

The article "Integrated cloud-based risk assessment model for continuous integration" by K. Vijayakumar and ChokkalingamArun was published in the journal Int. J. Reasoning-based Intelligent Systems, Volume 10, Issues 3/4, 2018.

There is a common tendency to overlook architectural, security concerns in favour of functional concerns during the development stages of a software application or product. The risks in the areas where applications are being deployed and face a critical security threat are particularly high in the current era, with its ever-evolving dynamics in internet and mobility environments. Prevention is always preferable to reaction in any situation. The implementation of such a framework would be highly significant because it would aid in continuous risk assessment throughout the application development stages, a process that is becoming increasingly important as new technologies and practices , such as continuous integration and development, gain prominence. This conference paper presents an innovative framework for incorporating a continuous risk assessment strategy into software development projects for use in cloud-based environments.

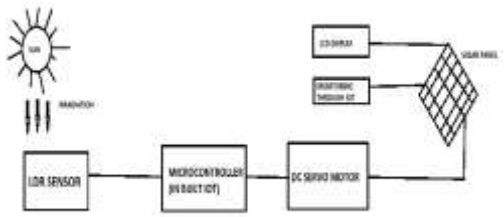

Fig 3.1 Block Diagram

ESP 32

ESP32 is a low-cost, low-power Microcontroller with an integrated Wi-Fi and Bluetooth. It is the successor to the ESP8266 which is also a low-cost Wi-Fi microchip albeit with limited vastly limited functionality.

It is an integrated antenna and RF balun, power amplifier, low-noise amplifiers, filters, and power management module. The entire solution takes up the least amount of printed circuit board area. This board is used with 2.4 GHz dual-mode Wi-Fi and Bluetooth chips by TSMC 40nm low power technology, power and RF properties best, which is safe, reliable, and scale-able to a variety of applications.

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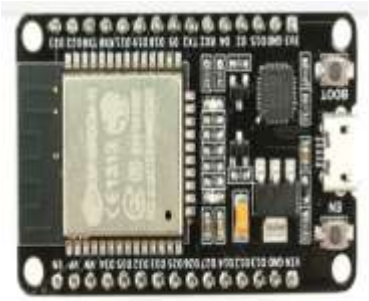

Fig 3.2 ESP 32 Microcontroller

SG90 SERVO MOTOR

There are many different servo motors on the market, and each one has an unique speciality and set of uses. The following two paragraphs will help you identify the right type of servo motor for your project/system.

Most of the hobby Servo motors operates from 4.8V to 6.5V, the higher the voltage higher the torque we can achieve, but most commonly they are operated at +5V. Almost all hobby servo motors can rotate only from 0° to 180° due to their gear arrangement so make sure you project can live with the half circle if no, you can prefer for a 0° to 360° motor or modify the motor to make a full circle. The gears in the motors are easily subjected to wear and tear, so if your application requires stronger and long running motors you can go with metal gears or just stick with normal plastic gear.

Next comes the most important parameter, which is the torque at which the motor operates. Again there are many choices here but the commonly available one is the 2.5kg/cm torque which comes with the Tower pro SG90 Motor. This 2.5kg/cm torque means that the motor can pull a weight of 2.5kg when it is suspended at a distance of 1cm. So if you suspend the load at 0.5cm then the motor can pull a load of 5kg similarly if you suspend the load at 2cm then can pull only 1.25. Based on the load which you use in the project you can select the motor with proper torque. The below picture will illustrate the same.

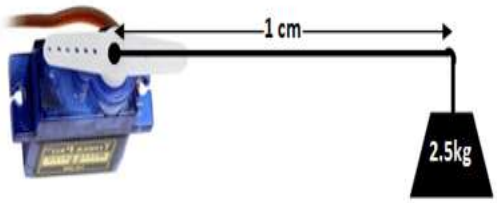

Fig 3.3 Servo motor

SOLAR PANEL

The amount of sunlight that reaches the surface of the earth in an hour and a half is sufficient to meet all of the world's energy needs for a complete year. Solar technologies convert sunlight into electrical energy either through photovoltaic (PV) panels or through mirrors that concentrate solar radiation. This energy can be used to generate electricity or be stored in batteries or thermal storage.

Current in PV panel

$$i_{pv} = N_{ll} I_{LG} - N_{ll} I_{DS} \left[e^{A\left(\frac{v_{pv}}{N_{sl}} + \frac{i_{pv} R_{se}}{N_{ll}}\right)} - 1 \right] - \left[\frac{N_{ll}^2 v_{pv} + N_{ll} N_{sl} (i_{pv} R_{se})}{N_{ll} N_{sl} R_{sh}} \right]$$

Fig 3.4 Solar Panel

Below, you can find resources and information on the basics of solar radiation, photovoltaic and concentrating solar-thermal power technologies, electrical grid systems integration, and the non-hardware aspects (soft costs) of solar energy. You can also learn more about how to go solar and the solar energy industry. In addition, you can dive deeper into solar energy and learn about how the U.S. Department of Energy Solar Energy Technologies Office is driving innovative research and development in these areas.

LDR – Light Dependent Resistor

An LDR is a component having a variable resistance that changes depending on the amount of light it receives. This enables their usage in light sensor circuits. A light-dependent resistor (LDR) is a light-controlled variable resistor. The resistance of this decreases with increasing incident light intensity; in other words, it exhibits photo-conductivity. An LDR can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits. An LDR is made of a high resistance semiconductor. In the dark, an LDR can have a resistance as high as a few mega ohms (MΩ), while in the light, an LDR can have a

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resistance as low as a few hundred ohms. If incident light on an LDR exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their whole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of an LDR can substantially differ among dissimilar devices.

A Light Dependent Resistor (LDR) is also called a photo resistor or a cadmium sulfide (CdS) cell. It is also called a photoconductor. It is basically a photocell that works on the principle of photoconductivity. The passive component is basically a resistor whose resistance value decreases when the intensity of light decreases. This optoelectronic device is mostly used in light varying sensor circuit, and light and dark activated switching circuits. Some of its applications include camera light meters, street lights, clock radios, light beam alarms, reflective smoke alarms, and outdoor clocks.

Fig 3.5 LDR Sensor

LIQUID CRYSTAL DISPLAY (LCD)

Depending on how many lines are used for connection to the microcontroller, there are 8-bit and 4-bit LCD modes. The appropriate mode is determined at the beginning of the process in a phase called "initialization". In the first case, the data are transferred through outputs D0-D7 as it has been already explained. In case of 4-bit LED mode, for the sake of saving valuable I/O pins of the microcontroller, there are only 4 higher bits (D4-D7) used for communication, while other may be left unconnected.

Consequently, each data is sent to LCD in two steps: four higher bits are sent first (that normally would be sent through lines D4-D7), four lower bits are sent afterwards. With the help of initialization, LCD will correctly connect and interpret each data received. Besides, with regards to the fact that data are rarely read from LCD (data mainly are transferred from microcontroller to LCD) one more I/O pin may be saved by simple connecting R/W pin to the Ground. Such saving has its price. Even though message displaying will be normally performed, it will not be possible to read from busy flag since it is not possible to read from display.

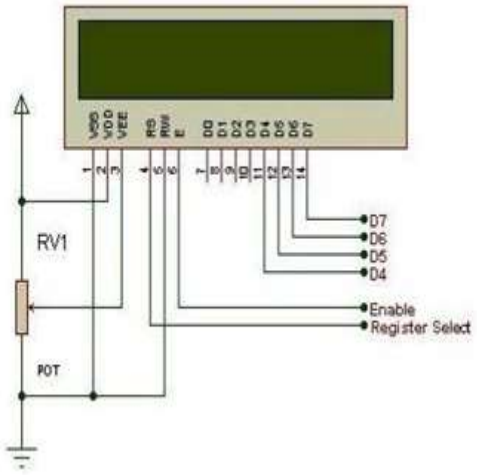
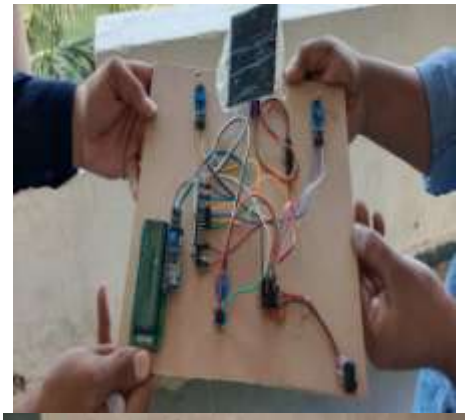
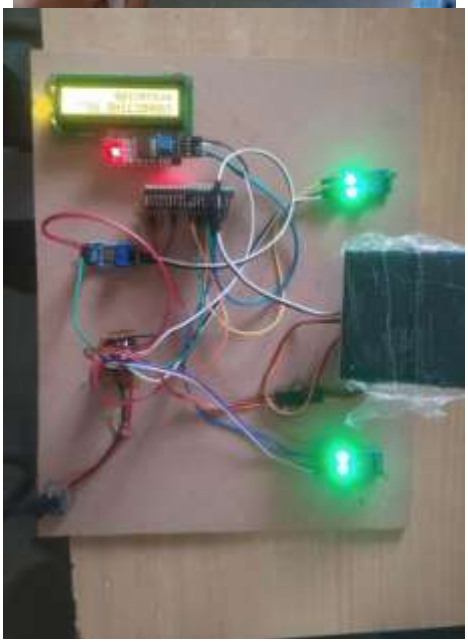


Fig 3.6 LCD display

III. RESULT





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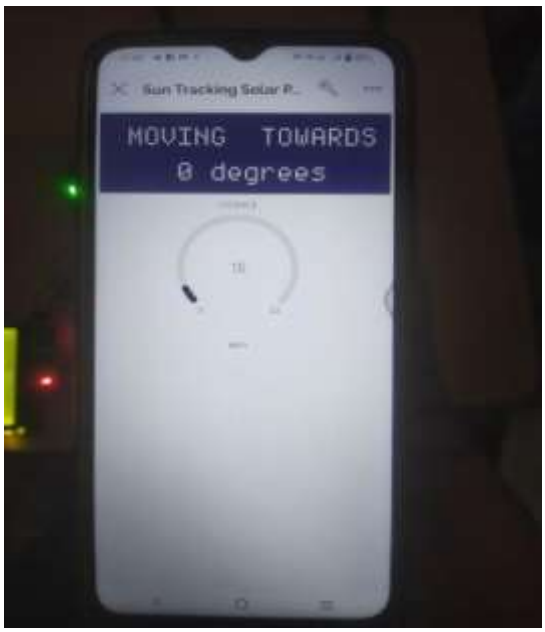

IV. CONCLUSION

Energy consumption per person is increasing exponentially in the twenty-first century as we advance in technology, population, and economic development, yet our energy supplies, such as fossil fuels, are depleting quickly. Hence, in order to meet our energy needs and promote sustainable growth, we must consider alternate strategies (such as the use of renewable energy sources). In this project, Dual Axis Solar Tracker, we've developed a demo model of solar tracker to track the maximum intensity point of light source so that the voltage given at that point by the solar panel is maximum. After a lot of trial and errors we've successfully completed our project and we are proud to invest some effort for our society. Now, like every other experiment, this project has couple of imperfections.

(i) Our panel senses the light in a sensing zone, beyond which it fails to respond.

(ii) If multiple sources of light (i.e. diffused light source) appear on panel, it calculates the vector sum of light sources & moves the panel in that point.

This project was implemented with minimal resources. The circuitry was kept simple, understandable and user friendly.

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