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IMPLEMENTATION OF DAY AND NIGHT SOLAR ENERGY TRACKING SYSTEM

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***Abstract**:* This research presents a novel approach as solar technology continues to progress, costs are coming down and efficiency is increasing, opening up solar energy for a wider range of uses. Putting the following technologies into practice could become a reality. This project aims to design a system that generates current using vehicle headlights. For this system to function and effectively use sunlight, the orientation of the solar panels is optimized during the day. It smoothly switches to using ambient light from passing car headlights at night, turning this underutilized resource into electrical energy. By ingeniously tackling the difficulties associated with generating energy at night, this dual-mode system seeks to contribute to sustainability goals by offering a consistent and dependable supply of renewable energy. The abstract highlights how the system can adjust to different illumination situations and provides a promising avenue for enhancing energy resilience and efficiency.

I. INTRODUCTION

The beginning point of day and night solar tracking device that makes use of the headlights of moving cars represent a fresh take on sustainable energy. generation. One part of a photovoltaic system is a solar panel. They consist of many solar cells stacked one on top of the other to form a panel. People use more current these days to meet their demands. There are numerous ways that renewable energy sources like solar, wind, and water can be used to create current. Solar energy is the most practical of these renewable energy sources for producing current. This technology takes advantage of the combined potential of artificial light sources and sunlight by functioning flawlessly day and night. The mechanism of the solar tracking system described entails orienting solar panels towards sources of light, like nighttime car lights, that maximize energy production. This generated current can be monitored using technology.Utilizing car headlights to illuminate solar panels at night is a novel way to capture solar power, as typical solar energy systems rely on sunlight to produce electricity. A solar panel installed on a tracking system would follow the sun during the day to maximize exposure to sunlight in this day-and-night solar energy tracking system. When it got dark, the system would switch to using a parked car's headlights to produce the required illumination. This novel method may make it possible to generate solar energy continuously, even at night or during times of low sunlight. Utilizing car headlights as a light source may further increase the system's portability and versatility, enabling a larger range of applications. different settings and circumstances. It should be mentioned, though, that this system would probably draw a sizable amount of power from the car's battery, which would have an effect on the car's general operation and range. The system's effectiveness would also be influenced by the vehicle's headlights' brightness and intensity, as well as by the tracking system's and solar panel's design and efficiency.

RESEARCH METHODOLOGY

2.1 HARDWARE REQUIREMENTS

- SOLAR PANEL
- LDR SENSOR
- NODEMCU
- LIQUID CRYSTAL DISPLAY
- ATMEGA328
- DC MOTOR

2.2 HARDWARE DESCRIPTION

2.2.1 SOLAR PANEL

Solar panels employ photovoltaic (PV) cells to turn sunlight into power. The materials used to make these cells are photoexcited electrons that, when exposed to light, flow through a circuit to generate direct current (DC) electricity. An inverter, which changes direct current (DC) electricity into alternating current (AC) electricity, one or more solar panels, and occasionally additional parts like controllers, meters, and trackers make up an array or system of solar panels. Solar panels have various benefits, including the use of a clean, renewable energy source, a reduction in greenhouse gas emissions, and a decrease in electricity costs. They can be used for both off-grid and grid-connected applications. They do, however, have several drawbacks, such as reliance on the quantity and quality of sunshine, needing to be cleaned, and being expensive initially. Since homes are more inclined to install solar panels in neighborhoods where they already exist, social contagion may potentially contribute to the adoption of solar.

2.2.2 LDR SENSOR

A unique kind of resistor known as a Light Dependent Resistor (LDR) operates on the basis of photoconductivity, which implies that the resistance of an LDR varies with light intensity. The photosensitive semiconductor materials used to create LDRs are arranged in a Zig-Zag pattern and include cadmium sulphides (CdS), lead sulphides, lead selenides, indium antimonides, and cadmium selenides. The Zig-Zag form has two metal contacts on either end that aid in connecting it to the LDRs. The photosensitive material is covered with a transparent layer to keep it safe and enable light absorption from the surrounding environment for operation.

The LDR operates on the basis of photoconductivity, which states that as light intensity increases, the LDR's resistance lowers.of light. The photoconductive material absorbs light energy, which causes its valence band electrons to become excited and move into the conduction band. This increases the material's conductivity in proportion to the intensity of the light. In order for the electrons in the valence band to be stimulated and move into the conduction band, the energy in the incident light must be higher than the bandgap gap energy. Around 1012 Ohm is the maximum resistance of LDRs in the dark, and it gets lower as light levels rise

2.2.3 NODE MCU

Based on the ESP8266 Wi-Fi module, the NodeMCU is a multipurpose microcontroller board intended for Internet of Things (IoT) applications. Its main objective is to combine Wi-Fi capabilities into a small and easily portable platform to enable connectivity and control in a variety of electrical applications. Both novice and expert developers will find the NodeMCU relatively simple to work with as it runs on a firmware based on Lua and can be programmed using the Arduino IDE. Functionally, the NodeMCU's integrated WiFi connectivity allows for smooth communication with other devices and the internet. It is equipped with a potent 32-bit microcontroller unit that can run code and issue commands to communicate with other peripherals like actuators and sensors. GPIO (General Purpose Input/Output) pins on the board let users communicate with external

PIN CONFIGURATION

GPIO Pins (General Purpose Input/Output):

GPIO0 to GPIO15: These pins are multipurpose and can be used for digital input/output, PWM (Pulse Width Modulation) output, I2C, SPI, and more. Some pins have specific functionalities or limitations, so it's essential to refer to the board's pinout diagram or documentation for details.

Power Supply Pins:

VIN: This pin is used to supply voltage to the board. It can typically handle a range of voltages, but it's recommended to provide a stable 5V power source.

3.3V and GND: These pins are for supplying power at 3.3 volts and ground respectively. USB-to-Serial Interface:

TX and RX: These pins are used for serial communication with the computer or other serial devices. TX stands for transmit,

and RX stands for

receive. Reset and Flash

Buttons:

RST: This is the reset pin, which, when pulled LOW, resets the microcontroller.

FLASH: Used for putting the board into flashing mode for firmware updates.

Analog Pins:

A0: Some NodeMCU boards have an analog pin labeled as A0, allowing for analog input functionality.

Special Purpose Pins:

D0 (GPIO16): This pin has a special purpose related to deep sleep functionality in the ESP8266.

2.2.4 LIQUID CRYSTAL DISPLAY

A liquid crystal display, often known as an electronic visual display or video display, is a flat panel display that makes advantage of liquid crystals' ability to modulate light. Light is not directly emitted by liquid crystals. A digital clock's seven-segment display, preset words, and numerals are examples of fixed graphics that can be shown or hidden on LCDs. They can also display arbitrary images, like those found on a general-purpose computer display. The only difference between them is that although other displays have larger parts, arbitrary images are composed of many tiny pixels. An LCD is a cheap, tiny display. The dark blob on the rear of the board is an integrated controller, which makes it simple to interact with a microcontroller.

Since this controller (HD 44780) is common to many displays, libraries for numerous micro-controllers, like the Arduino, make displaying messages as simple as writing one line of code.

LCDs are utilized in many different applications, such as signage, instrument panels, computer monitors, televisions, and cockpit displays in airplanes. They have mostly supplanted cathode ray tube (CRT) displays in consumer electronics, including video players, gaming consoles, clocks, watches, calculators, and phones. In addition to having a larger selection of screen sizes than CRT and plasma displays, they don't experience image burn-in because they don't utilise phosphors. Unfortunately, LCDs might suffer from image persistence.

2..5 ATMEGA328

As a member of the AVR family of microcontrollers, Atmel produces the ATmega328 microcontroller. This well-known microcontroller is utilized in many different fields, such as automation, robotics, and embedded systems. An external crystal oscillator may raise the clock speed of the 8-bit ATmega328 microcontroller to 25 MHz. Its maximum clock speed is 20 MHz. For data storage, it has two KB of SRAM, one KB of EEPROM, and thirty-two KB of flash memory. The 23 input/output (I/O) pins of the ATmega328 can be utilized for a number of different things, including analog input, PWM output, digital input/output, and UART communication. A 10-bit ADC, two timers/counters, a serial USART, an SPI interface, and a TWI interface are among the peripheral modules that are included with it.

C programming language or the AVR assembly language are used to program the ATmega328. Programming the ATmega328 is made easier with the help of the widely used Arduino platform, which offers an easy-to-use interface for writing and uploading code to the microcontroller.

Based on the ATmega328 microcontroller, the Arduino Uno board is a popular tool for learning and prototyping. Several power-saving modes, including idle, power-down, and standby modes, are available for the ATmega328, which can help lower power consumption and lengthen battery life. Additionally, it features an integrated voltage regulator that can function with input voltages ranging from 1.8 V to 5.5 V. The ATmega328 is a popular microcontroller with a wide range of applications since it is strong and adaptable

2.2.6 DC MOTOR

An electro-mechanical device that transforms electrical energy into rotational or mechanical motion is a DC motor. It uses the interplay of magnetic fields to create motion in accordance with the electromagnetism principle. A DC motor's stator and rotor are its two primary constituents. The stationary component that produces a magnetic field when an electric current flows through it is called a stator. The rotor is positioned within this magnetic field and mounted on an axle, typically taking the shape of a coil or permanent magnet. An electromagnetic force is produced when the motor is given a direct current (DC), and this force interacts with the magnetic field within the stator. The rotor rotates as a result of this interaction producing a torque. The motor's speed is determined by the strength of the current, whilst the direction of the current dictates the direction of rotation. DC motors are widely used in diverse applications owing to their controllability, simplicity, and capacity to deliver a steady torque at varying speeds. They are used in a variety of industries, including robotics, manufacturing, automotive systems, and home appliances. Because the motor's voltage or current may be readily adjusted to alter its speed and direction, these motors are very adaptable and frequently used in a variety of contexts.

2.3 SOFTWARE REQUIREMENTS

2.3.1 ARDUINO IDE

Programming Arduino microcontrollers is done via the software tool known as the Arduino Integrated Development Environment (IDE). On Arduino boards, it offers an easy-to-use interface for developing, uploading, and testing code. The Arduino IDE is a cross-platform program compatible with Linux, Mac, and Windows. It comes with a text editor for creating code, a compiler to translate the code into machine language, and an Arduino board programmer to upload the code.

The Arduino IDE offers a plethora of libraries and examples to assist users in getting started with Arduino programming, in addition to supporting the C/C++-based Arduino Programming Language. To make writing and debugging easier, the Arduino IDE also has tools like syntax highlighting, code completion, and error checking.code. Overall, the Arduino IDE is a powerful and accessible tool for programming Arduino microcontrollers and building interactive projects

2.3.2 PROTEUS

The main use of the proprietary software tool set Proteus is electrical design automation. It is a Windows program for designing printed circuit boards (PCBs) and simulating schematics. Electronic design experts and technicians primarily utilize the program to generate electronic prints and schematics for PCB production, as well as to facilitate fast prototyping for research and development.

Additionally, it may be found in institutions all around the world where students are taught embedded design, electronics, and PCB layout. It also has tools that let you model your IoT projects digitally. Proteus schematic capture is a robust design environment that includes full support for assembly variations, design re-use, and a comprehensive BOM reporting sub-system.

World-class rapid microcontroller simulation is combined with mixed-mode SPICE simulation in Proteus Virtual System Modelling (VSM). It makes it possible to quickly prototype firmware designs in software as well as hardware. Before ordering a real prototype, you may design, test, and debug your embedded projects using the Proteus electrical circuit simulator. Proteus is a comprehensive simulation program that offers a large variety of library components and measurement tools for electrical simulation.

Furthermore, Proteus views adaptation as a first-class object, which facilitates the quick construction of reliable and flexible applications. It lets programmers define program intent and flexible components, and a control-theoretic runtime may modify knobs to

PROJECT DESCRIPTION

3.1 WORKING OF PROPOSED SYSTEM

The proposed system brings a solution to the disadvantages of existing system. The existing system tracking sun light in the morning only but we designed our project to track the vehicle light to generate current. we track the sun in the morning and also track the vehicle light in the night time.

Two LDR is fixed on the solar panels either side. All that an LDR is is a light-dependent resistor (LDR), whose resistance changes in response to light levels. A voltage signal is produced from the variable resistance. The voltage signal is then sent to the ADC. Simply explained, an analog to digital converter (ADC) transforms an analog input signal into a matching digital signal after receiving two LDR voltage signals.

Microcontroller receives the digital signal that has been transformed. Here the microcontroller is the flash type reprogrammable microcontroller received two digital signals from the ADC and compares that signal. The signal is adjusted based on solar light. The microcontroller turns on the driver circuit to rotate the motor and shows the relevant data on the LCD.

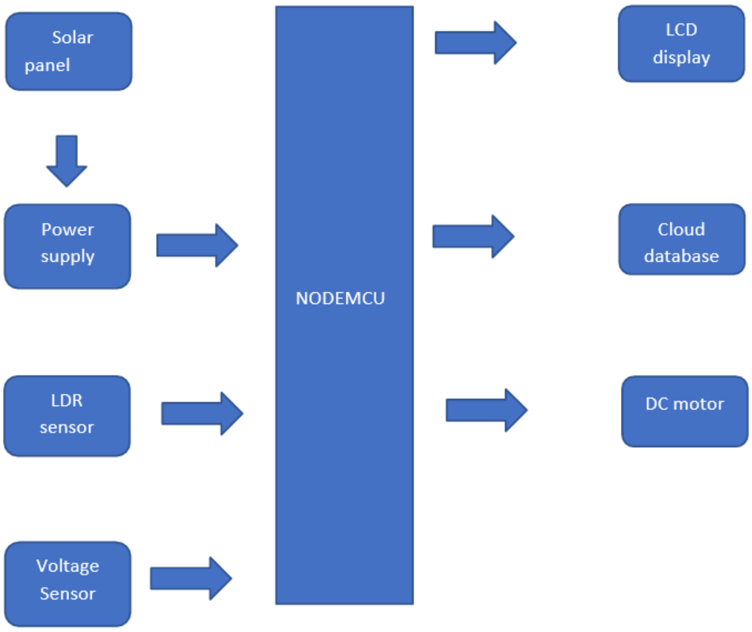

Fig. 3.1 FLOW CHART OF PROPOSED SYSTEM

IV. RESULTS AND DISCUSSION

4.1 Results of Descriptive Statics of Study Variables

The outcomes solar panel will track the sun during the day and vehicle light during the night. The solar panel will turn to the road side automatically during the night by using the LDR sensor. LDR sensor will send the data to the motor driver to turn the solar panel towards the roadside at night. The current generated by the system will be stored in the battery and the voltage sensor will measure the outcome voltage to the battery and send the data to the controller and the voltage that comes from the solar panel to the battery will be shown in the LCD display. The intensity of the LDR sensor will be displayed in the LCD. By using the nodemcu the gathered data from the sensors are stored to the cloud. By using the stored current from the battery we can use this current for streetlights and traffic signals etc.

Fig:4.1

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