Intelligent Solar Lighting System

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ABSTRACT: Nearly every application uses solar energy. Such an application does not exist where it cannot be utilized. The primary focus of the paper is that, in contrast to a standard solar lighting system, this device is application-oriented and offers a number of extra capabilities. Since the lighting system is intended for outdoor lighting, high-glowing, low-power LEDs are employed in it. The module uses a keyboard to de-energize half of the LEDs once the user enters a certain time period, demonstrating how much more care is done to conserve electricity. An improved integration of smart control mechanisms and solar power technologies is what an intelligent solar lighting system embodies, created to maximize functionality and energy economy in outdoor lighting applications. This system uses photovoltaic panels to capture solar energy and produces electricity, which is then stored in batteries for later use. The system, which is equipped with sensors, microcontrollers, and sophisticated algorithms, is able to dynamically modify the timing, distribution, and intensity of light according to several environmental factors, including ambient light levels, motion detection, and weather patterns.

KEYWORDS: LED, SOLAR, LIGHTING SYSTEM, SENSORS, BATTERY.

I.INTRODUCTION: An Intelligent Solar Lighting System represents a pioneering advancement in the real of sustainable and efficient energy solutions. Combining solar technology with smart functionalities, this innovative system harnesses the power of the sun to illuminate outdoor spaces while integrating intelligent features for enhanced performance, energy conservation, and convenience. Night travel has always been troublesome and considered unsafe because of the lingering darkness Like light remains ON even during the day. And by mistake sometimes lights remain OFF even during the nights. Street lights also run using the electricity supplied by the respective electric boards. And so when in the night, the supply

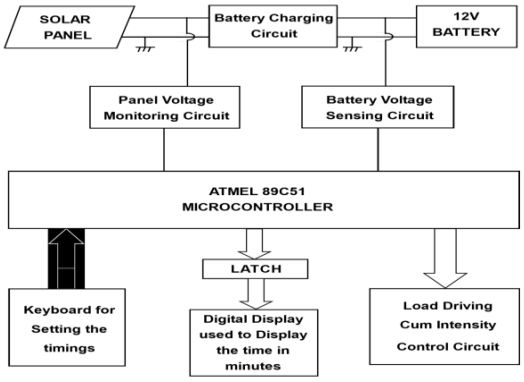
is cut off due to any reason, the surrounding is completely engulfed in darkness as street lights and also the lights from our homes go OFF.

This also leads to confusion and accidents. Several mishaps happen due to the darkness that engulfs our surroundings. An intelligent solar lighting system revolutionizes outdoor illumination by merging solar technology with smart features for optimal efficiency and convenience. Comprising photovoltaic solar panels, rechargeable batteries, and energy-efficient LED lights, these systems harness sunlight during the day to power illumination during the night. Enhanced with motion sensors, dusk-to-dawn sensors, and wireless connectivity, they adapt dynamically to environmental conditions and user needs, ensuring efficient energy usage and maximizing safety. By intelligently managing energy consumption and leveraging renewable solar power, these systems offer significant environmental benefits while providing reliable and cost-effective lighting solutions for various outdoor applications. With their modular design and scalability, they can be easily installed and expanded to cover large areas, making them ideal for pathways, parks, streets, and other outdoor spaces. Intelligent solar lighting systems represent a sustainable and innovative approach to outdoor lighting, blending cutting-edge technology with environmental consciousness to create brighter, safer, and greener communities. LED based street light with auto intensity control using solar power from photovoltaic cells. As awareness for solar energy is increasing more and more individual and institutions are opting for solar energy. Photovoltaic panels are used for charging batteries by converting the sunlight into electricity. Renewable energy is the energy that is derived from any source that can be naturally replenished. When energy is produced using traditional methods, natural resources such as coal and wood are used. While trees can be replanted, it takes time for them to grow, so it may not be enough to keep the world supplied with wood for energy production needs. Types of renewable energy sources include waterpower, solar power, wind power, and biofuels. The world needs renewable energy because most of the energy produced now is produced using fossil fuels that do not have an unlimited supply. Eventually, these fossil fuels will no longer be Available, and we will need to other sources of energy. By using renewable energy, we can offset some of the use of nonrenewable energy sources and keep the supply in existence longer.

Renewable energy is also usually cleaner than some more traditional forms of energy. Solar power is an especially clean form of renewable energy. Along with cleaner energy comes less of an environmental impact and cleaner air for everyone to breathe. When this reaction happens multiple times, energy is created. Solar panels are the devices that convert solar energy into several other forms of energy in order to generate power.

This can be used perform several functions. These resources do not come in an unlimited supply, Continuing to use them at the rate we do means that they are going to renewable energy is the energy that is derived from any source that can be naturally replenished. Run out at some point by using renewable energy, we can offset some of the use of non-renewable energy sources and keep the supply in existence longer. Renewable energy is also usually cleaner than some more traditional forms of energy.

II.PROPOSED SYSTEM: The block diagram of the paper work "Smart Solar Lighting System". For better understanding, the total block diagram is divided into various blocks and each block explanation is provided here. The complete block diagram of this paper work is provided at the end of this chapter. The following is the description of overall function of the block diagram Solar panels can be used to exploit solar energy that, when absorbed, can be an efficient source of energy for electricity and heating. In addition, the power that is produced by solar panels can be used for many other things. Here in our module we are using the solar panel to generate electricity to glow the outdoor lights.



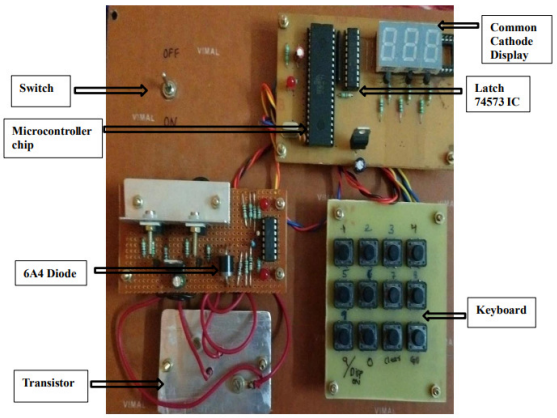
2.1 BLOCK DIAGRAM

The panel used here is a 20W panel. For real applications this can be increased to generate more power depending on the number of lights used. As the project is mentioned as an Intelligent Solar Lighting System, the module continuously monitors the solar panel voltage as well as the battery voltage. For this reason voltage sensing circuits have been designed for the battery as well as the solar panel by using an IC LM 324 which is nothing but an Op-Amp IC. It is called as Quad Operational Amplifier because, it consists of four operational

amplifiers internally, in which we use two op-amps for sensing the voltage of the battery and the solar panel. The output of this sensing circuit is fed to the micro-controller that monitors the voltage and performs the operation defined in it. The output of micro-controller is also used to drive the load. Here load is nothing but the high glowing LED's in the lamp. As the controller cannot provide the required power supply to drive the high glowing LED's that requires higher currents and voltage, a load driving circuit is designed to drive them in which we are using power MOSFET's. Here we are dividing the load into two halves, so we use two powers MOSFET's to drive them. By operating the driving circuit with the help of these MOSFET's we also can control the light intensity i.e., by deactivating the half of the LED's intensity will be reduced and by operating all maximum intensity can be obtained. Thus this is also called as the intensity control circuit.

III.HARDWARE RESULTS:

The basic hardware module of Intelligent Solar Lighting System consists of the following units: Microcontroller chip, Switch, 6A4 Diode, Transistor, Latch 74573 IC, Common Cathode Display, Keyboard, LED.

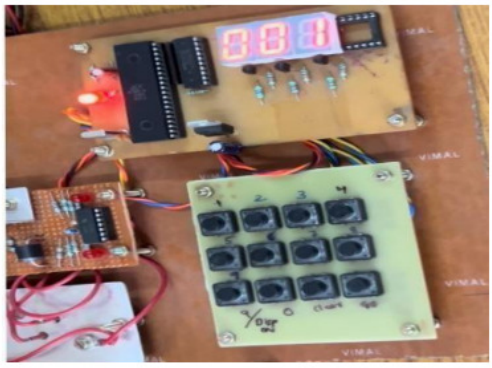


3.1 HARDWARE SETUP

When LEDs are powered by batteries and controlled by a keyboard for setting timers, the process involves a combination of electrical principles and programming logic. Initially, the LEDs are connected to the battery power source through a circuit. This circuit includes components like resistors to regulate the current and protect the LEDs from excessive voltage. The keyboard serves as an input device to control the timing mechanism. When a specific sequence or combination is entered through the keyboard, it triggers the programming embedded within a microcontroller or a control unit. This timer function is designed to keep track of time according to the specified settings entered through the keyboard. The system involves the cooperation of LEDs, batteries, a keyboard interface, and a microcontroller or control circuit. The LEDs are powered by batteries, the keyboard enables user interaction to set

timers, and the microcontroller interprets these commands, controlling the LED illumination by regulating power distribution to achieve the specified outcome, such as having only half of the LEDs glow after the set timer duration.

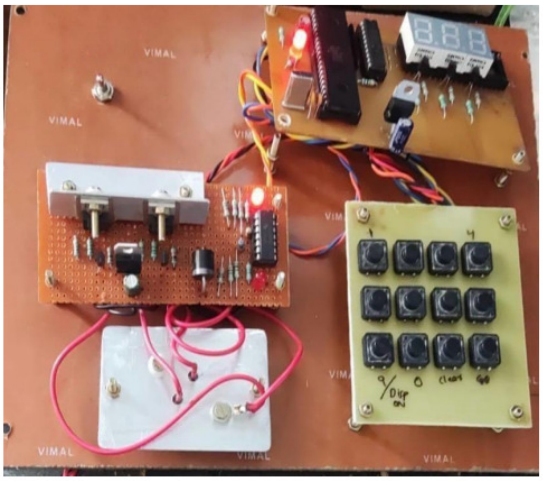
To set a 1-minute timer using the keyboard panel, press the designated timer button. Use the numeric keys to input '0-9' key buttons, here we are setting timer for 1 minute. After pressing the GO button, the display will shut off while the timer continues running internally.



3.2 TIME SETTING

This design choice optimizes user experience by conserving power while maintaining functionality. Despite the display's closure, users can rely on the system's internal mechanisms to track time accurately. Such efficiency enhances the device's usability in various settings, catering to both convenience and practicality. Whether in professional environments requiring precise timing or everyday tasks necessitating efficient management, this feature ensures seamless operation.

Upon pressing the GO button, the display closes, and the internal timer initiates. Subsequently, when the solar input is interrupted, all LEDs activate, emitting light as a response to the solar power cutoff.

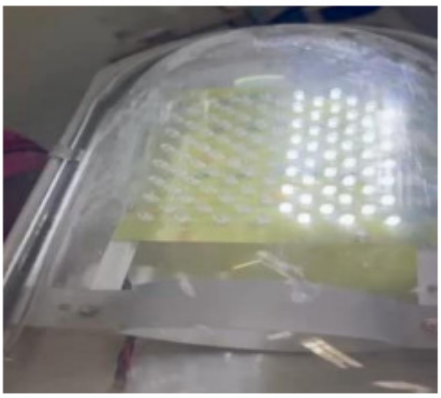


3.3 HALF OF THE TIME

3.4 FIRST HALF OF THE TIME

This sequential process ensures timely execution of tasks and serves as a visual indicator of power status. This swift action

ensures efficient execution of tasks. Subsequently, should there be an interruption in solar input, all LEDs activate, emitting light in direct response to the solar power cutoff.



3.5 SECOND HALF OF THE TIME

This deliberate action ensures a specific visual output, likely designed to conserve energy or provide a distinct indication to users. By programming the system to activate only a portion of the LEDs post-timer, it offers a nuanced response, tailored to the intended functionality or user requirements. This strategic approach highlights the system's adaptability and capacity for customization, enhancing its usability and effectiveness in various contexts.

IV.CONCLUSION: The "Intelligent Solar Lighting System" paper work is successfully planned, tested, and a physical unit is made. This research employs solar energy as a means of battery charging, which is categorized as a non-conventional power generation approach. The sun is the primary energy source. The sun is the main source of energy; electromagnetic waves are the form that the sun emits. The fundamental benefit of employing non-conventional energy resources is that the energy generated by this process is abundant, limitless, non-polluting, and requires no maintenance or operator input. The load's capacity to draw current must be taken into consideration while choosing a battery. Battery voltage is also monitored in this paper work, and a control circuit is devised to prevent the battery from completely draining by cutting off the load when the battery voltage drops below a predetermined level. Similarly, to expedite the process of charging the battery, a solar panel of appropriate power should be utilized.

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