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AI Based Smart High Way with Green Energy Resources Using IoT Devices

Gautami A[1], Muthumariappan M[2], ThangaVignesh C[3], Sunilkumar R[4], Sudharsanan V[5]
[1] *Assistant Professor, Department of ECE, SNS College of Technology, Coimbatore, India*
[2, 3, 4, 5] *B.E. Student, Department of ECE, SNS College of Technology, Coimbatore, India*

Abstract: ***The Worldwide concern to mitigate the soaring energy crisis introduces us to the small-scale renewable energy generation as a preferred enabling source for highway lighting. Production of renewable energy from highways using solar tracking panel can be utilized in various applications. In this project we use solar panels to generate renewable energy which can be stored in lithium batteries. The IOT monitoring system in interfaced with Adafruit software which is used to check the pollution and stores the daily utilization in cloud. The SOS alarm is used along with the device to indicate the accident occurred in remote areas to the nearby toll gate. SOS message will send IFTTT to the domain mail ID toll gate. This prototype uses Node MCU for controlling application and database monitoring. In future the project can be extended by implementing other renewable resources like wind energy.***

Keywords: Sos alarm, Solar tracking panel, Adafruit, Mcu , Renewable enegry.

I. INTRODUCTION

Power plays a crucial role in every one life. Green energy resources provide the ultimate power compared to that of manual powered one. By naturally getting the way of energy stores into batteries and we can use in a required time. In this way of save power doesn't require a uninterruptable power supply. And it is the good one to doesn't affect the environment. While in the countries like United Arab Emirates (UAE), solar energy is more feasible because of its abundant availability as the UAE has roughly 350 sunny days in a year with around 10 hours of daily sunlight in a day. Therefore, solar energy is being widely explored and used in the UAE. The UAE has initiated some mega projects such as the 100 MW Shams 1 CSP plant that was first initiated in 2013 as the largest renewable energy project in the Middle East with an area of 2.5 square kilo meter. Moreover, the 50-billion- dirham project on the world's tallest solar power tower with a height of 262 meters was initiated in Dubai with a 13MW solar PV as the first phase of the eventually 5000 MW Mohammed Bin Rashid Al-Maktoum Solar Park in 2014.

The solar park is targeted to produce 75% of the total output power of Dubai from clean energy and Dubai is to be named as the first city in the world with the lowest carbon footprint by the year 2050. Solar street light systems are very attractive choice because they avoid long cabling required for conventional AC power-based lighting systems. Moreover, light emitting diode (LED) based solar lights are more efficient than the conventional high- pressure sodium (HPS) based lights that are being used in the AC lighting systems. Therefore, this paper proposes an optimal design of standalone solar street lighting system. the importance of transitioning from conventional energy resources to renewable sources is becoming clearer to consumers. Green energy is a solution to greater sustainability in our power grid, but the term is met with confusion by some, and commonly used to refer to renewables by others. The U.S. energy market provides a range of services and products with green energy, also called green house. Without the power consumption we are all not live in a gratification life. It is the mandatory one to save our power consumption of unusage time.

II. DESCRIPTION

To monitoring the activities of the smart highways we use the following sensors

1) Arduino Uno
2) Gas sensor
3) Ir sensor
4) Ldr
5) Node Mcu
6) Solar panel
7) Battery

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A. Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328. It has 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 contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions as shown in fig 4.1

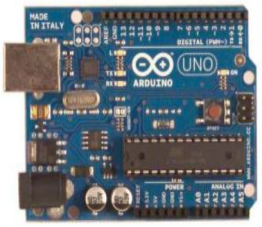


Fig. 1 ARDUINO UNO

B. Gas sensor

The GAS sensor is a chemical optical sensor utilizing the acidic nature of gas for detection. It consists of a gas-permeable membrane in which a pH-sensitive luminescence dye is immobilized together with a buffer and an inert reference luminescent dye. Gas permeating into the membrane changes the internal pH of the buffer. With this changes the luminescence of the pH-sensitive dye. Together with the inert reference dye internal referencing is made for detection of the luminescence lifetime of the sensor. The measurement signal detected by the pCO2 mini correlates to the partial pressure of gas ambient.

Applications

1) Modified atmospheres
2) Indoor air quality
3) Stowaway detection
4) Cellar and gas stores
5) Marine vessels
6) Greenhouses
7) Landfill gas
8) Confined spaces
9) Cryogenics
10) Ventilation management
11) Mining
12) Rebreathers (SCUBA)

For HVAC applications, CO2 sensors can be used to monitor the quality of air and the tailored need for fresh air, respectively. Measuring CO2 levels indirectly determines how many people are in a room, and ventilation can be adjusted accordingly. See demand controlled ventilation (DCV)

In applications where direct temperature measurement is not applicable, NDIR sensors can be used. The sensors absorb ambient infrared radiation (IR) given off by a heated surface.



Fig. 2 GAS SENSOR

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C. Ir sensor

Infrared sensors are the most often used sensor by amateur roboteers. Understanding how they behave can help address many of your requirements and would suffice to address most of the problem statements for various robotics events in India. Be it a typical white/black line follower, a wall follower, obstacle avoidance, micro mouse, an advanced flavor of line follower like red line follower, etc, all of these problem statements can be easily addressed and granular control can be exercised upon your robots performance if you have a good operational understanding of Infra red sensors.

Construciton of Ir module

Infra red sensors are in the form of diodes with 2 terminals as shown in fig 4.3. You can buy a pair of such diode (one transmitter and one receiver) at a very low cost. Here onwards, we will use Tx to refer to a transmitter and Rx to refer to a receiver diode.

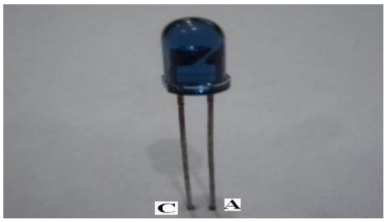


Fig. 3 Ir sensor

Upon careful observation, you will notice that amongst the two 'legs', one has a much wider base within the diode. That is normally the cathode (negative) whereas the leg having a smaller base would be the anode (positive terminal).

When the Tx is forward biased, it begins emitting infra red. Since it's not in visible spectrum, you will not be able to see it through naked eyes but you will be able to view it through an ordinary cell phone camera.

D. Switch

In electrical engineering, a switch is an electrical component that can break an electrical circuit, interrupting the current or diverting it from one conductor to another. The mechanism of a switch may be operated directly by a human operator to control a circuit (for example, a light switch or a keyboard button), may be operated by a moving object such as a door-operated switch, or may be operated by some sensing element for pressure, temperature or flow. A relay is a switch that is operated by electricity. Switches are made to handle a wide range of voltages and currents; very large switches may be used to isolate high-voltage circuits in electrical substations.

Types

1) Rotary
2) Push button
3) Toggle switch
4) Slide
5) DIP



Fig. 4 Switch

Description: The most familiar form of switch is a manually operated electromechanical device with one or more sets of electrical contacts, which are connected to external circuits. Each set of contacts can be in one of two states: either "closed" meaning the contacts are touching and electricity can flow between them, or "open", meaning the contacts are separated and the switch is non-conducting. The mechanism actuating the transition between these two states (open or closed) can be either a "toggle" (flip switch for continuous "on" or "off") or "momentary" (push-for "on" or push-for "off")

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E. LDR

Light dependent resistors or LDRs are often used in circuits where it is necessary to detect the presence or the level of light. They can be described by a variety of names from light dependent resistor, LDR, photo resistor, or even photo cell (photocell) or photoconductor.

Symbol

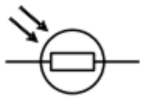


Fig. 5 LDR

Although other devices such as photodiodes or photo-transistor can also be used, LDRs are a particularly convenient electronics component to use. They provide large change in resistance for changes in light level.In view of their low cost, ease of manufacture, and ease of use LDRs have been used in a variety of different applications. At one time LDRs were used in photographic light meters, and even now they are still used in a variety of applications where it is necessary to detect light levels

A photo resistor or light dependent resistor is a component that is sensitive to light. When light falls upon it then the resistance changes. Values of the resistance of the LDR may change over many orders of magnitude the value of the resistance falling as the level of light increases. It is not uncommon for the values of resistance of an LDR or photo resistor to be several mega ohms in darkness and then to fall to a few hundred ohms in bright light. With such a wide variation in resistance, LDRs are easy to use and there are many LDR circuits available.

LDRs are made from semiconductor materials to enable them to have their light sensitive properties. Many materials can be used, but one popular material for these photo resistors is cadmium sulphide (CdS).

F. Node MCU Microcontroller

The NodeMCU (NODEMCU MICROCONTROLLER UNIT as shown in fig 4.9) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Express if Systems, contains the crucial elements of a computer: CPU, RAM, networking (Wi-Fi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

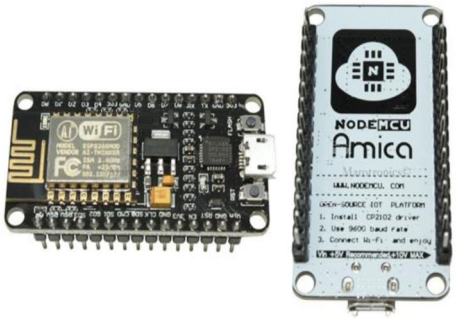


Fig. 5 NODE MCU

However, as a chip, the ESP8266 is also hard to access and use. You must solder wires, with the appropriate analog voltage, to its pins for the simplest tasks such as powering it on or sending a keystroke to the “computer” on the chip. You also have to program it in low-level machine instructions that can be interpreted by the chip hardware. This level of integration is not a problem using the ESP8266 as an embedded controller chip in mass-produced electronics. It is a huge burden for hobbyists, hackers, or students who want to experiment with it in their own IoT projects.

But, what about Arduino? The Arduino project created an open-source hardware design and software SDK for their versatile IoT controller. Similar to NodeMCU, the Arduino hardware is a microcontroller board with a USB connector, LED lights, and standard data pins. It also defines standard interfaces to interact with sensors or other boards. But unlike NodeMCU, the Arduino board can have different types of CPU chips (typically an ARM or Intel x86 chip) with memory chips, and a variety of programming environments. There is an Arduino reference design for the ESP8266 chip as well. However, the flexibility of Arduino also means significant variations across different vendors. For example, most Arduino boards do not have WiFi capabilities, and some even have a serial data port instead of a USB port.

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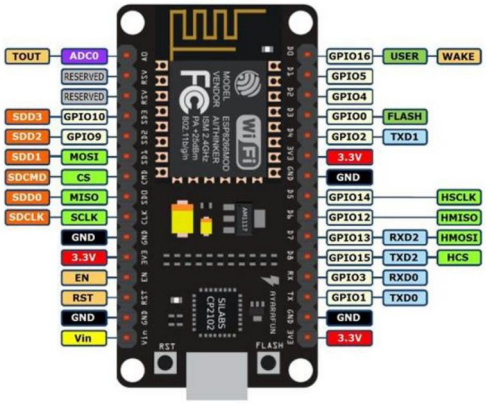


Fig. 5 NODE MCU

G. Solar Panel

Solar panels are classified according to their rated power output in Watts. This rating is the amount of power the solar panel would be expected to produce in 1 peak sun hour. Different geographical locations receive different quantities of average peak sun hours per day. In Australia, the figures range from as low as 3 in Tasmania to over 6 in areas of QLD, NT and WA.

As an example, in areas of the Hunter Valley in NSW, the yearly average is around 5.6. The monthly figures for this area range from below 4.0 in June to above 6.5 in December. This means that an 80W solar panel would ideally produce around 320W per day in June and around 520W per day in December, but based on the average figure of 5.6, it would produce a yearly average of around 450W per day. Without taking losses into account. Solar panels can be wired in series or in parallel to increase voltage or current respectively. The rated terminal voltage of a 12 Volt solar panel is usually around 17.0 Volts, but through the use of a regulator, this voltage is reduced to around 13 to 15 Volts as required for battery charging.Solar panel output is affected by the cell operating temperature. Panels are rated at a nominal temperature of 25 degrees Celcius. The output of a typical solar panel can be expected to vary by 2.5% for every 5 degrees variation in temperature. As the temperature increases, the output decreases. With this in mind, it is worth noting that, if the panels are very cool due to cloud cover, and the sun bursts through the cloud, it is possible to exceed the rated output of the panel. Keep this in mind when sizing your solar regulator.



Fig. 6 Solar Panel

H. Battery

Battery converts chemical energy into electrical energy by a chemical reaction. Usually the chemicals are kept inside the battery. It is used in a circuit to power other components. A battery produces direct current (DC) electricity (electricity that flows in one direction, and does not switch back and forth)



Fig. 7 Battery

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III. EXISTING METHODOLOGY

In the existing System, Non-Renewable energies are used for lighting systems on Highway. We all know that non renewable energy like coal, natural gas are extracted from the earth. Coal is one of the non renewable energy sources because it takes millions of years to form. In India 80 percent of energy gets by non renewable resources only, it can be extinct at one point. In the existing system there is no automatic brightness adjustment of light, it leads to loss of energy. Solar street light systems are very attractive choice because they avoid long cabling required for conventional AC power-based lighting systems. Moreover, light emitting diode (LED) based solar lights are more efficient than the conventional high-pressure sodium vapor (HPS) based lights that are being used in the AC lighting systems.

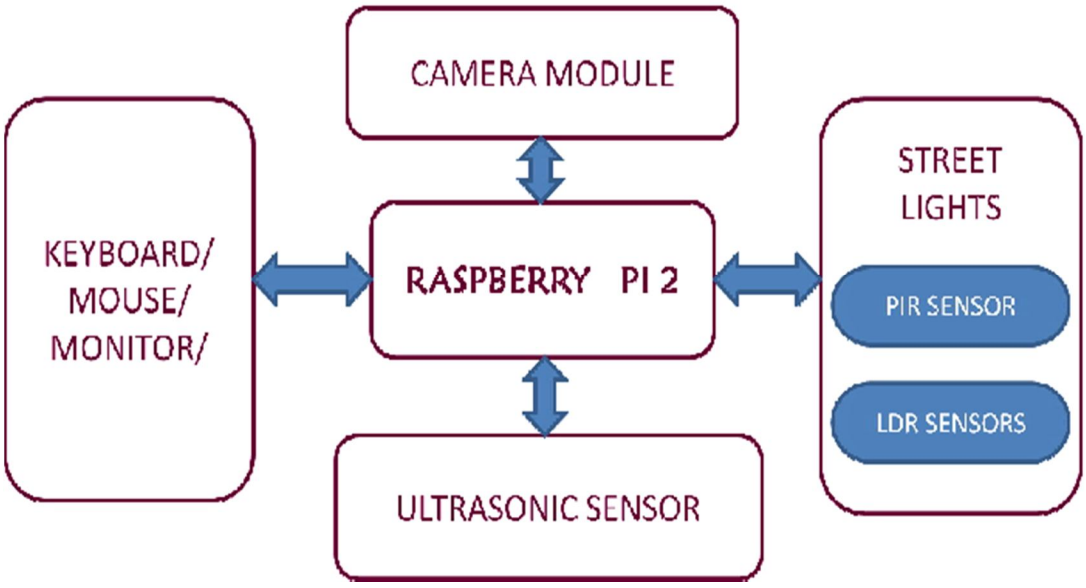


Fig. 8 Block diagram

A. *Disadvantages*

1) Non renewable energy producing costs are high.
2) It's by-products cause damage to the environment

IV. PROPOSED METHODOLOGY

In this proposed system, solar energy is used to make the highway smarter.because renewable energy sources also called non-conventional energy, are sources that are continuously replenished by natural processes. Here the solar panel is interfaced with the battery.photovoltaic cells in solar panels convert photons into electrons and it is stored battery stored charges are utilized for various purposes. artificial intelligence (AI) is the ability of a computer or a robot controlled by a computer to do tasks that are usually done by humans because they require human intelligence and discernment. Artificial intelligence in which coordinates the all actions and the components are directly and indirectly connected to the controller.highway streets lights brightness adjust automatically by based on infra-red sensor at that have no vehicle or human on highway, light will ON at low brightness. Infrared sensor connected to the controller, any vehicle crossing the ir sensor automatically controller enables the solar street light at high brightness. Pollution sensors detect the environmental pollution on the road side by using renewable energy. For solar lighting is achieved by using DC lamps. Through IOT technology, all the details are sent to the website through an artificial Intelligence. Automatic solar tracking is done by using light sensors and AI algorithms. Mems sensor provides angle of solar panel to the intelligence. Nodemcu and Arduino microcontrollers are used. In that nodemcu has inbuilt a Wi-Fi module through it is achieved.

A. *Advantages*

1) It is a simple and effective.
2) It does not cause any pollution to the environment.
3) Control the usage of Nonrenewable energy

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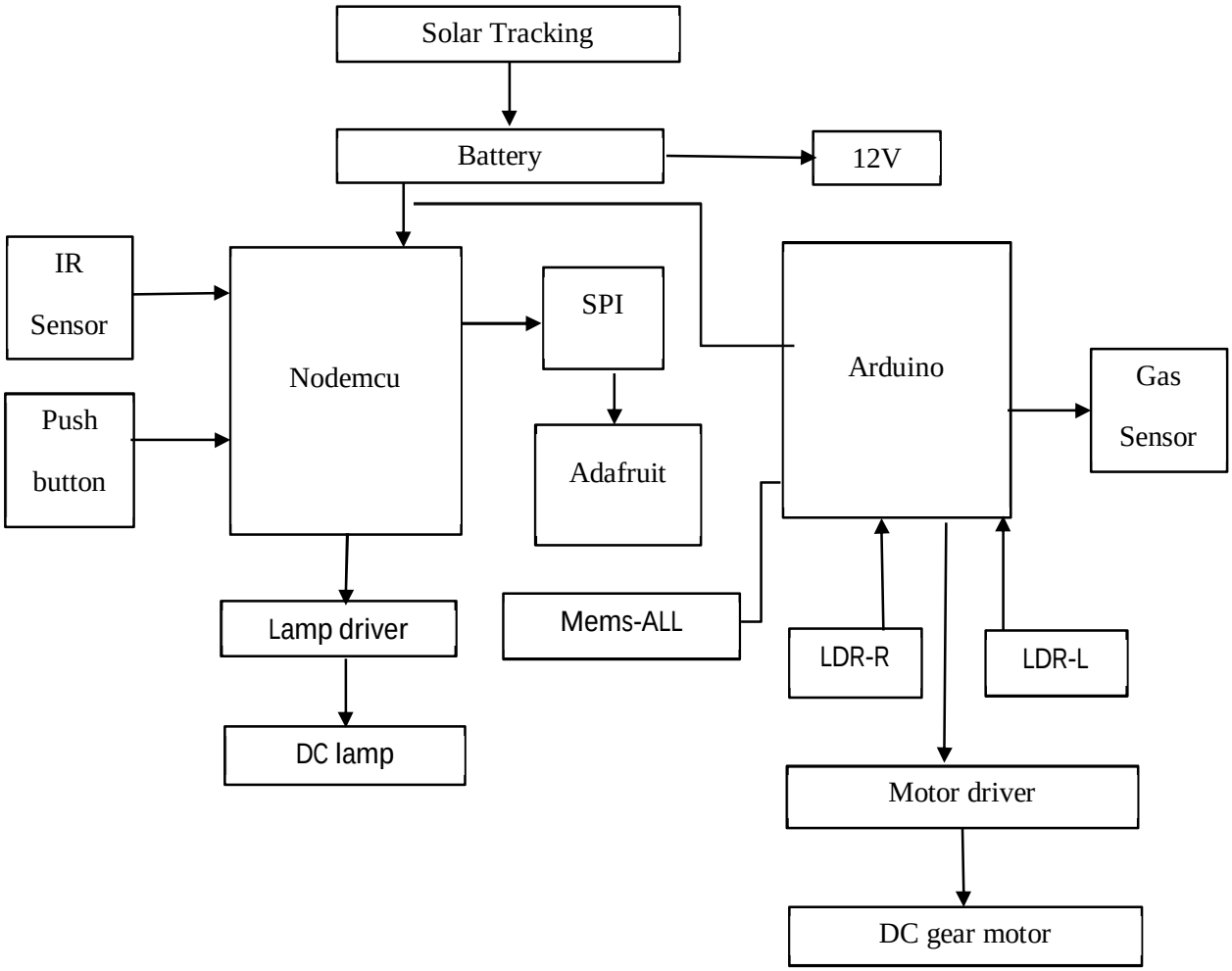


Fig. 9 Block diagram of proposed system

B. Receiver Side



Fig. 9 Receiver side

V. RESULT AND DISCUSSION

Internet of Things (IOT) and artificial intelligence (AI) through which we control the project and get updates rapidly. IOT used for getting pollution updates through pollution sensor and through WiFi. We connected the internet to the Nodemcu microcontroller and Adafruit is an IOT platform in that pollution level continuously updating to this website. DC lamp brightness adjusted automatically through AI algorithm and any emergency on the roadside through ifttt email notification sent to the emergency team. This project can be implemented in all roadside areas by using renewable energy. This will help to reduce fossil fuels usage and it provides a green environment.

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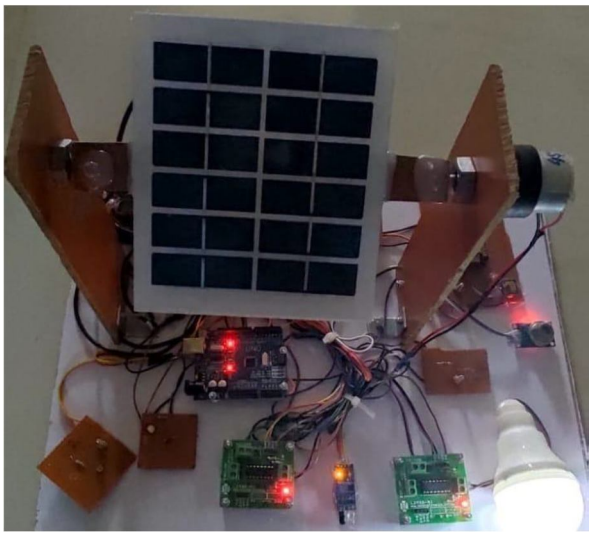


Fig. 10 Experimental setup

VI. CONCLUSION AND FUTURE WORK

A. *Conclusion*

The solar panel is a good and effective solution for power generation. In this project Artificial Intelligence based automatic street light control and moving of solar panel based on sunlight are all the actions controlled by Artificial Intelligence. Solar panels used to convert solar energy into electricity. The energy produced by solar is stored in batteries and used to provide power supply for dc lamps. More benefits can be achieved in terms of fuel saving by operating this advanced scheme. Significant research work needs to exploit the potentialities. Condition of renewable energy sources such as solar systems is satisfactory in India but requires additional attention for better development of renewable energy sources.

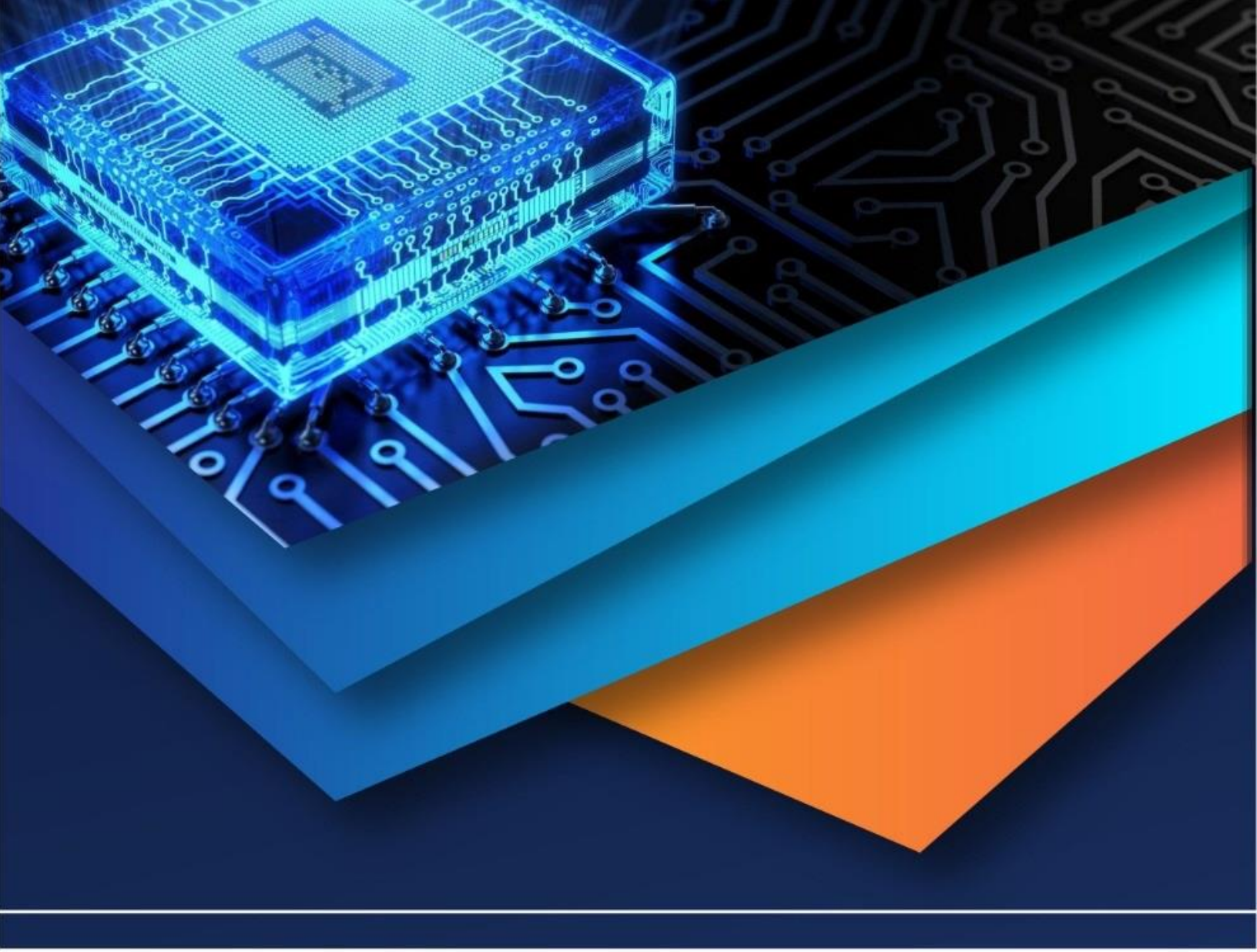
B. *Future Work*

As integrated smart highway is the system based on solar and Artificial intelligence. These two are actual and provisional scenario for renewable energy in India. This integrated smart highway is very essential and useful eco-friendly electrical power generation. This generated power is fully based on renewable energy sources which will replace the current need of fossil fuels which leads to reduce greenhouse gases, CO2, pollution. This generated power used for electrical charging station (ECS) further which will used to change the hybrid electric vehicles.

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