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Solar And Wind Based Smart Street Lighting

¹Mrs. Bokade.J.B, ² Mr.Patil Dhanraj, ³ Mr.Kalme Nagesh,

⁴ Mr.Gaikawad Bajrang, ⁵ Mr.Alange Shivhar,

¹Lecturer, ²Student, ³Student, ⁴Student, ⁵Student ¹Electrical Engineering,

¹Vishweshwarayya Polytechnic, Latur, India

❖ **Abstract:** This project is based on the idea of maintaining maximum utilization and minimum loss of available energy. The plenty of solar energy available during the day time is stored in a solar cell and the stored energy is used to glow the street lights during the whole night. Also the System provides a power saving mode of operation by adapting the method of automation. A dark sensor and a light sensor provides the automatic "ON"/"OFF" facility to the street lights, so that it will glow automatically when it is required(i.e. when the surrounding will be dark) and it will be turned "OFF" automatically if sufficient light is available in the surrounding. Again the auto intensity control mechanism has been applied by the help of a microcontroller to control the light intensity of the luminaries as per the requirement. Hence the loss of energy due to unnecessary glow of the street lights can be avoided.

The main aim of this project is to utilize the application of the Adriano board to control the intensity of street light. As the traffic decreases slowly during late-night hours, the intensity gets reduced progressively till morning to save energy and so, the street lights switch on at the dusk and then switch off at the dawn, automatically. The process repeats every day. White Light Emitting Diodes (LED) replaces conventional HID lamps in street lighting system to include.

❖ **Index Terms – Charge Controller, Tracker System , Solar Plate, Wind Turbine .**

❖ Introduction

➤ Solar Tracker System:-

We need to save or conserve energy because most of the energy sources we depend on, like coal and natural gas can't be replaced. Once we use them up, they're gone forever. Saving power is very important, instead of using the power in unnecessary times it should be switched off. In any city "STREET LIGHT" is one of the major power consuming factors. Most of the time we see street lights are ON even after sunrise thus wasting lot of energy. Over here we are avoiding the problem by having an automatic system which turns ON & OFF the street lights at given time or when the ambient light falls below a specific intensity. Each controller has an LDR which is used to detect the ambient light. If the ambient light is below a specific value the lights are turned ON.

A light dependent sensors is interfaced to the pic 18f452 microcontroller it is used to track the sun light and when the sensors goes dark the led will be made on and when the sensor founds light the led will be made OFF.

It clearly demonstrates the working of transistor in saturation region and cut-off region. The working of relay is also known Microcontroller and the code is written in c language in Micro ide, the resulted value can be seen with the help of UART or LCD display Automatic Street Light Control System is a simple yet powerful concept, which uses transistor as a switch. By using this system manual works are 100% removed. It automatically switches ON lights when the sunlight goes below the visible region of our eyes. This is

done by a sensor called Light Dependent Resistor (LDR) which senses the light actually like our eyes. It automatically switches OFF lights whenever the sunlight comes, visible to our eyes.

Aim of this project is to control the street light using LDR. When the light falling occur means resistance value will be change. There is no light then the resistance value is change. From this resistance change the voltage variation can be obtained this value is given to ADC of PIC, PIC

➤ Wind Turbine System:-

In this discussion, we will explore the characteristics of Darrieus designs and Savonius designs, two prominent types of vertical axis wind turbines (VAWTs).

Darrieus designs are known for their slender, vertical blades that resemble an eggbeater, while Savonius designs feature a cylindrical shape with curved blades that resemble an S- shape.

Additionally, we will delve into the concept of successful drag-based VAWTs, including the use of cup anemometers for measuring wind speeds and the prevalence of Darrieus VAWTs compared to Savonius VAWTs in the current market.

➤ OBJECTIVE:

The objective of a Smart Hybrid Solar + Wind Turbine Project is to combine solar and wind energy systems to create a more reliable, efficient, and sustainable energy generation solution. By integrating both renewable sources, this hybrid system aims to overcome the limitations of individual energy sources, providing continuous power supply even when one source is less efficient (e.g., solar energy during cloudy days or low wind periods). Below are the key objectives of such a project.

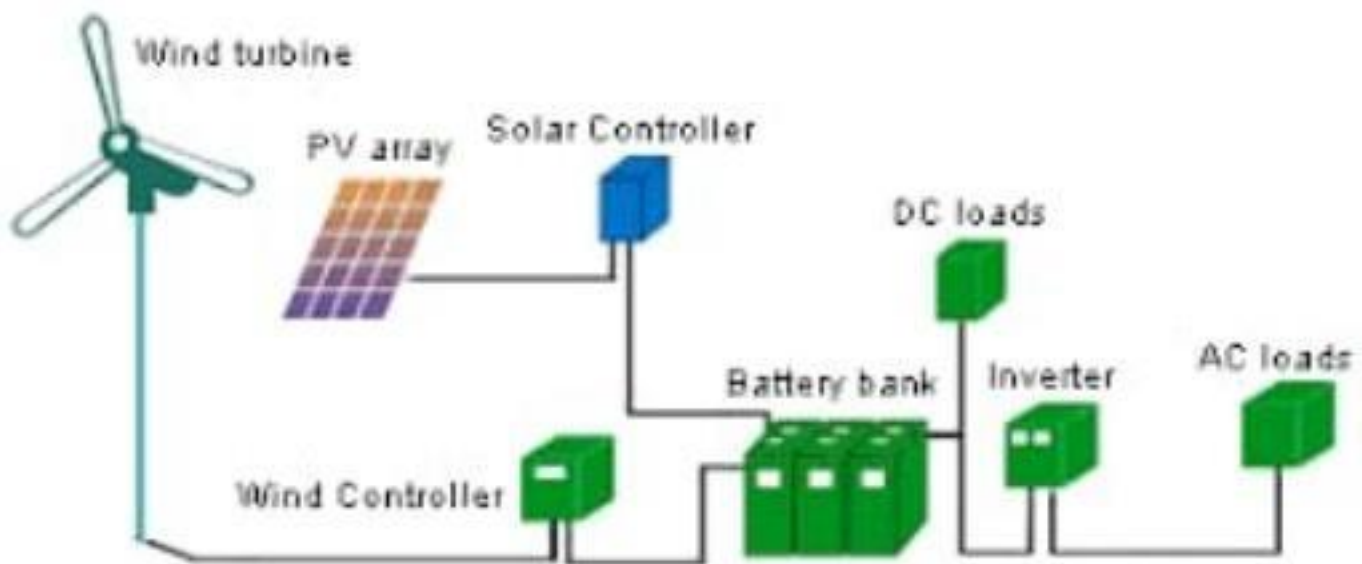


Fig: 1 (Solar And Wind) Smart Hybrid System

1. **Maximize Energy Generation:** Combine solar and wind energy to harness the strengths of both systems. Solar energy is abundant during the day, while wind power can be more consistent at night or in areas with high wind potential, leading to continuous energy production.
2. **Improve Reliability and Stability:** By integrating two renewable energy sources, the system can reduce variability and provide a more stable and reliable energy output. This hybrid system compensates for the fluctuations of solar or wind alone, ensuring a consistent power supply.

3. **Enhance Energy Storage and Distribution:** The project could include smart storage solutions (such as batteries or grid integration) that store excess energy when production is high. This stored energy can then be used during periods when energy production from both sources is low.
4. **Reduce Dependency on Conventional Energy:** This hybrid system aims to reduce reliance on non-renewable, grid-based power sources, contributing to a cleaner and more sustainable energy model.
5. **Increase Efficiency and Cost-Effectiveness:** By using both solar and wind systems together, the overall efficiency can be optimized, potentially lowering the cost per unit of energy generated. This approach can reduce the need for backup generators and lower operational costs over time.
6. **Smart Grid Integration and Management:** Utilize advanced smart technologies for monitoring and managing the hybrid system. The integration of IoT sensors, real-time data analytics, and automated control systems will help optimize performance, improve energy distribution, and allow for predictive maintenance.
7. **Sustainability and Environmental Benefits:** Reduce the carbon footprint by providing a green alternative to fossil fuels. By harnessing the natural resources of both wind and solar, the project contributes to reducing greenhouse gas emissions and supporting sustainable energy development.
8. **Scalability and Flexibility:** Design the system in a way that allows for easy scalability, adapting to varying energy demands or geographic locations. Whether it's a small-scale solution for remote areas or a larger grid-connected system, the hybrid model can be customized to fit different needs.

Overall, the goal is to provide a reliable, cost-efficient, and environmentally sustainable energy solution that leverages the best of both solar and wind power to meet the demands of modern energy needs.

➤ **LITERATURE SURVEY:**

✧ **Solar Energy:-**

- Photovoltaic (PV) systems and Concentrated Solar Power (CSP).
- Evolution of solar panel technology (from early silicon-based to perovskite and organic photovoltaic cell).
- Grid-connected and off-grid solar power systems.
- Environmental and economic impacts of solar energy.

✧ **Wind Energy:**

- History and development of wind turbines.
- Types of wind turbines: Horizontal Axis Wind Turbines (HAWT) and Vertical Axis Wind Turbines (VAWT).
- Offshore and onshore wind farms.
- Wind power capacity and global deployment trends.

➤ RESEARCH METHOD:

1. For Solar: You might focus on efficiency, cost-effectiveness, energy storage, or new materials.

For Wind Turbines: You could explore the efficiency of different turbine designs, environmental impacts, or noise reduction technologies.

● Problem Examples:

How can the efficiency of solar panels be improved using different materials? What is the impact of wind turbine blade design on energy generation efficiency?

2. Literature Review

● Purpose: Study existing research papers, articles, and case studies to understand the current knowledge and gaps in solar and wind turbine technology.

● Key Areas to Explore:

Technological advancements in solar panel materials (e.g., perovskite solar cells). Wind turbine designs and innovations (e.g., horizontal vs. vertical axis turbines). Economic feasibility and market penetration.

3. Hypothesis Development

Based on your literature review, formulate a hypothesis. For example:

- Solar: “The efficiency of solar panels can be increased by using perovskite materials compared to traditional silicon-based cells.”
- Wind: “Vertical-axis wind turbines are more efficient in urban areas than traditional horizontal-axis turbines due to space constraints and wind direction variability.”

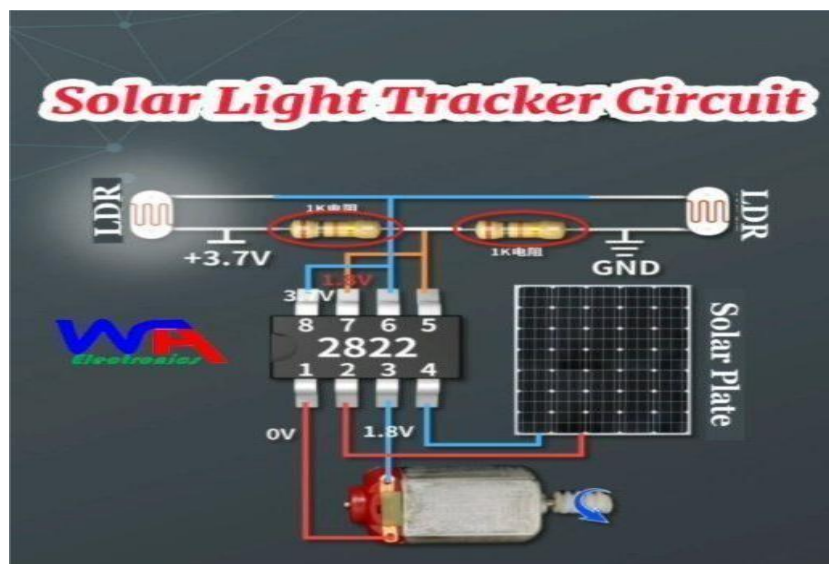


Fig. Working of solar tracking system

It works on the same principle as HSAT, keeping the axis of tube horizontal in north-south line and rotates the solar modules from east to west throughout the day. These trackers are usually suitable in high-latitude locations but do not take as much land space as vertical single-axis trackers (VSATs).

➤ LDR SENSOR:-

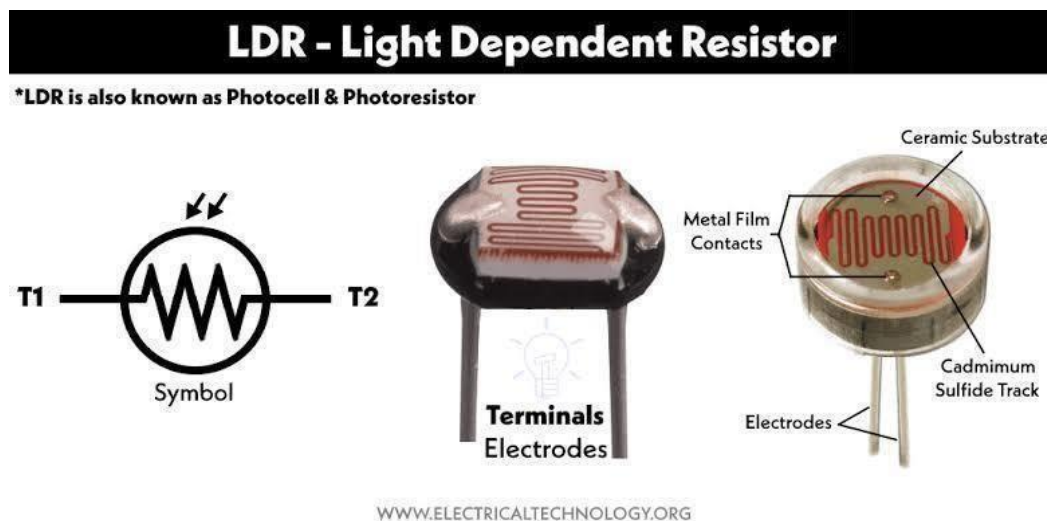


Fig. LDR Sensor

A Light Dependent Resistor (LDR) works on the principle of photo conductivity, where the resistance of the device decreases as light intensity increases, and vice versa. This is because light causes electrons in the semiconductor material to become free, increasing conductivity and reducing resistance.

➤ FLOW CHART:-

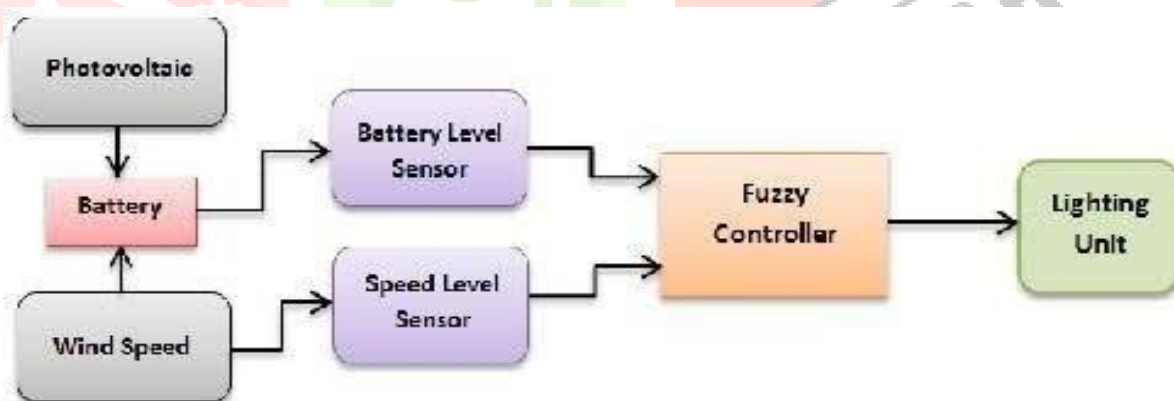


Fig: Flow Chart Sys

➤ WORKING PRINCIPLE SOLAR TRACKER:-

A solar street light with a solar tracker is an advanced and energy-efficient lighting system that harnesses solar power while optimizing energy absorption through an automatic sun-tracking mechanism, ensuring maximum efficiency and prolonged illumination; the system begins its operation during the daytime when a 10W solar panel captures sunlight and converts it into electrical energy using photovoltaic cells, generating DC power, which is then regulated by a solar charge controller that ensures the battery is charged optimally.

while preventing overcharging, deep discharge, and voltage fluctuations; the energy collection process is further enhanced by the solar tracker, which utilizes an LDR (Light Dependent Resistor) sensor to continuously detect sunlight intensity and direction, sending real-time data to the microcontroller, which acts as the central processing unit, analyzing the sensor's input and determining the required movements for the solar panel to align itself with the sun's position throughout the day; once the microcontroller processes the data, it sends control signals to the motor drive controller, which then regulates the motion of the DC motor responsible for adjusting the solar panel's angle, allowing it to tilt or rotate accordingly to achieve the highest possible solar energy absorption; if the system is designed for mobility, caster wheels enable smooth repositioning, ensuring that the panel can effectively follow the sun's path from sunrise to sunset; the diode is used to prevent reverse current flow, ensuring that energy does not discharge back into the solar panel during the night, while resistors regulate and control the current flow, protecting the system from excessive voltage that could damage sensitive components; as sunlight decreases and night approaches, the LDR sensor detects low light levels and signals the microcontroller to activate the LED light, which then illuminates the street using the energy stored in the battery, providing bright and efficient lighting throughout the night without requiring an external power source; to ensure transparency and ease of monitoring, a digital screen is incorporated into the system, displaying real-time parameters such as battery voltage, solar panel angle, sunlight intensity, energy consumption, and LED status, allowing users or maintenance personnel to assess system performance, detect issues early, and ensure the light functions optimally at all times; with all components working in synchronization, this solar- powered street light with a tracking system not only ensures maximum energy utilization but also offers an eco-friendly, cost-effective, and self- sustaining solution for outdoor lighting, reducing dependency on conventional electricity, minimizing carbon footprint, and enhancing overall sustainability for urban and rural environments alike, making it an ideal choice for public streets, highways, parks, and remote areas where grid power may be unavailable or unreliable.

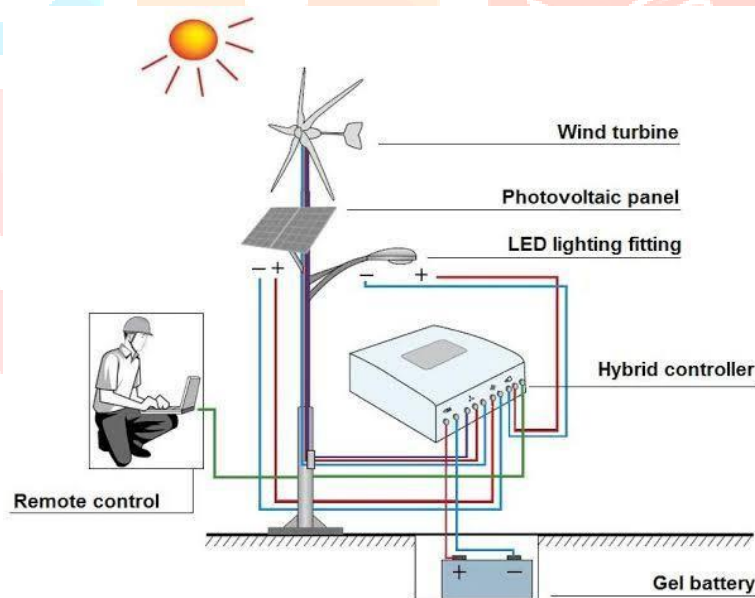


Fig: Working Diagram

➤ WORKING PRINCIPLE WIND TURBINE:-

wind turbine works by converting the kinetic energy from the wind into mechanical energy, which is then turned into electricity.

Here's how it works:

1. **Blades capture wind energy:** When wind blows, it causes the blades of the turbine to spin. The blades are designed to catch the wind's energy and use it to create rotational motion.

2. Rotation of the rotor: The spinning blades turn a rotor, which is connected to a shaft. The rotor typically consists of three blades that are aerodynamically shaped to maximize efficiency.
3. Mechanical energy to electrical energy: The rotor is connected to a generator inside the turbine. As the rotor spins, it turns the shaft, which drives the generator. The generator then converts the mechanical energy into electrical energy.
4. Transmission of electricity: The electricity generated is sent through cables to a transformer, which increases the voltage so that it can travel long distances via the power grid.
5. Control-system: Modern turbines have a control system that adjusts the position of the blades (using yaw motors) to face the wind direction and optimize efficiency. They also shut down if wind speeds become too high, to avoid damage.

➤ **BLOCK DIAGRAM:**

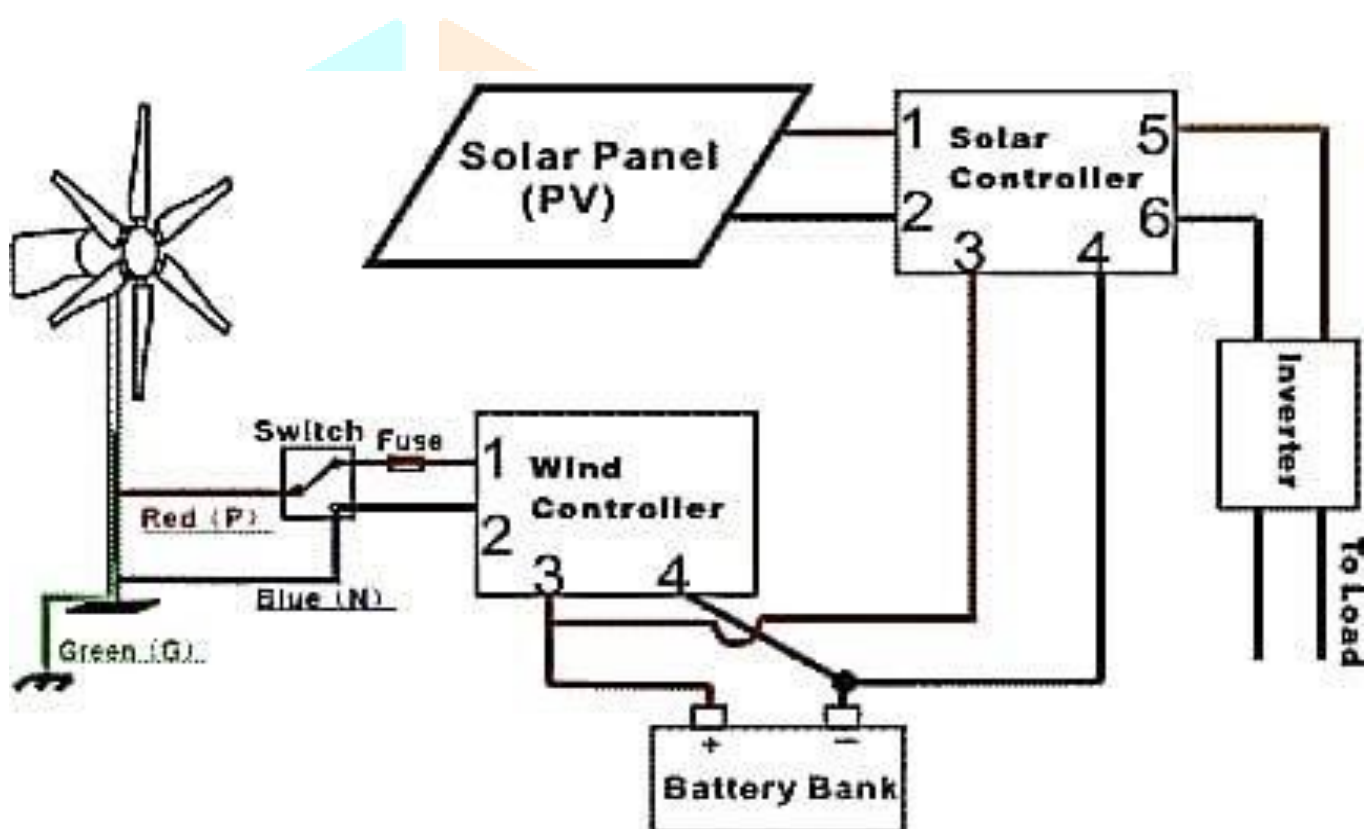
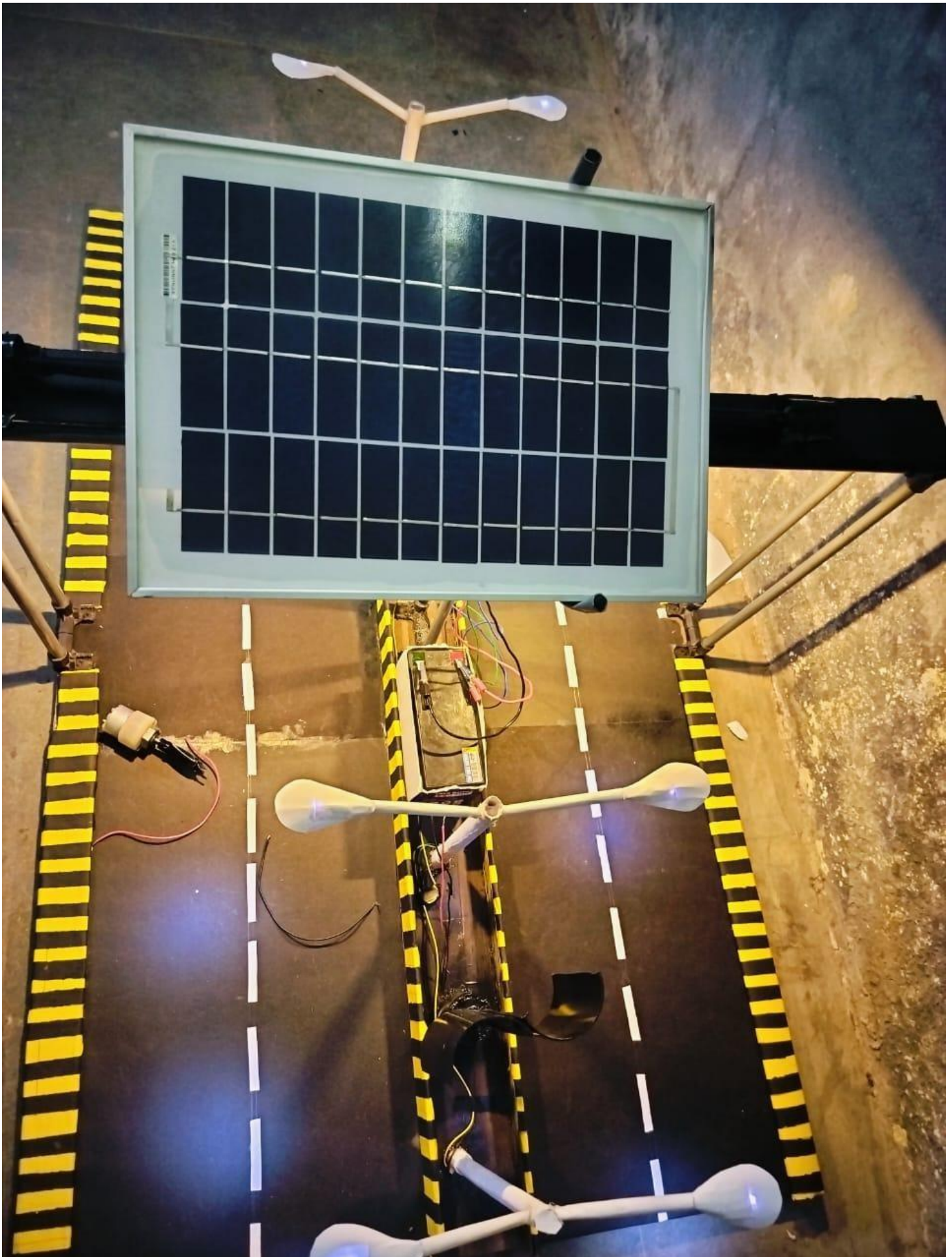


Fig: Block Diagram of Solar And Wind

➤ Hardware implementation:-



CONCLUSION:-

The conclusion of a solar and wind energy project highlights the potential of renewable energy source in addressing climate change reducing carbon emission, and providing sustainable energy solutions. By leaving solar and wind technologies, the project can significantly contribute to diversifying energy source, enhancing energy security, and promoting economic growth through job creation in the clean energy sector.

Additionally, the integration of solar and wind energy system can reduce reliance on fossil fuels, minimize environment impact, and lead to long-term cost saving. However, its essential to consider challenges such as intermittency, storage solutions, and upfront investment costs. Overall, such projects offer promising avenues for a sustainable future while aligning with global for reducing environment footprint and promoting green energy technologies.

➤ REFERENCE: -

https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.cdm.aau.dk/student_handbook/project_report/references/&ved=2ahUKEwjN-omTxJiMAxX6nmMGHZ4mAaQQzsoNegQIJxAT&usg=AOvVaw1hkRzC8WiWYECaPB9qX6_Y

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