46th KSCST SPP Synopsis Report

Project Proposal Reference No. : 46S_BE_0058

Project Title: "POWER GENERATION AT HIGHWAYS USING VERTICAL WINDMILL, EFFICIENT SOLAR SYSTEM AND IOT"

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Introduction:

This project presents power generation at highways using vertical windmill, efficient solar system and internet of things. One of the main problems ever since people realized that natural resources will eventually run out is that a substitute would need to be discovered. Additionally, the usage of fossil fuels significantly contributes to pollution, global warming, and greenhouse gas emissions. Increased use of renewable energy sources like solar, wind, and biomass is necessary in the twenty-first century to solve these issues. Any country's progress depends heavily on energy. We mainly focus on the use of air on highway dividers with the help of a vertical-axis wind turbine. When the vehicle passes on the highway, it produces a considerable amount of air due to its speed. This air strikes the blade of the vertical axis wind turbine tangentially and rotates it in one direction, using air from both sides of the road. This is a feasible and economical solution to generate power. The vertical-axis wind turbine's shaft is attached to a device that produces energy. A battery is used to store the electrical output of the solar system and vertical axis turbine. Additional uses for this energy storage include toll gates, EV charging points and street lights. In our approach, we place solar panels on dividers so that solar panels will generate power from the sun's light during the day and produce some energy even from vehicle headlights during the night. We are using a solar tracking system to improve efficiency. We monitor the energy produced by both energy sources using sensor networks and upload the data into the cloud using Internet of Things. This data will be used for analysis and further improvements. We use ThingSpeak Cloud for data storage. We are also implementing an automatic street light

controller system to make efficient use of the generated power using IR and LDR sensors. If there is any movement on the road, only the street lights will turn on; otherwise, they will remain off.

Objectives:

● Incorporation of more renewable energy to the power system.

● Design of a new method of generation of electricity using the wind energy generated by the moving vehicles on the highways.

● To convert light energy into electrical energy by solar cells.

● Solar tracking/Light tracking system is adopted to increase the efficiency.

● Development of Stand-alone system for providing the power to the

highways.

● To monitor pollution monitor and garbage collection status from various

areas

● To control the street lights using sensor network.

● Centralizing the power generation and usage information to cloud using

IoT technology

Methodology:

Vertical turbines are placed at highways; they will rotate with wind speed so that we can convert vehicle movements into electric energy. We will place solar panels at highways which will use solar energy at day time and convert it into electric energy and also it will produce electrical energy by vehicle headlights during night time. Generated power will be used to power up the street lights at night. Here we have built smart energy conservation system, which will turn on the light in night time only when there is vehicle movement. So that we can save up to 50% energy. LDR is used to detect the day/night time, based on the signal from LDR controller will turn the lights on/off. We will monitor power generation and consumption using sensor network and upload the data to cloud using IoT technology.

Tools used: Arduino Uno, LDR sensor, IR sensor, Solar panel, Battery, DC Motor, Charging circuit, Street lights (LEDs), Wi-Fi module, IR sensor, LCD

Software Requirements: Arduino sketch, Thingspeak.com Cloud, Embedded C, CAD Solidworks

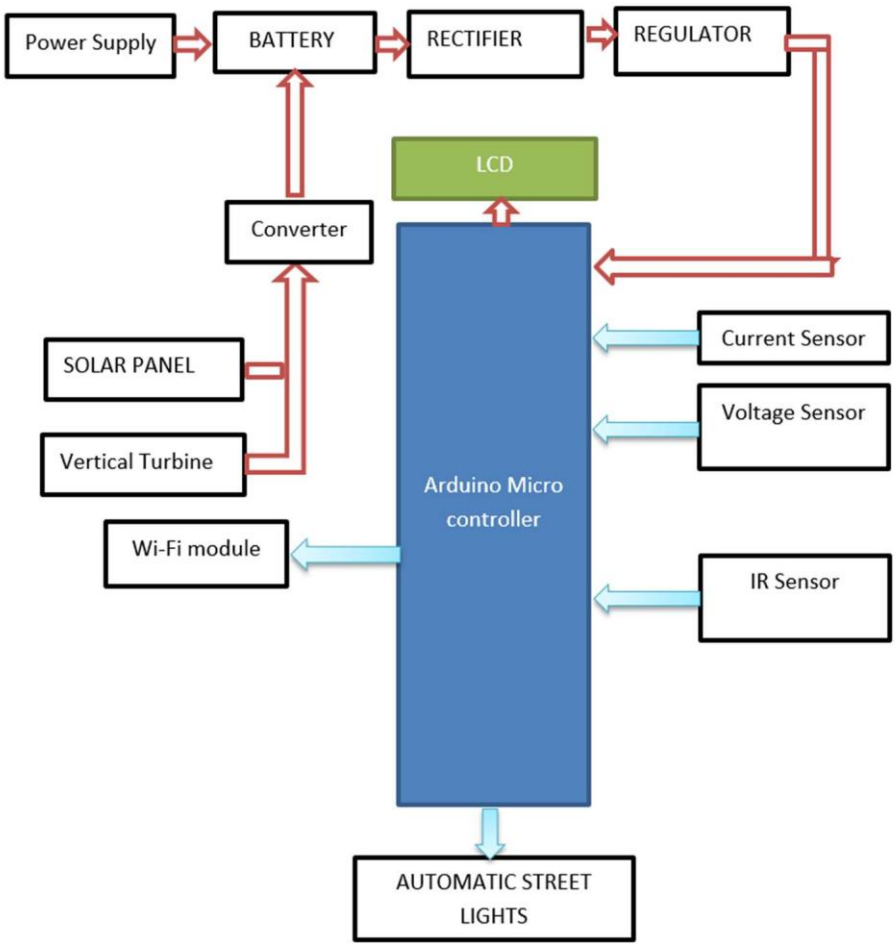

Figure 1: Block Diagram

Results and Conclusion:

This section deals with the results obtained from implementation of the project, and discussing their implications. The project was designed and implemented and the mentioned objectives were met and the wind and solar powers can be taken on daily basis for further analysis. The 2-D plot of voltage, current, power of wind and the voltage, current, power of solar and the total power can be viewed in ThingSpeak by creating respective fields in a channel. The voltage and the current from the respective sources gets multiplied to get a power and the total power is obtained by summing those two. It is obtained that around 25 watts to 30 watts of total power can be obtained from this single model depending on the wind speed. Although these vertical wind turbines do not generate as much energy as that of horizontal wind turbines, they are ideal for small-scale electricity generation. The higher power level that can be extracted from the airflow is defined by power output. There will be no complete energy extraction from the wind due to mass and momentum conservation.

Renewable energy sources are increasingly being used to provide clean energy and reduce costs. VAWT's design allows for low-cost operation and testing to meet

environmental pollution challenges. Hybrid models of vertical turbines and solar panels provide a source of green power on highways.

Figure 2: Voltage, current and power readings uploaded to ThingSpeak

Group of turbines on highways can generate large amounts of energy, which can be used to power street lights, tolls, EV charging points, and rural areas nearby. Solar panels convert solar energy into electric energy, and smart energy conservation system turns on lights only when vehicle movement is detected. Sensor network and IOT technology will monitor power generation and consumption.

Scope for future work:

This project can be further extended to allow power generation from sound energy and there is possibility of tapping the energy from the road or even the speed breakers. We can also provide priority for ambulance by blocking the other lane by a red signal for some time. Also, to reduce the cost of making this setup, we can optimize the design and materials even further to increase the efficiency.