Nano Tree: A Renewable Energy Resource

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Abstract - With the growing population these days, it is important to adapt to renewable energy resource. The use of traditional sources of energy tends to increase the pollution in the environment, which is also one of the major reasons to avoid them. So, the main alternative is to make use of solar energy, for which solar trees would be the best option. The solar panels in the tree are arranged according to the principle "SPIRALING PHYLLOTAXY" which increases the efficiency. This is said to be much more efficient than the traditional Solar PV systems which are being used these days. And by harvesting this energy from the tree we can apply it for various applications.

I. INTRODUCTION

A significant debate regarding the phenomenon of global warming is going on these days. And also, mankind is searching for a way to dodge the consequences of it. Various steps have been taken to reduce the use of traditional fuels for energy and substitute the same with sustainable and renewable sources such as wind energy, solar energy, etc. Even though there is an abundance of solar energy, till date electricity is being harvested from nuclear power plants, natural gas, and coal. So, this project demonstrates and concentrates on how an artificial tree will harvest solar energy and use it for various demonstrates and concentrates on how an artificial tree will harvest solar energy and use it for various public applications. For constructing this artificial tree, the first step is to model a nano leaf. This nano leaf is said to have 2 transparent layers, one on top and the other at the bottom. Between these 2 layers, a thin solar panel layer is placed which helps in converting the sunlight to electrical energy. In this project, we mainly concentrate on using the harvested power for 3 applications which are, streetlights, traffic lights, and a small conventional charging station for mobile phones. In all the applications the controlling operation is carried out by the microcontroller with help of readings from the IR sensors.

II. METHODOLOGY

This project harvests solar energy from the PV tree built and uses it for powering applications such as streetlights, traffic lights, and public mobile charging station. The first step is to identify a perfect location to this tree can be implemented. This could be a public park, city street, or a parking lot, etc. Once the location is confirmed, the next step is to conduct an assessment in the area to check for amount of sunlight the location receives throughout the day and year. This intel can be helpful in determining the number of solar panels and batteries needed to power the project. After the assessment, next step is to design the system. This design will be according to the local regulations and standards. The next step is to procure high-quality materials that are durable and can withstand every climatic conditions. After gathering the installation is carried out. The solar panels are mounted on a tree like structure and are arranged on a principle called "Spiraling Phyllotaxy" so that it receives maximum sunlight. Once the system has been installed, the next step is to test and commission it. The testing will involve checking the performance of solar panels, batteries, charge controllers as well as lighting fixtures, traffic signals, and charging stations. Any issues that arise during testing will need to be addressed by the respective authority. After testing and commissioning, the final step is to maintain and monitor the system, which involves regular inspection and maintenance.

Overall, this model is said to reduce the carbon footprint of the community, saves energy costs, and provides a more efficient and reliable solution than traditional grid-connected solar harvesting systems.

III. COMPARISON OF FIXED PANEL HARVESTING AND SOLAR TREE

Sr No.	Important Parameters	Fixed Panel Harvesting	Solar Tree Harvesting
1	Design	Simple design with no or very few improvements	Very versatile design with frequent improvements
2	Area consumed for installation	It uses a large piece of land	Requires less space
3	Amount of irradiance absorbed per m^2	Less irradiance is absorbed	More irradiance is absorbed
4	Orientation of panel	If angle is above 20^o, they are efficient	If angle is between 40^o-80^o, they are efficient
5	Effect of shadowing	Less effect of shadowing	Some shadowing effect is present.
6	Cost of implementation	Less expensive because of simple design	Costs more because of complex design

IV. DESIGN AND PROGRAM FLOW

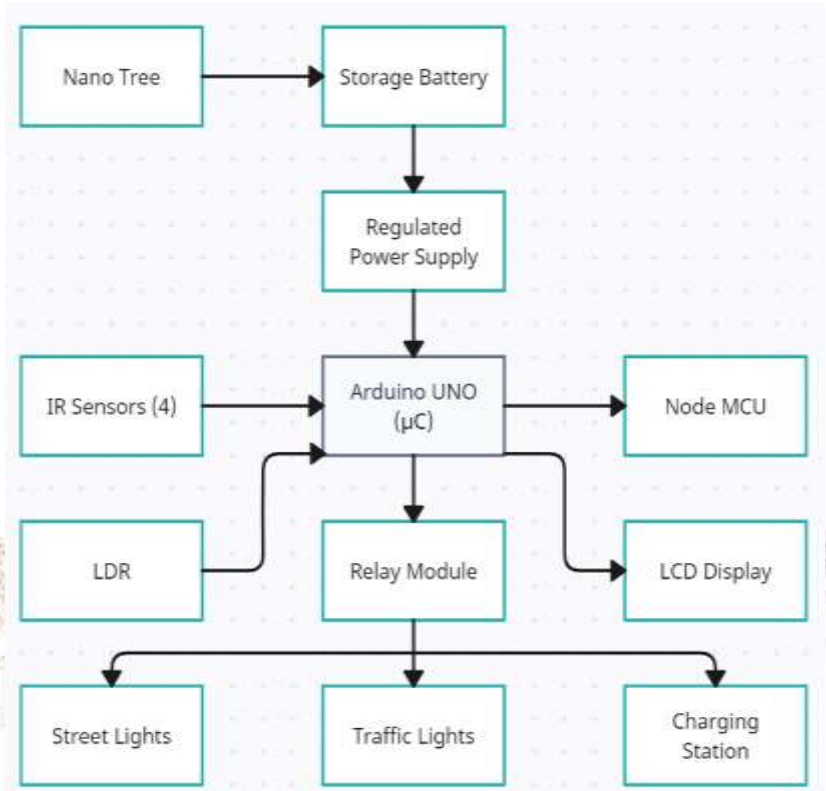

Fig. 1: Block Diagram of the Design

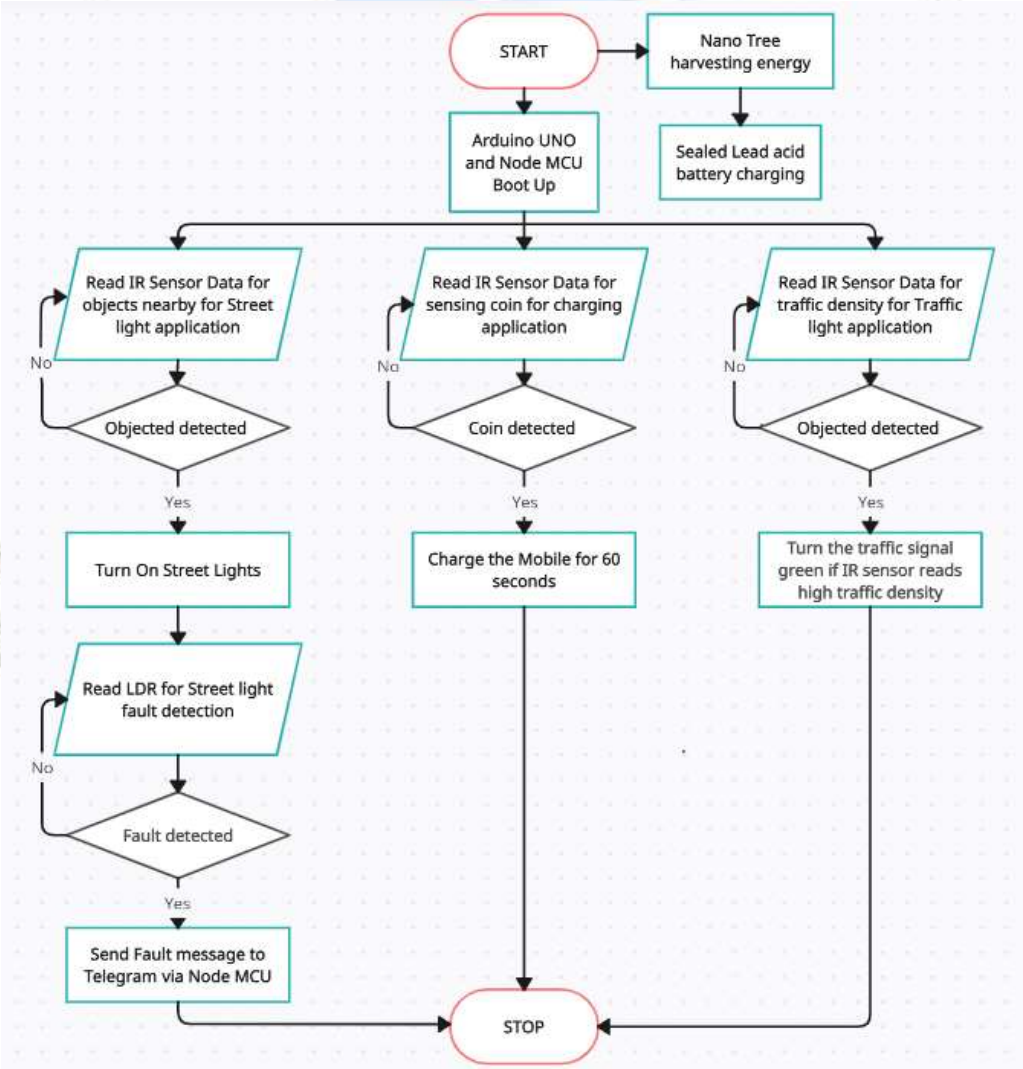

Fig. 2: Program Flow

Figure 1 and Figure 2 show the block diagram and program flow of this model. The role of every component in the block diagram is given below.

- **Nano Tree:** This "Nano Tree" is nothing but a solar tree in which PV (photovoltaic) panels are mounted on to it as the leaves or branch terminals as a typical tree. This PV cells are ones that help in converting the solar energy into electric energy.
- **Storage Battery:** The storage battery is used to store the energy that is being harvested from the solar tree and in the end, this stored energy is used for various public applications.
- **Regulated Power Supply:** This block provides an even flow of voltage and potential throughout the whole model. This regulation of parameters occurs for the ones from the battery to other blocks such as sensors, Arduino UNO (microcontroller), Node MCU, etc.
- **Arduino UNO:** In this project the Arduino UNO plays a vital role. This is a microcontroller which is used to control various operation in this block. It performs various input and output operations.
- **IR Sensors:** In this project IR sensor is used in every application. This acts an object sensing element in the street light, traffic light as well as mobile charging application.
- **LDR:** LDR is used in this project to detect any faults that occur in the street light application.
- **Node MCU:** This block is used for communication with an individual whenever a fault in the street light application is detected by the microcontroller via LDR.
- **LCD Display:** This displays the states of this project and it is also used to show if any fault occurs in the street light as well as shows the timer when the mobile charging starts.
- **Relay Module:** This module controls the switching on or off operation in this project and this relay module is being controlled by the control signal from the microcontroller.
- **Street Lights, Traffic Lights and Charging Stations:** These three terminal blocks are the end applications that use the harvested solar energy.

V. CONCLUSION

This model is an innovative and eco-friendly approach for harvesting solar energy. It is designed to mimic the shape of a real tree, with solar panels arranged in a way that maximizes their exposure to sunlight. Compared to traditional methods of harvesting energy on rooftops, solar trees are said to be much more efficient. Their ability to blend in with the environment also makes them an attractive option. Several studies have concluded about harvesting shows that solar trees can generate 20% more energy than the traditional way. Therefor the implementation of solar trees can be an efficient solution to meet the increasing demand for renewable energy and mitigate the effects of climate change.

VI. REFERENCES

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