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IoT Based Solar Agricultural Robot for Grass Cutting

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ABSTRACT: The advanced technology driven machines are leading the engineering of coming up new tools. The IoT-enabled solar-powered grass cutter harnesses radiant energy from the sun as its primary power source and further, the machine integrates IoT (Internet of Things) technology to enable it to process the trimming of grass with improved efficiency and minimal human intervention. This type of technology driven grass cutter is especially valuable for maintaining vital areas like hotels, stadiums, parks, and public spaces. Herein, a new IoT based solar energy powered grass cutter design is reported. The key components that drive the functionality of this advanced grass cutter include the NodeMCU, a WIFI module, motor drivers, a solar panel with a charge controller, a battery, and an ultrasonic sensor for obstacle detection. The final designed grass cutter components work seamlessly to automate grass cutting operations in outdoor spaces towards ensured effective and obstacle-free processing of the task.

KEYWORDS: Internet of Things, Agriculture, Grass cutter, Blynk app, Ultrasonic sensor.

I. INTRODUCTION

Internet of Things (IoT) is the network of interconnected devices, mechanical and digital machines, vehicles, home appliances and other objects embedded with sensors, software, switches and connectivity which enable these things to connect to a network and collect and exchange data. The system creates the scope of connecting the non-internet enabled physical devices and machines to be connected over the internet and remotely monitored and controlled. A thing in the Internet of Things can also be a person with a heart monitoring implant or an automobile with obstacle sensor or home appliances connected to an application platform. This is also applicable to industrial machines like drill of an oil rig or a jet engine of an airplane. These things are assigned to an IP address and are able to transfer data over internet.

Agriculture plays an important role in all part of the India. Due to sudden change in climate and lower rainfall in all over India, the scope of agriculture becomes down. Without wasting the water, cultivation should yield maximum. In traditional method, the land gets irrigated with excess amount of water than the crop needs. The wastage of excess water can be overcome by modern irrigation system such as drip irrigation, sprinkle irrigation etc. The design and implementation of a clever irrigation gadget are broadly settled in different situations and most reliable price performance on the electric gadget.

1.1 PROBLEM STATEMENT

- Manually operating conditions.
- The system is operated only at the farming land.
- The accuracy of the system is low.

1.2 OBJECTIVE

- To measure and report the air and temperature in a given environment by using a humidity sensor.
- To measure the amount of water in the soil at the root zone using soil moisture sensors.
- To monitor and control the robot's movement with the help of an Ultrasonic Sensor

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1.3 SCOPE

Video cameras can be used to acquire pictures of the object being spotted. By fixing a metal detector to the robot, it can be send to battlefields, forests, coal mines, etc...to find out the metal objects.

Temperature sensors are incorporated into the machine to get the extreme temperature of dangerous zones where human beings cannot go. As a result of attaching a smoke sensor to the machine, it can get the information related concentration of smoke or gases in the respective fields.

The Size of the machine can be compact. The efficiency of the machine can be modified by increases the capacity of the battery. We can also place a bin to collect the grass and we can also configure the ultrasonic sensors depending on the distance.

II. COMPONENTS

COMPONENTS AND SPECIFICATIONS:

- DHT11 SENSOR
- ARDUINO UNO
- ESP8266
- RELAY
- 12V and 9V BATTERY
- ULTRASONIC SENSOR
- SOIL MOISTURE SENSOR
- MOTOR DRIVER
- SERVOMOTOR
- MOTOR PUMP

BLOCK DIAGRAM

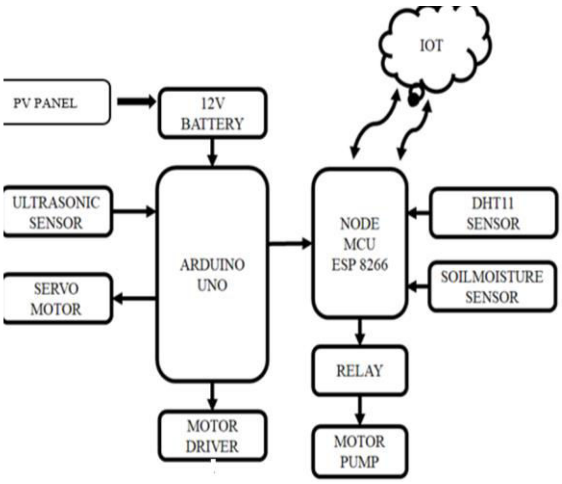

Fig -1: Block Diagram

WORKING

The IoT solar energy-based multipurpose agricultural robot for smart farming monitoring system integrates various components to enhance agricultural practices. It begins with the deployment of humidity, temperature, and soil moisture sensors across the agricultural field. These sensors collect real-time data on crucial environmental parameters. The Arduino UNO microcontroller serves as the system's brain, receiving sensor data and executing programmed algorithms. Based on this data, the microcontroller controls the relay to activate or deactivate agricultural equipment such as irrigation systems or ventilation fans as necessary. Integration with the Blynk app allows farmers to remotely monitor sensor readings and control the system via a user-friendly interface on their smartphones. Solar panels harvest renewable energy to power the system,

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ensuring autonomy and sustainability. Together, these components enable efficient monitoring and management of agricultural operations, optimizing crop yields and resource utilization while promoting sustainability in farming practices.

CIRCUIT DIAGRAM

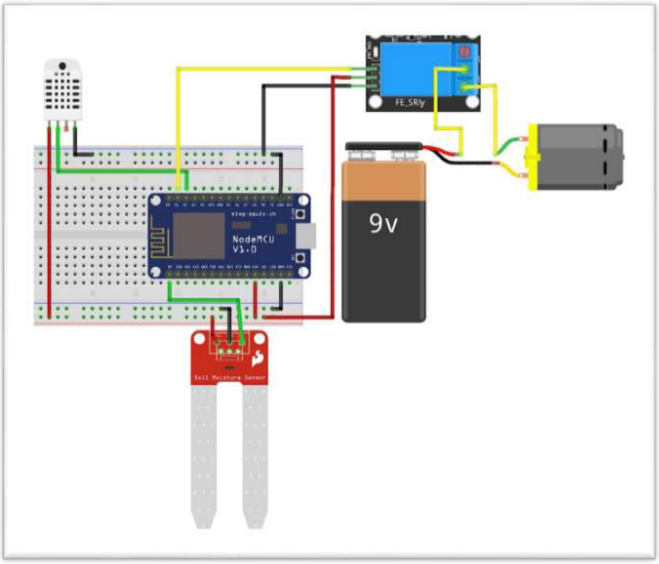

Fig -2: Circuit Diagram of Soil Moisture Sensor

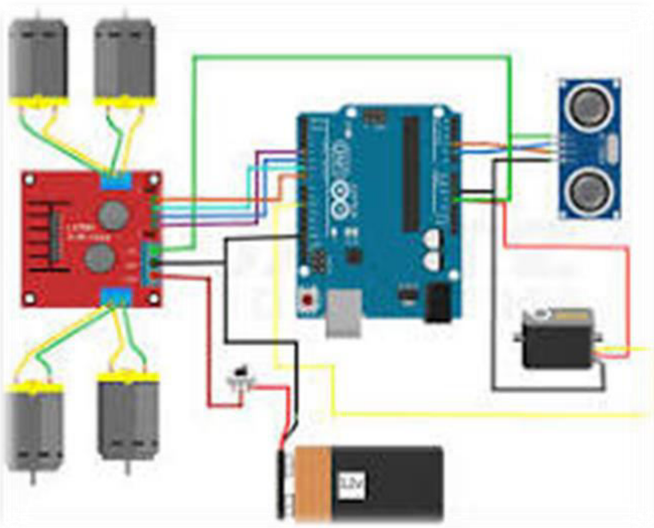

Fig -3: Circuit Diagram of Motor Driver

III. RESULT AND DISCUSSIONS

Initially, the program is written in the embedded C in Arduino software. After completion of the code save and run the program. If any errors are found the code should be modified. Then again execute the program and verify it. If errors were not found, next compile the program and dump the code into the Arduino board. Then notice a popup window called debugging done. After that check the results in the serial monitor

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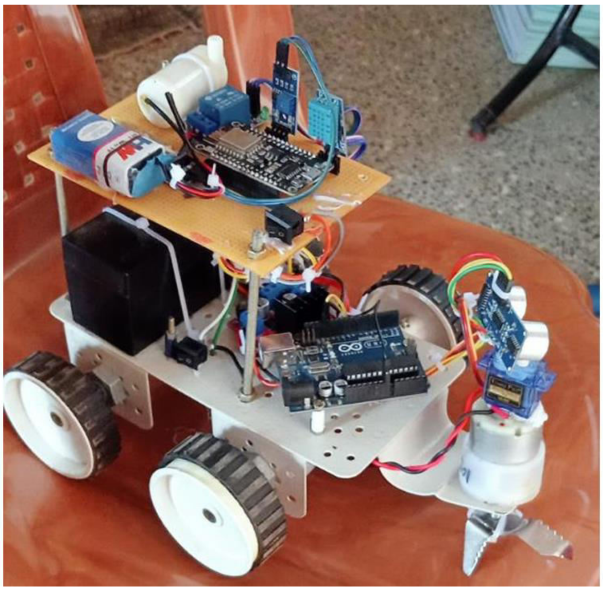

Fig -3: Hardware Kit

Here the design has a solar panel, DC motors, battery, and microcontroller. The components are incorporated into a microcontroller. The ultrasonic sensor transmits the signal to detect the objects. If any echo signal is received that information goes to the microcontroller that controls the movement of the DC motors. In the case of no object detected by the sensors the grass cutter move until it finds the object in front that shows by glowing LED light. When it finds the object changes the path based on the preferences. The cutter motor is connected to the battery and the microcontroller and it works uninterruptedly to cut the grass consistently. Meanwhile, the battery gets charges using the solar panel.

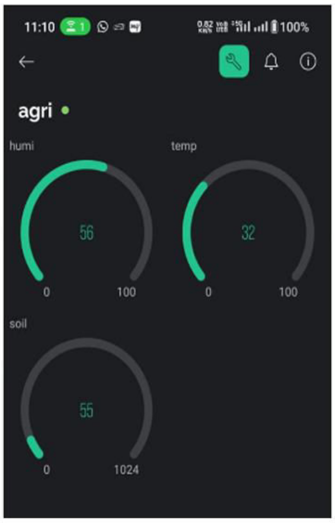

Fig -3: OUTPUT from IOT Platform Through Blynk App

IV. CONCLUSION

In conclusion, the IoT-based solar-powered grass cutter effectively addresses the environmental challenges posed by traditional grass cutters. By harnessing renewable energy, employing smart technology for automation and remote control, and ensuring minimal emissions and noise, these innovative machines represent a dominant and sustainable choice for maintaining green spaces across a variety of settings. Through their efficient, eco-friendly, and forward-looking design, IoT-based grass cutters are poised to revolutionize the landscape of lawn maintenance and contribute to a greener and cleaner future. The results from stress, strain, and displacement analyses collectively indicate that the prototype exhibits minimal

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deformation, maintains structural integrity, and responds well to the applied loads, and also indicates that additional assessments may be needed to ensure the design meets all necessary criteria for structural integrity and performance.

The following benefits are realized from the designed solar grass cutter:

- Reduced costs due to better blade efficiency and less weight of total components
- Reduced fuel costs, no pollution, and no fuel residue due to utilization of solar energy
- The sensors used in the prototype are not affected by the environment
- The DC motor maintains consistent speed when used in load settings
- The solar panel constantly charges the battery
- The labor cost is reduced as it can be operated by a normal person.

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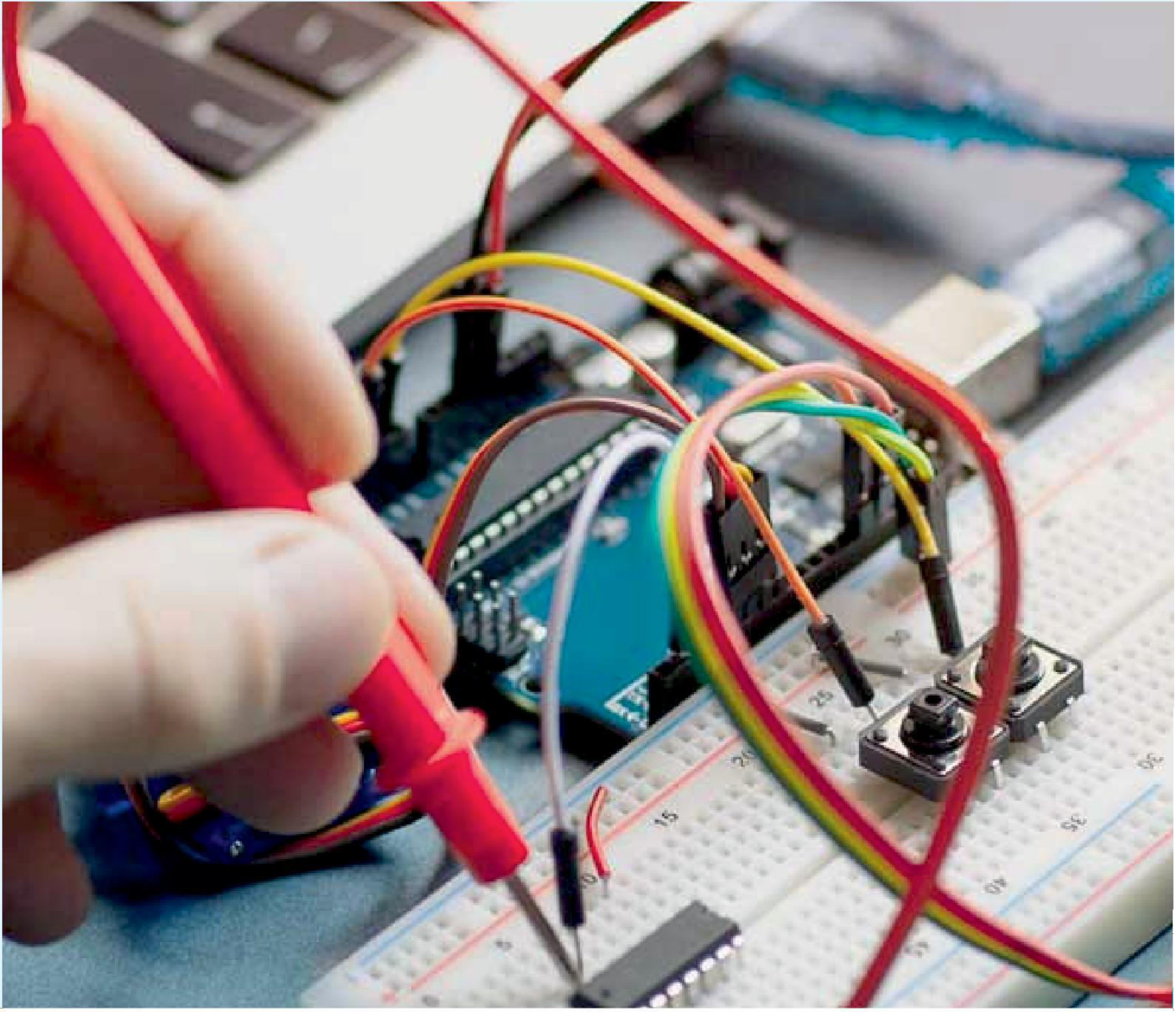

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