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Technological Innovation in Agriculture Using Agro Robo

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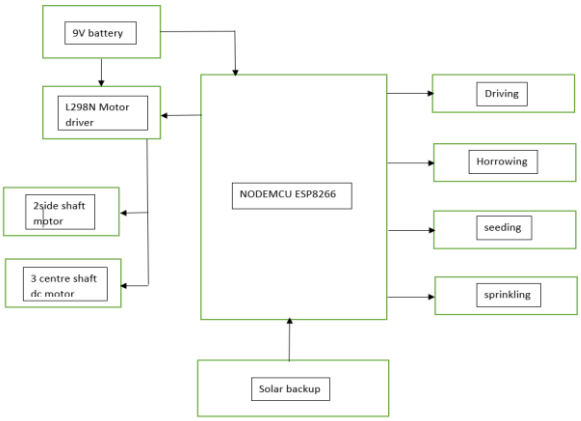
ABSTRACT:In India nearly about 70 percentage of people are depending on agriculture. Numerous operations are performed in the agricultural field like seed sowing, grass cutting, ploughing etc. The present methods of seed sowing, pesticide spraying and grass cutting are difficult. The equipment's used for above actions are expensive and inconvenient to handle. So the agricultural system in India should be encouraged by developing a system which will reduce the man power and time. This work aims to design, develop and design of the robot which can sow the seeds, cut the grass and spray the pesticides, this whole system is powered by solar energy. The designed robot gets energy from solar panel and is operated using Bluetooth/Android App which sends the signals to the robot for required mechanisms and movement of the robot. This increases the efficiency of seed sowing, pesticide spraying and grass cutting and also reduces the problem encountered in manual planting.

KEYWORDS: Agriculture, autonomous, grass cutting, pesticide spraying, robot, seed sowing, solar powered.

I. INTRODUCTION

Agriculture is the main source of livelihood of many people in different parts of the world. Approximately 60% of the land can be ploughed and used to grow crops. Unfortunately, farmers are still reliant on traditional techniques that have evolved hundreds of years ago. Due to this, the yield of crops are becoming low. However, there are a number of factors that contribute to the low yield of crops such as inappropriate soil preparation, lack of moisture in the fields and many more. If these methods are not implemented appropriately, the farmer will suffer from financial losses. For getting higher yield on crops, monitoring is the vital task for the farmers. The purpose of "AGRO ROBO" is to increase the quality and quantity of agricultural production by using technology to make farmers more intelligent and more connected. Thus the issues of farmers can be solved apart from enhancing their minimum earnings. The robotic system plays an immense role in all sections of societies, organization and industrial units. The main aim of AGRO ROBO is to develop a microcontroller based system that helps on-farm operations like seeding, fertilizing at pre-designated distance and depths.

II. OVERVIEW OF THE SYSTEM



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The block diagram consists Nodemcu Wi-Fi board is used for driving the agribot which is used for various purposes of agriculture. Nodemcu has 13 GPIO (General Purpose Input Output) pins out of which 6 pins are used for driving a robot, 2 are used for harrowing purpose, 2 are used for seeding mechanism and 2 for sprinkling purpose. Since Nodemcu cannot be connected directly to the motor, L298N motor driver is used to rotate the motors. Nodemcu has Wi-Fi connectivity which act as a server and mobile app acts as a client which is used to drive the robot serving various purposes for agricultural works. App gives command through http:// (hypertext transfer protocol) server to Nodemcu. Nodemcu gives digital (High or low signal) to driver IC. Driver IC drives the motor according to the given signal (Clockwise or in anticlockwise direction). Nodemcu can be connected to Wi-Fi hotspot or Wi-Fi router. Both server and client should be connected tosame Wi-Fi network.

III. CIRCUIT IMPLEMENTATION

INodemcu Wi-Fi board is used for driving the agribot which is used for various purposes of agriculture. Nodemcu has 13 GPIO (General Purpose Input Output) pins out of which 6 pins are used for driving a robot, 2 are used for harrowing purpose, 2 are used for seeding mechanism and 2 for sprinkling purpose. Since Nodemcu cannot be connected directly to the motor, L298N motor driver is used to rotate the motors.Nodemcu has Wi-Fi connectivity which act as a server and mobile app acts as a client which is used to drive the robot serving various purposes for agricultural works. App gives command through http:// (hypertext transfer protocol) server to Nodemcu. Nodemcu gives digital (High or low signal) to driver IC. Driver IC drives the motor according to the given signal (Clockwise or in anticlockwise direction). Nodemcu can be connected to Wi-Fi hotspot or Wi-Fi router. Both server and client should be connected to same Wi-Fi network.

Components

- **NODEMCU ESP 8266**

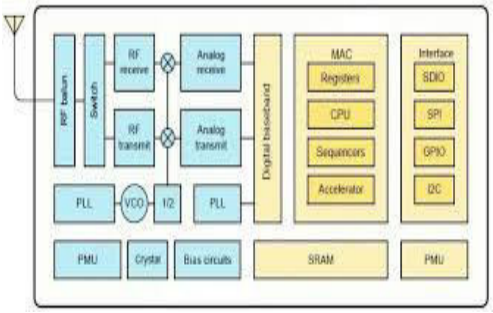

Figure 2: ARCHITECTURE

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects.

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✞ SOLAR PANEL

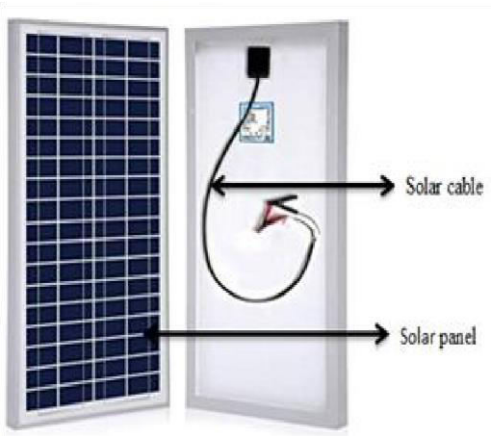

Figure 3: SOLAR PANEL

The solar cells that are seen on satellites and calculators are also called photo voltaic(PV) cells as shown in Fig.3, which as the name implies (photo meaning \light" and voltaic meaning \electricity"), convert solar energy directly into electrical energy. A module is a group of cells which is electrically connected and packed into a frame (most commonly referred as solar panel). Solar panels are a great way to cut your electricity that everyone wants to live on their own or at least reduce our home's carbon footprint, and solar panels make this dream possible. Solar panels are made of photovoltaic a (PV) cell, which converts sunlight into electricity.

✞ MOTOR DRIVER L298N

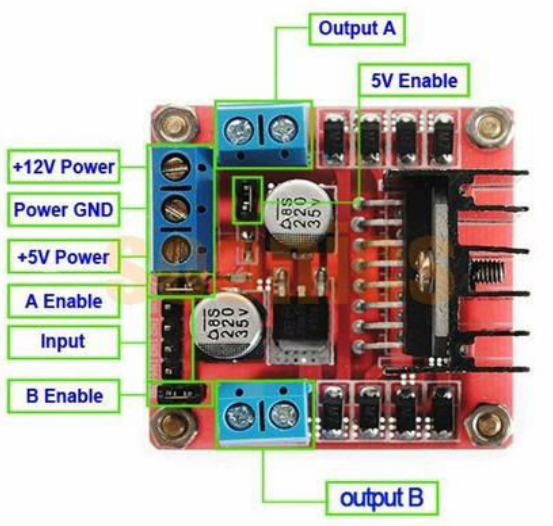

Figure 4: MOTOR DRIVER

Double H driver module uses ST L298N dual full-bridge driver, an integrated monolithic circuit in a 15- lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors . Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

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- **ESP8266 Arduino CORE**

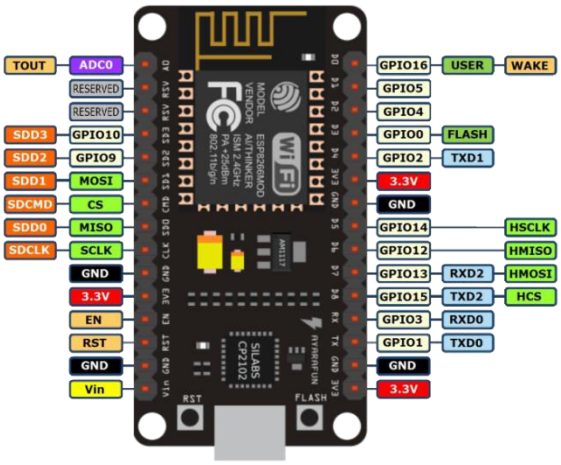

Figure 5: Arduino Core

As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in the Arduino Due, they needed to modify the Arduino IDE so that it would be relatively easy to change the IDE to support alternate tool chains to allow Arduino C/C++ to be compiled down to these new processors. They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file down to the target MCU's machine language. Some creative ESP8266 enthusiasts have developed an Arduino core for the ESP8266 WiFi SoC that is available at the GitHub ESP8266 Core webpage. This is what is popularly called the "ESP8266 Core for the Arduino IDE" and it has become one of the leading software development platforms for the various ESP8266 based modules and development boards, including Node MCUs .

- **DC MOTOR**

SIDE SHAFT **CENTER SHAFT**

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications

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IV. IMPLENTATION OF ALGORITHM

The flow chart in Fig.7 explains the algorithm of automated seed sowing, horrowing and sprinkling water and pesticide sprayer robot using MIT App

Algorithm for the robot is as follows:-

Step 1: Start

Step 2: Switching on the robot

Step 3: Pairing the WI-FI device with the mobile phone

Step 4: robot should wait until it receives signal from the app.

Step 5: If it receives signal, robot works accordingly

Step 6: If the signal is not received go to step 4

Step 7: universal OFF signal is used to deactivate.

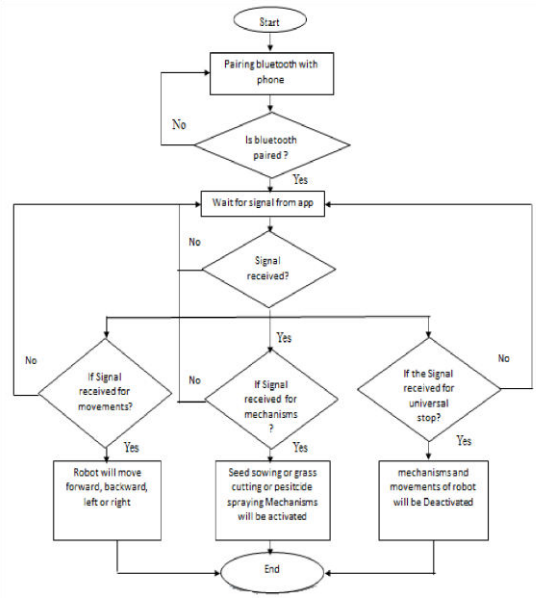

Fig.8 Flowchart of Algorithm

V. RESULT AND DISCUSSION

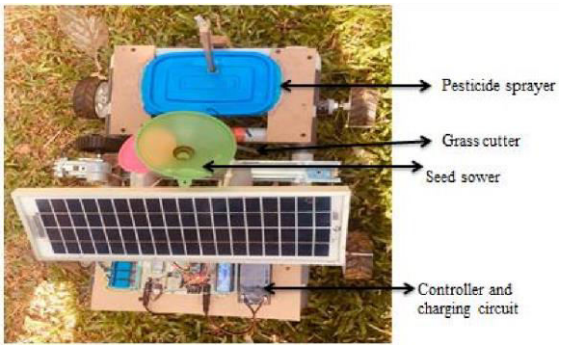

Fig.9 Snapshot of the Automated Seed Sowing, Grass Cutting and Pesticide Sprayer Robot Using Bluetooth/Android App.

Fig.9 shows the entire prototype of the automated multipurpose robot which is controlled through app. It performs seed sowing, grass cutting and pesticide spraying simultaneously on all the types of farming land.

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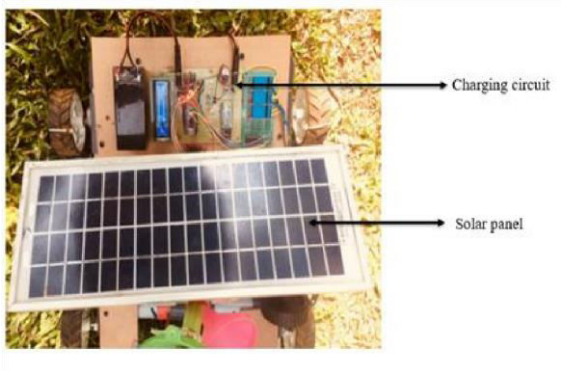

Fig.10 Snapshot of solar charging.

The solar panel shown in Fig.10 stores and converts the solar energy into electrical energy which is given to charging circuit in order to charge the battery to 12 V which will give the necessary power to controller, DC motor and different mechanisms.

Fig.11 Snapshot Of Android App

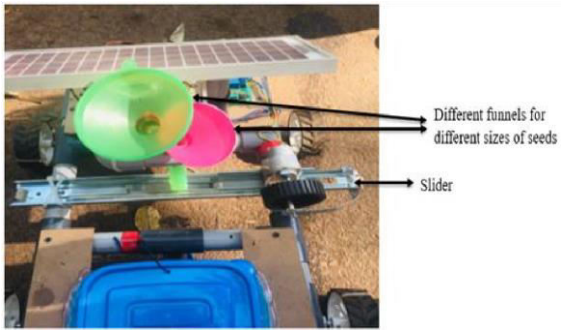

Fig.12 Snapshot of seed sowing mechanism

In seed sowing mechanism, a funnel is used to store the seeds. A slider with hole is provided in order to sow the seeds in ground at regular intervals. The slider moves on the basis of to and fro motion with the help of DC motor which is fixed to slider as shown in Fig.12

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Fig.13 Snapshot of seed pesticide spraying mechanism

In pesticide sprayer mechanism, a container is used for the storage of the pesticide solution. A mini submersible pump which is used for pumping the pesticide to the pesticide sprayer which is kept inside the container. The pesticide sprayer is as shown in the Fig.13.

VI. CONCLUSION

An autonomous multipurpose agricultural robot is designed to perform the complex farming tasks like seed sowing, grass cutting and pesticide spraying. This work is designed to perform sowing of two different sized seeds. The benefits of robot are reduced human intervention and efficient resources utilization. Instructions are passed to the system using bluetooth which ensures no direct contact with human and thus safety of operator is ensured. The robot is solar powered hence it is renewable energy source. The operations are performed using android app. Innovative seed sowing, grass cutting and pesticide sprayer equipment has significant influence in agriculture. By using this advanced work, farmer can save more time and also reduce lot of labour cost.

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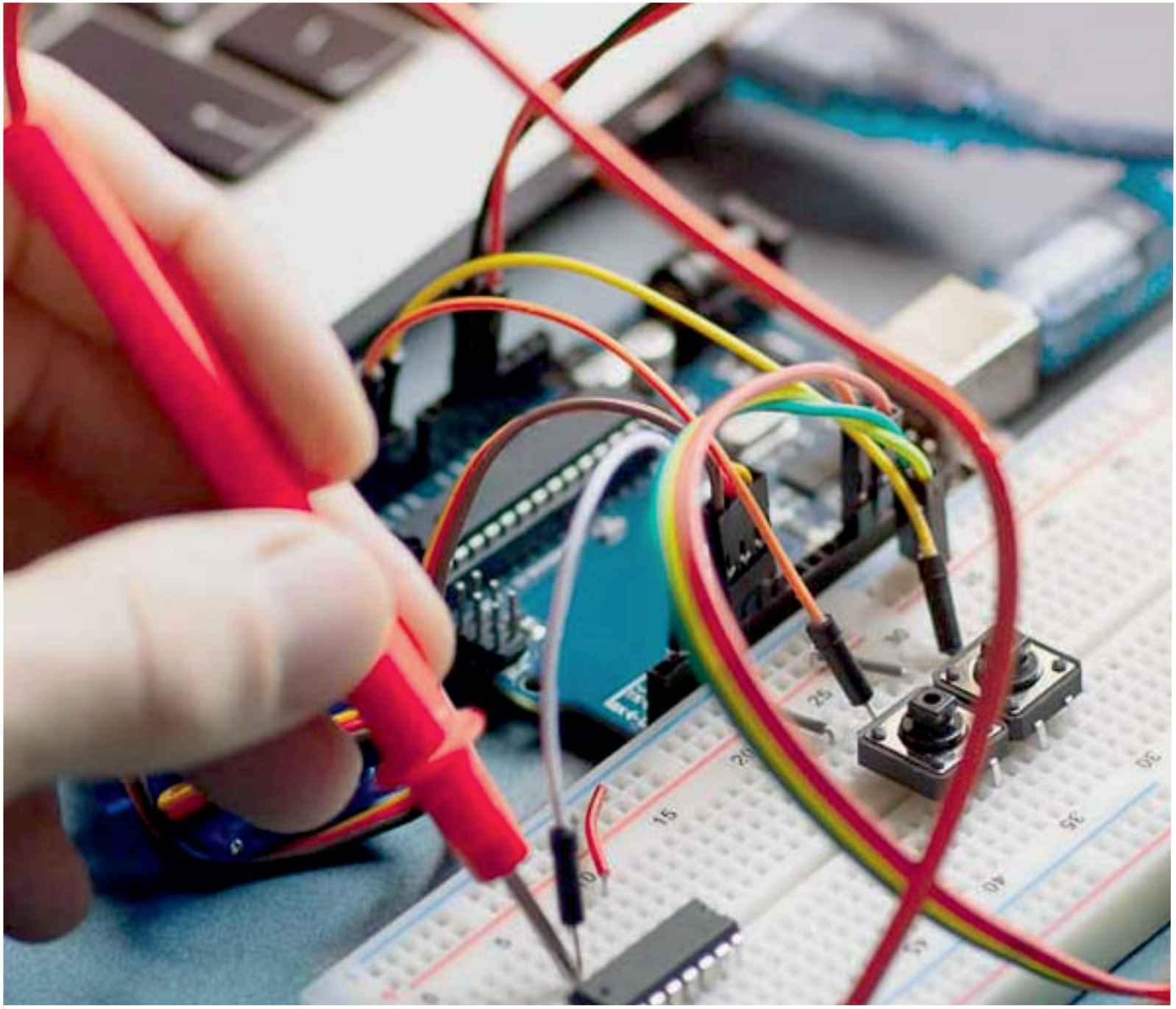

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