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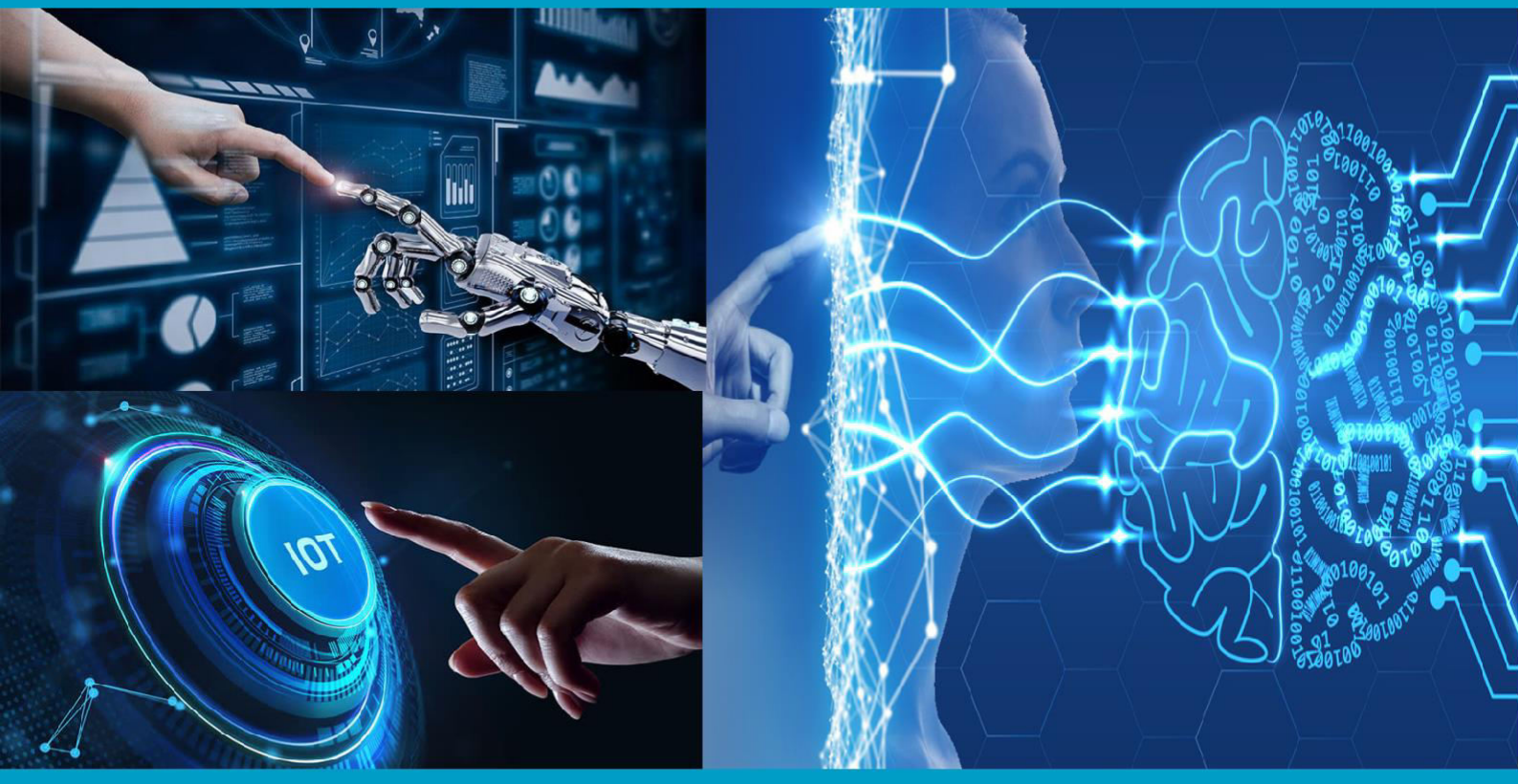

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Smart Agricultural Robot Using 4WD Vehicle

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ABSTRACT: The purpose of this project is use a 4wd (four-wheel drive) vehicle to implement a smart agricultural robot for agricultural productivity and farming management. This adaptable project is a strong farming robot that can automatically plough, sow seeds, and deliver water. Sensors like the DHT 11 and the soil moisture sensor help the crops flourish in a favorable environment (Digital temperature and humidity sensor). Seeds are sown using a servo motor, and water is applied using a sprinkler motor. The obstruction is located using an ultrasonic sensor. This is a job that Arduino is accustomed to doing. The robot can be turned on or off with the switch. A servo motor is used to sow the seeds, and a sprinkler motor is used to deliver the water. When an impediment is discovered, the robot is moved to the right using the ultrasonic sensor. The microcontroller Arduino Uno is used in this technique. Every operation is carried out automatically. There is a soil moisture sensor attached to the relay module. A water supply is determined by how much water is found in the soil. The robot's movement is accomplished by its dc motors. Batteries are used to supply energy. The main advantages of creating a multi-purpose, intelligent agricultural robot are increased productivity and time savings, which enable better farm management. As a result, crop productivity benefits from the use of technologically sophisticated agricultural equipment.

KEYWORDS: Arduino, soil moisture sensor, DHT 11 sensor, servo motor, sprinkler motor, ultrasonic sensor, relay module, dc motors.

I. INTRODUCTION

Agriculture refers to the practice of cultivating crops. India is currently ranked second in the world for farm output. The majority of income comes from agriculture. All of the crops and livestock we need to survive are managed by farmers. They are the society's food producers as a result. However, some of the significant problems, like high input costs, labor-intensive tasks, a lack of skilled personnel, rising time demands, and a lack of water resources, are spreading more widely. To solve these problems, a clever agricultural robot has been created. Due to its contribution of effective and time-saving technologies, robotics is crucial to agricultural production and management. The objective of this project is to develop a smart, multifunctional agricultural robot that can cultivate crops, plant seeds, and water crops (sprinkling of water). To ensure that the crops are grown in the optimum conditions possible, the sensors are utilized to assess environmental factors including temperature, humidity, and soil moisture. The microcontroller used in this project is an Arduino Uno. The dht11 sensor measures humidity and temperature (digital humidity and temperature sensor). A soil moisture sensor is used to determine how much moisture is present in the soil. The field is first ploughed with a pointed metallic instrument, and then seeds are seeded using a servo motor, and water is sprayed with a sprinkler motor. An ultrasonic sensor is used by the robot to identify obstacles in its path. The soil on the seed is covered with a wooden sheet. Every action is done automatically.

I.I. problem statement

Agriculture is a crucial sector of the Indian economy and provides most of the country's income. As the number of skilled farmers declines, the needs of farmers increase. In traditional agriculture, the land is cultivated in ox carts,

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which is a tedious and time-consuming task. The tractor will eventually be replaced by a more expensive ox cart. Major problems in the agricultural sector include labor shortages, rising wages, wasted seeds, increased wasted water, and a lack of understanding of soil moisture.

I.II. problem solution

This project is developed as a multipurpose smart agricultural robot that can plough the ground, plant seeds, and water the crops (sprinkling of water) to eliminate the challenges and drawbacks of traditional and manual farming. The sensors are used to monitor environmental factors including temperature, humidity, and soil moisture, allowing the crops to thrive in the ideal conditions. The microcontroller used in this project is an Arduino Uno. Temperature and humidity are measured using the dht11 sensor (digital humidity and temperature sensor). A soil moisture sensor is used to determine the amount of moisture in the soil. The field is ploughed by a sharp metallic structure, following which seeds are sowed by a servo motor, and water is sprinkled by a sprinkler motor. An ultrasonic sensor detects obstacles in front of the robot. All of the mechanisms are operated automatically with the aid of loaded programming for the Arduino Uno.

II. LITERATURE SURVEY

Prakash Kanade, Ashwini (2021)

It is a single-purpose project used for seed-sowing. It is created and built using the Arduino Uno (ATMega368) microcontroller for seed sowing with a dc motor in an already ploughed field. The dc motor is powered by an Arduino Uno and a motor driver. L293D is the motor driver utilized in this project. The motor driver is a link between the ATMega368 microcontroller and dc motors. To run or work, motors require a lot of power. Motor drivers are employed since microcontrollers can't handle a lot of power. The primary function of a motor driver is to convert a low current control signal into a higher current signal that may be used to drive a motor. The ultrasonic sensor ensures that the robot travels appropriately, while the infrared sensor ensures that the seeds are sown at consistent intervals. We can control all of our info from our cell phones via Bluetooth. We need to connect the system's operations to our phone through Bluetooth first, so we'll utilize an electromagnetic switch (also known as a relay) and then an Arduino. This Arduino will program the data in any way necessary. Depending on the conditions, power is supplied to the back wheel via gears, which are likewise regulated via the Android app.

K. Gowthami, K. Greesha, N. Supraja (2019)

Utilizing Smart Farming Agribot is a project that is designed to plough and sow seeds. It is created and built using the Arduino Uno (ATMega368) microcontroller for seed plowing with a metallic construction and seed sowing with a dc motor. The dc motor is powered by an Arduino Uno and a motor driver. L293D is the motor driver utilized in this project. The motor driver is a link between the ATMega368 microcontroller and dc motors. To run or work, motors require a lot of power. Motor drivers are employed since microcontrollers can't handle a lot of power. The primary function of a motor driver is to convert a low current control signal into a higher current signal that may be used to drive a motor. The seed is sown in sowing the seeds at regular intervals with the use of an ultrasonic sensor. We can control all of our info from our cell phones via Bluetooth. We need to connect the system's operations to our phone through Bluetooth first, so we'll utilize an electromagnetic switch (also known as a relay) and then an Arduino. This Arduino will program the data in any way necessary. Depending on the conditions, power is supplied to the back wheel via gears, which are likewise regulated via the Android app.

Prem Veer Gautam, H.L. Kushwaha, Adarsh Kumar (2019)

It is a project intended for seed planting. It is created and built using the Arduino Uno (ATMega368) microcontroller for seed sowing with a dc motor in an already ploughed field. The dc motor is powered by an Arduino Uno and a motor driver. L293D is the motor driver utilized in this project. The motor driver is a link between the ATMega368 microcontroller and dc motors. To run or work, motors require a lot of power. Motor drivers are employed since microcontrollers can't handle a lot of power. The primary function of a motor driver is to convert a low current control signal into a higher current signal that may be used to drive a motor. The robot moves correctly, and the seed is sown at regular intervals by the metering plate. We can control all the instructions from our mobile phone via Bluetooth. First, we'll use an electromagnetic switch (also known as a relay) to connect the system's functionalities to our phone via Bluetooth, and then we'll utilize an Arduino. This Arduino will program the data in any necessary way. Depending on the conditions, power is supplied to the back wheel via gears, which may also be regulated via the Android app.

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PVS Jaya Krishna, M. Suryavamsi, N. Jashwanth Sai (2018)

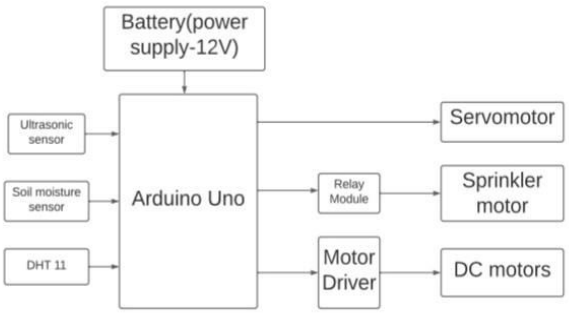
It is a project intended for seed planting. It is created and built using the Arduino Uno (ATMega368) microcontroller for seed sowing with a servo motor in an already ploughed field. The Arduino Uno with motor driver is connected to the servo motor. L293D is the motor driver utilized in this project. The motor driver is a link between the ATMega368 microcontroller and dc motors. To run or work, motors require a lot of power. Motor drivers are employed since microcontrollers can't handle a lot of power. The primary function of a motor driver is to convert a low current control signal into a higher current signal that may be used to drive a motor. A servo motor is used to sow the seeds. We can control all of our info from our cell phones via Bluetooth. We need to connect the system's operations to our phone through Bluetooth, so we'll utilize an electromagnetic switch (also known as a relay) and then an Arduino. This Arduino will program the data in any way necessary. Depending on the conditions, power is supplied to the back wheel via gears, which are likewise regulated via the Android app. The robot is propelled by dc motors.

III. PROPOSED SYSTEM

This project is aimed to design a smart agricultural robot using a 4wd vehicle for multipurpose like ploughing, seed sowing, and automatic water supply. Ploughing is done using a 'V-shaped metallic structure. Seeds are sowed using a servo motor and water supply using a sprinkler motor. We use dht11(Digital temperature and humidity sensor) and soil moisture sensor for the seeds to grow in the perfect environment. Every task is completed automatically.

Ploughing Mechanism:
The robot is placed in a field and switched on. Ploughing is done on an uneven land using a sharp metallic structure present in the front part of the robot. It works so effectively that the soil becomes suitable for the sowing of seeds and farming.

Seed Sowing Mechanism:
Seeds are sown after ploughing. A seed container is used to contain the seeds and the lid of the seed container is connected to the servomotor. Servomotor contains a shaft that rotates precisely and opens the container so that the seed is dropped. A servomotor is a combination of a dc motor and potentiometer. The maximum angle rotated by the servo motor is 180 degrees. A servo motor is an electrical device that can push or rotate an object with great precision. It is just made up of a simple motor that runs through a servo mechanism. It works on the PWM (Pulse width modulation) principle that is its angle of rotation is controlled by the duration of applied pulse to its Control PIN. This degree of rotation can be controlled by applying the Electrical Pulse of proper width, to its Control pin. Servo checks the pulse every 20 milliseconds. The pulse of 1 ms (1 millisecond) width can rotate the servo to 0 degrees, 1.5ms can rotate to 90 degrees (neutral position) and 2 ms pulse can rotate it to 180 degrees.



Block Diagram

A sprinkling of water(or)Water Supply(or)Irrigation:
After the task of seed sowing is completed, a certain amount of water is sprinkled based on the output given by the dht11 sensor(digital temperature and humidity)and soil moisture sensor. If the temperature is high and humidity and moisture in the soil are low then more amount of water is required for the seed and vice versa. The sprinkler motor is connected to a relay module, and based on the moisture present in the soil, the water is supplied The water is supplied or irrigation is done using a sprinkler motor. Finally, the metallic sheet covers the ploughed soil.

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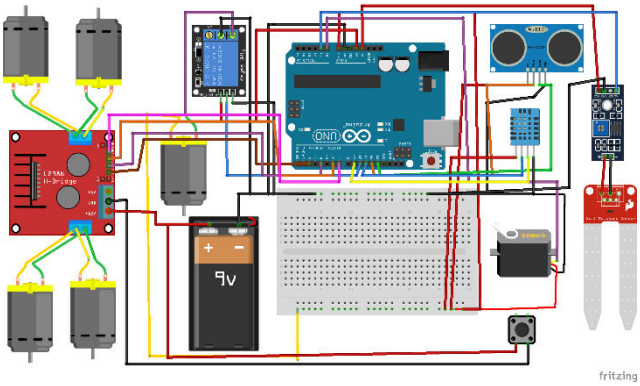
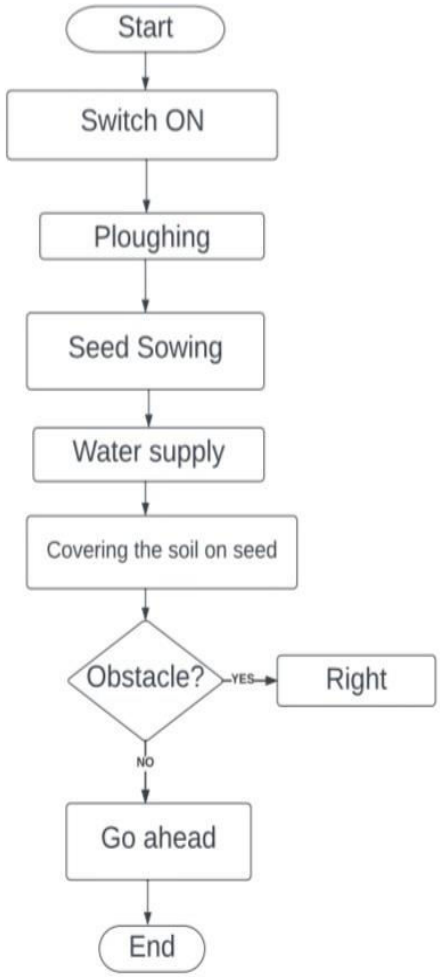


Circuit Diagram

Movement of Robot:

The dc motors are used for the movement of the wheels of the robot. The movement is automatic.



Flow Chart

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IV. RESULTS

FIG1: Hardware Component connections.

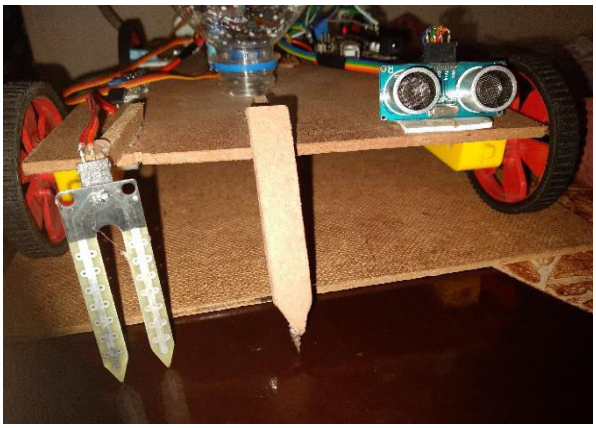

FIG2: Ploughing tool

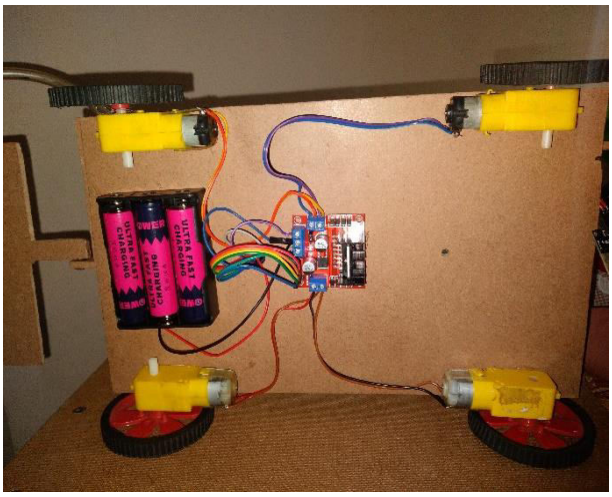

FIG3: Batteries and motor driver connected to dc motors

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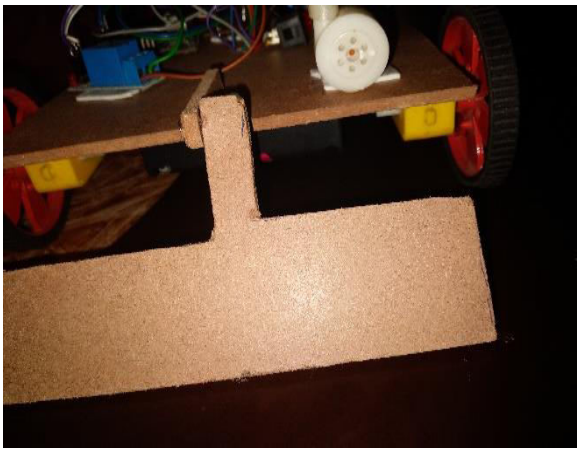

FIG4: Wooden sheet used to cover soil on the seed

VI. CONCLUSION

In this project, we have designed a multipurpose robot used for ploughing, seed sowing, and irrigation. Ploughing is done through a sharp metallic structure. Seeds are sown using a servo motor and water is supplied using a sprinkler motor. All these are precisely done using the sensors like dht11(digital temperature and humidity sensor) and soil moisture sensor. The robot run using dc motors and ultrasonic sensors is used for obstacle detection. The motor driver used in this project is L298N which acts as an interface between the microcontroller and motors.

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