ARM Based Remote Controlled Farming Robot

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Abstract: *The main objective of this project is to control an agricultural robot through the Smartphone. In the current world, many countries don't have skilled labor regarding agriculture which may affect the growth of the developing countries. In India, there is approximately 70 percent of people are fully dependent on agriculture only. We need to know the basic agriculture methods to automate the process of sowing, ploughing, seeding, watering, by using an Arduino DUE ARM-based microcontroller, which is controlled through a Smartphone. The farming robot uses the esp8266 wi-fi chip module for connecting and controlling the app. These robots can agriculture the fields with a crop like a groundnut, onions, potato and many more. The world in the field of agriculture is changing from drones to an autonomous tractors to robotic arms and farming robots.*

KEYWORDS: Arduino, Arduino Due, esp8266 Wi-Fi Module, L293 Motor Control, H-Bridge, Blynk App.

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INTRODUCTION

Agriculture is the main source of raw materials and food grains which are the primary needs of humans and the growth of agriculture helps the financial economy of the country. So, it plays a vital role in human life and the country's economic growth. Robots are useful which indirectly save the lifetime of the person by preventing hazardous environmental accidents. By assisting a robot, some of the tasks perform accurately and fast when compared to manpower. Therefore, with the help of robots, agriculture contains a secure working environment for farming. Nowadays, Agriculture is done by using a smart and intelligent process that comes under automation and IoT technologies.

In our project, Arduino due microcontroller is used which is an ARM microcontroller board. This ARM microcontroller is 32-bit which is the first Arduino board. This board is highly efficient in performing operations quickly. In our proposed farming robot is capable of doing field operations like detect an object, ploughing, seed sowing, water and pesticides spraying, monitor soil moisture and temperature.

OBJECTIVE

The main objective of designing this multi-functional robot is simply to facilitate the farmers for agriculture purposes. All functions are merged into a single robot to do farming.

This project aims to reduce farmer efforts with fast speed, increase efficiency, and reduce the amount of time for an operation. The aim is to give outcomes at a given time and help to reduce pollution.

MOTIVATION

Previously, numerous works have been done related to the farming sector using various technologies.

Abdullah Tanveer[1]has proposed that farming can be done using new technologies to yield higher growth of crops. In this temperature, light, humidity, and soil moisture are checked. By using the calculated values, it automatically controls with latest electronics technology using microcontroller and GSM phone line. The project works automatically and hence reduces the manpower.

A. AmritaSneha[2]has proposed the Agricultural Robot for Automatic Seeding and Ploughing. All the readings and the parameters are carefully verified by the farmers. The wireless sensor community has more benefits so users focus on the developing tools. Automatic farming robots mainly control input, improves efficiency, and always test the new growing methods.

However, there has been no such farming robot that can do many different tasks through one bot.

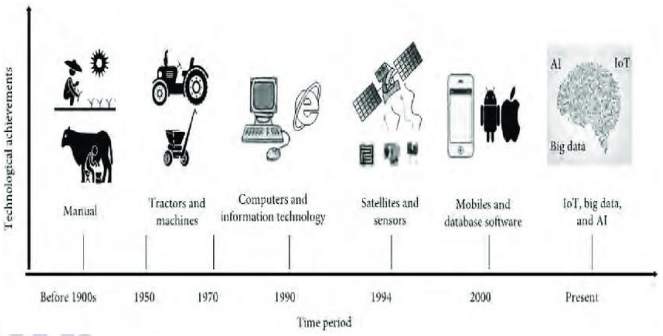

Figure -1: Evolution of Farming Techniques.

PROPOSED WORK

The previous existing system consists of a vehicle controlled by PIC16F887 microcontroller as a master controller, humidity sensor for irrigation is indicated by LCD, etc., and other accessories. This system integrates all the functions such as plugging, seeding, and watering into a single robot and performs the operations automatically. The farmer command through Bluetooth Module.

Our proposed system involves an ultrasonic sensor, temperature sensor, spraying pesticides, soil moisture sensor which will behave as a bonus to the already existing system. To increase the efficiency, our system used an ARM controller in place of the PIC controller and it communicates via a wi-fi module. Our added proposal system will help farmers in various tasks and it becomes a multi-tasking device that will yield better factors and increases the performance of the farming robot.

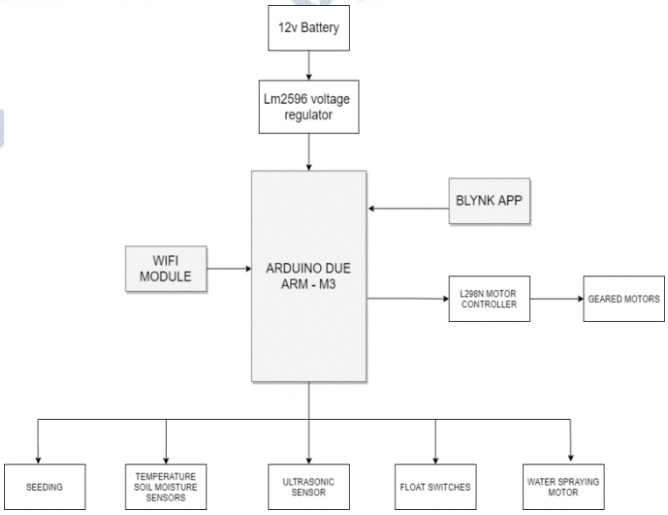

Figure -2: Block Diagram of the Farming robot via Blynk app.

HARDWARE

For developing this project, we mainly used hardware components as follows:

Arduino Due [1]

Arduino Due is a microcontroller board. It is based on the Atmel SAM3X8E ARM Cortex-M3 CPU which is the first Arduino board based on a 32-bit ARM core microcontroller.

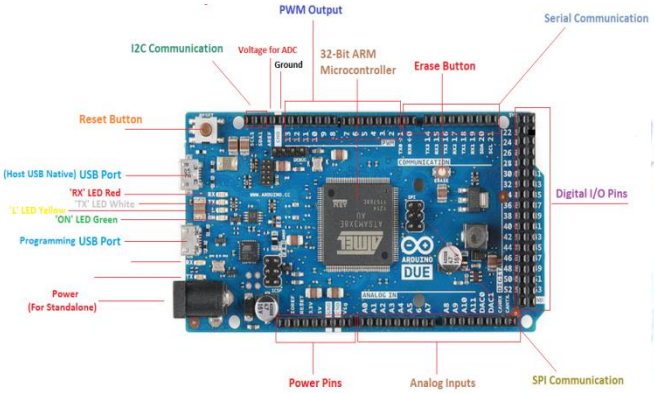

Figure -3: Pin Configuration of Arduino Due.

We use the programming serial port for programming the board. We select the board type and then program the board through the Arduino IDE.

ESP8266 Wi-fi Module [2]

ESP8266 is a Wi-Fi-enabled system on chip (SoC) module developed by the Espressif system. By using UART which is having a specific Baud rate in the ESP8266-01 module which helps the microcontroller to communicate in which AT commands are used.

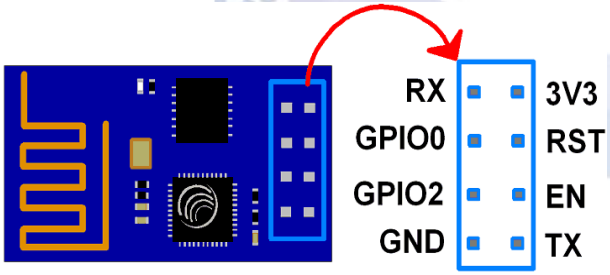

Figure -4: ESP 8266 Wi-fi Module.

LM2956 Voltage Regulators [3]

Voltage Regulator generates a fixed output voltage that remains constant regardless of changes to its input voltage.

Figure -5: LM2596 Pin Configuration.

Soil Moisture Sensor [4]

The fork-shaped probe with two exposed conductors acts as a variable resistor like a potentiometer whose resistance varies for the water content in the soil. If the water content in soil is less then high resistance is observed.

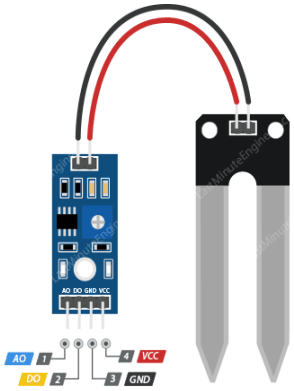

Figure -5: Soil Moisture Sensor.

Temperature Sensors [5]

A temperature sensor is an electronic device that measures the temperature of the environment and converts the input data into electronic data to record, monitor the temperature changes.

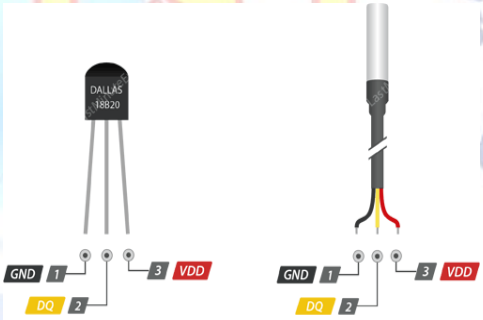

Figure -6: Temperature Sensor.

Ultrasonic Sensors [6]

An ultrasonic sensor is used to measures the distance of an object using ultrasonic sound waves. The transducer is used to send and receive ultrasonic pulses that relay back information about an object's proximity.

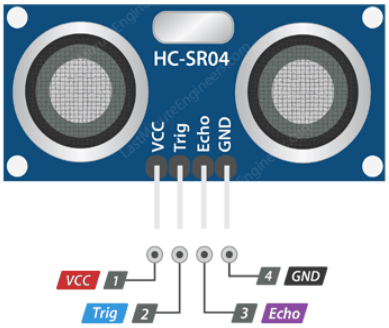

Figure -7: Ultrasonic Sensor.

Water Level Float Switches [7]

A float switch is a device used to sense the level of liquid within a tank by floating on the water. If it contacts the surface then it may actuate an alarm or an indicator.

L298N Motor Drivers [8]

Motor drivers are mainly used to control the speed and directions of two DC motors. It takes complete control over the DC motor by controlling its speed and rotations. This can be achieved by combining these two techniques.

1. PWM – For controlling speed
2. H-Bridge – For controlling rotation direction

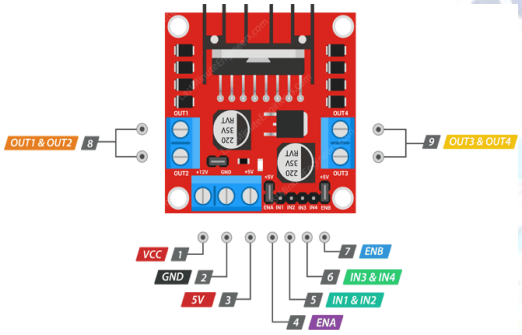

Figure -8: Motor Driver

SOFTWARE

For developing this project, we mainly used software as follows:

Arduino IDE is the open-source Arduino Software (IDE) that makes it easy to write code and upload it to the board. Any Arduino board can use this software.

The Blynk app is an app editor which allows you to build a graphic interface for your IoT project by simply dragging and dropping widgets.

WORKING

The Arduino due board is connected over the Blynk cloud server which uploads the data and retrieves the data over the cloud by using ESP 8266 wi-fi module. The necessary actions are performed by giving the commands from the Blynk app. We control the robot by using the control widgets on the app. All the data is been uploaded to the Blynk cloud server.

The Arduino Due is the main controller of the project. The program code that we have written will be dumped in this Arduino due board through the Arduino IDE. The esp8266 wifi module is been connected across the wi-fi which provides or establishes network connectivity to the Arduino due board. We are using the Blynk cloud app to monitor and control the robot. The soil moisture sensor calculates the soil moisture and gets the data and uploads it to the Blynk Cloud. We can monitor the uploaded data in the display widget of the Blynk app. We control the robot by the buttons assigned in the app. Whenever we make changes, the request has been sent to the hardware unit and then the robot turns accordingly. When the user makes a request or enters the command to do an operation like ploughing, then the motor assigned for ploughing gets turned on and then it ploughs. As well when spraying the water or pesticide it monitors the tank level and sends us the notification if the tank level is empty. The ultrasonic sensors attached to the robot finds if any obstacles are there and then it sends a notification to the mobile through the Blynk app.

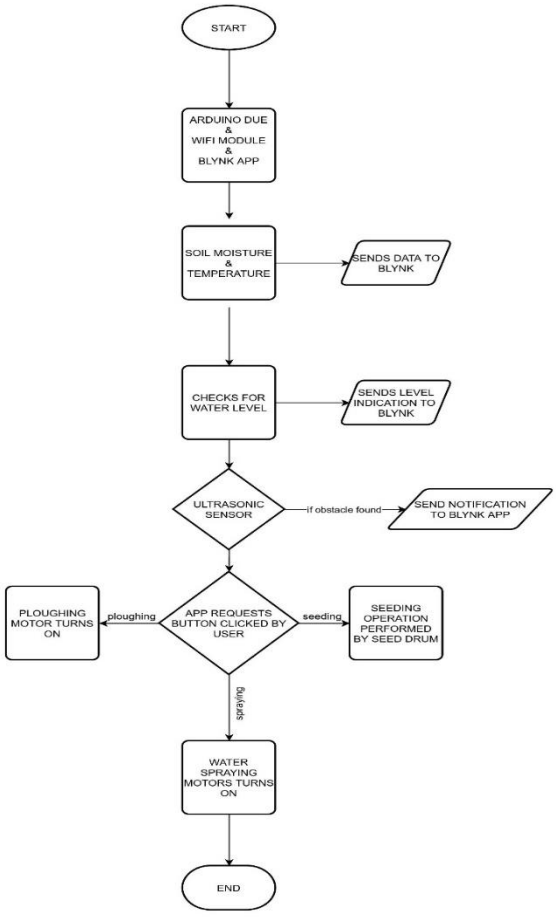

Figure -9: Flow Chart of Working Principle

RESULT

The output is observed and controlled by a remote (phone) after dumping the code in the Arduino Due Board using Arduino IDE software.

Figure -10: Front view of Farming Robot.

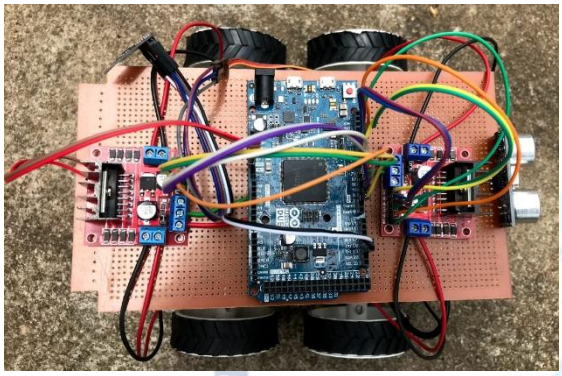

Figure -11: Top view of Farming Robot.

The farming robot can move in different directions with help of a motor driver which is operated by buttons (forward, left, right, back as shown below) in the Blynk app. It can also control the speed by using a slide bar in the Blynk app.

Figure -12: Directional Buttons and Speed Control in the Blynk app.

Temperature, soil moisture and level of water tank is displayed on the Blynk app. The task is performed accordingly.

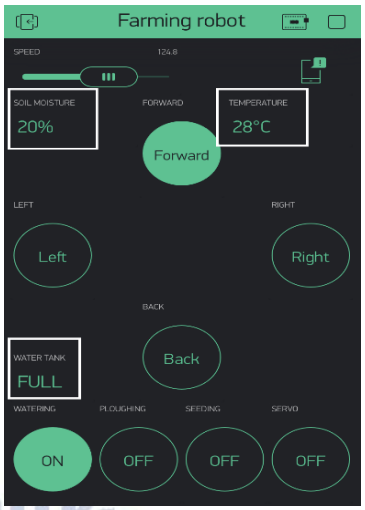

Figure -13: Display Details of Temperature, Soil Moisture and Water Level in the Blynk app.

The robot performs a specific operation which is given by the Blynk app. Every task is started according to the respective button activated in the Blynk app.

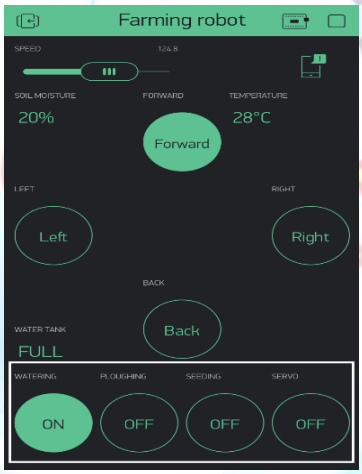

Figure -14: Buttons of specific task in the Blynk app.

While performing tasks, if any object detected in our path, then a notification is shown in the Blynk app.

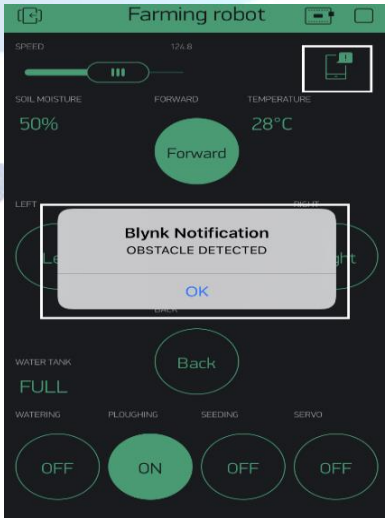

Figure -15: Notification in the Blynk app

FUTURE SCOPE AND CONCLUSION

The project is aimed at multi-tasking of a farming robot that gives accurate output and performs all tasks assigned to it. Irrespective of manpower, it works perfect and gains profit with less damage. These farming bots are controlled by less skilled labor. So, operations are easy and can be adopted by farmers. This project has a huge potential for further development with an increase in technology. This robot can be advanced by inculcating additional tasks for new technologies. By adopting new technologies, man control can be removed over a farming robot in future.

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