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ARDUINO BASED AGRICULTURE ROBOT USING BLUETOOTH

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Abstract **:** Robot controlled by giving the voice commands into the Arduino microcontroller using Bluetooth for agriculture purposes is the main objective of this project. It reduces manual work and introduces automation in the field of farming. Motor Driver L293D is a 16-pin IC that controls two DC motors simultaneously. DC motors has been used to drive the wheels, whereas motor driver drives the DC motors. The moisture content of the land is discovered via a soil moisture sensor. The water pump will automatically turn on if the relative humidity is below a certain threshold. Funnel is used for seed sowing and is connected with Arduino. “Arduino Bluetooth app”, input is given in the form of voice commands. Based on the voice commands, the robot will move forward, backward, right, left and performs seed sowing with design using Arduino IDE and Embedded C as the scripting language.

Index Terms **- Robot, Voice commands, Arduino Bluetooth app.**

I. INTRODUCTION

The majority of nations now do not have enough skilled labour, particularly in the agricultural sector, which has an impact on the development of developing nations. The manual method of sowing is the most common. Yet it takes more time, and there is always a manpower deficit.

Hence, in order to solve this issue, the sector needs to be automated. Many industries, including defense, surveillance, medicine, and industry, use automation robots. To reduce the need for human labour, the robot system is employed to design the method of cultivating agricultural land. When compared to tractors or other agricultural equipment, this machine uses less energy.

The Arduino-based agriculture robot using Bluetooth is an innovative solution for precision farming. This project involves the use of an agriculture robot equipped with sensors and Bluetooth technology to collect and analyze data on environmental factors such as soil moisture levels, temperature, and humidity. The data collected by the robot can be used to optimize crop production while minimizing environmental impact.

Precision agriculture is an emerging field that seeks to improve crop yields and reduce resource use through the use of technology. The Arduino-based agriculture robot project is a practical application of precision agriculture. By using an agriculture robot equipped with sensors, farmers can collect real-time data on environmental factors and make informed decisions about crop management.

The project is based on the Arduino microcontroller, which is a low-cost, open-source platform that is widely used in electronics and robotics projects. The microcontroller provides a flexible solution for controlling the agriculture robot's sensors and other components.

Bluetooth technology is used for wireless communication between the agriculture robot and a central database. This allows for real-time data collection and analysis, which can help farmers make quick and informed decisions about crop management.

The agriculture robot is equipped with sensors that measure soil moisture, temperature, and humidity. These sensors can be customized to meet the specific needs of the farm and the crops being grown. The robot also has a GPS module that allows for precise navigation and mapping of the farm.

The collected data can be analyzed using statistical and machine learning algorithms. This can help farmers identify areas of the farm that need attention, optimize crop management practices, and predict crop yields. The use of machine learning algorithms can also help farmers make decisions about crop management based on historical data.

The Arduino-based agriculture robot project has several benefits over traditional farming practices. By using real-time data, farmers can make informed decisions about crop management, reducing waste and resource use. The use of an agriculture robot can also reduce the need for manual labor, freeing up farmers to focus on other aspects of their business.

In addition, the project is based on open-source hardware and software, which means that it can be easily customized and adapted to meet the specific needs of individual farms. This allows farmers to take advantage of the latest technology without incurring high costs.

Arduino-based agriculture robot using Bluetooth is an innovative solution for precision farming. By using real-time data and technology, farmers can optimize crop production while minimizing environmental impact. The project is based on the principles of precision agriculture, IoT, open-source hardware and software, Bluetooth technology, and machine learning. These principles provide a solid foundation for the development of a practical and effective solution for modern agriculture.

II. Related Work

1. A Smart phone controlled fertilizing and plant watering Arduino

The paper aims to develop a robot that can accurately determine the appropriate amount of water and fertilizer needed for plants. The robot is equipped with a soil sensor, a water and fertilizer tank, a digital display, and is controlled via Bluetooth. After fertilizing the soil, the sensor is implanted to measure moisture content, which is displayed on the digital screen. The robot then waters the plant until the moisture content reaches 100%, ensuring proper hydration and fertilization for optimal plant growth. By automating this process, the system can prevent both over and under watering, while also addressing soil infertility for healthy plant development.

2. Arduino board-based seed sowing robot

This robot's design includes a small drilling unit that digs holes in the ground so that seeds can be sown. The depth of drilling can be remotely controlled using Bluetooth technology. The robot has a metal plate at the back that will spread sand over the seeds as it advances. A DC servomotor is used to control the valve on the seed tank feed line and the rate of seed distribution. The user can modify the seed-sowing algorithm used by the robot to alter the depth and quantity of seeds placed in each position. This robot can plant seeds between 2 and 5 cm deep. A Bluetooth module is included in the microcontroller unit to enable connection between the robot and a smart device.

3. Using an Arduino closed loop system for various farming parameters

The concept for an automated irrigation system for farming involves employing wireless sensors to gauge the soil's moisture content. The moisture levels will be tracked using a smartphone application, which is a crucial tool for maintaining crops. The method streamlines the watering procedure by watering the plants automatically using an Arduino and an Android app.

4. Agriculture automation using Arduino is a step towards modernising agriculture

A prototype robot has been developed to perform tasks such as ploughing and planting, which can be remotely controlled using smart sensors and advanced communication technologies. The robot is equipped with H-bridge driven DC motors that enable it to move in various directions. The mobile app and Bluetooth communication facilitate the control of the motors by the farmer, who can be located remotely while the robot is in the field.

5. Bluetooth Robotics

It describes about robots which will perform predefined tasks or are controlled by remote to perform the particular task like in the field of healthcare, education, industry, transport, agriculture, retail, and etc. It refers to the Bluetooth-controlled robot that will receive the command from the Arduino board with help of a Bluetooth module and Bluetooth terminal application which is installed in our smartphones. The control signals/ commands are designed by the programmers in such a way that they can provide the guidance/control signal to the robot.

III. RESEARCH METHODOLOGY

A battery, an ARDUINO microcontroller, a motor driver, dc motors, and a servo motor make up the proposed system. For seed sowing, a servo motor coupled to an Arduino is employed. The system-connected wheels are propelled by DC motors. The DC motors are driven by motor drivers. The moisture content of the land is discovered via a soil moisture sensor. The speech commands are integrated into the Arduino microcontroller to provide system direction. Battery recharging is possible.

The proposed research project aims to design and develop an Arduino-based agriculture robot that can collect and transmit data on environmental factors such as soil moisture levels, temperature, and humidity. The robot will be equipped with Bluetooth technology to enable wireless communication with a central database. The research methodology involves a combination of qualitative and quantitative research methods.

The first step in the research methodology is to conduct a thorough review of existing literature related to agriculture robots, Arduino microcontrollers, and Bluetooth technology. This will help to identify the current state of the field and any gaps that can be addressed by the proposed research. Based on the literature review, the research objectives and hypothesis are defined.

The research methodology involves the development of a prototype robot using Arduino microcontrollers and Bluetooth technology. The robot will be tested in real-world conditions to evaluate its performance in collecting and transmitting data on environmental factors. The performance evaluation will involve collecting both qualitative and quantitative data on the robot's ability to navigate through a farm and collect data on environmental factors.

The collected data will be analyzed using statistical and qualitative analysis techniques to draw conclusions about the performance of the agriculture robot. The results of the analysis will be used to evaluate whether the research objectives and hypothesis have been achieved. A research report will be written detailing the research methodology, results, and conclusions.

The research methodology for this project involves a combination of literature review, prototype development, performance evaluation, data analysis, and report writing. The aim is to develop a useful tool for farmers to collect and transmit environmental data, which could help them make more informed decisions about crop management.

3.1 Data Collection and Preprocessing

The data collection and preprocessing phase of the Arduino-based agriculture robot project involves the collection and organization of data from the robot's sensors and other data sources. The data collected by the robot includes information on environmental factors such as soil moisture levels, temperature, and humidity.

To collect the data, the agriculture robot is equipped with sensors that are connected to an Arduino microcontroller. The microcontroller collects the data from the sensors and stores it in the robot's memory. The data is then transmitted to a central database using Bluetooth technology.

Once the data has been collected, it needs to be preprocessed to ensure that it is in a format that can be easily analyzed. This involves cleaning the data to remove any errors or anomalies, and organizing it into a format that can be easily analyzed using statistical or machine learning algorithms.

In the preprocessing phase, the collected data is first checked for errors and missing values. Any missing data is either imputed or removed, depending on the amount of missing data and the type of analysis to be conducted. The data is then transformed to the appropriate format and unit of measurement. For example, if the data is in different units, such as Celsius and Fahrenheit, it needs to be converted to a consistent unit.

The preprocessed data is then ready for analysis. The data can be analyzed using various statistical and machine learning techniques to gain insights into the environmental conditions and make informed decisions about crop management.

The data collection and preprocessing phase of the Arduino-based agriculture robot project involves the collection and organization of data from the robot's sensors, cleaning and transforming the data into a format suitable for analysis, and preparing it for statistical or machine learning analysis.

3.2 Data and Sources of Data

The Arduino-based agriculture robot project collects data on environmental factors such as soil moisture levels, temperature, and humidity. The data is collected through sensors that are connected to an Arduino microcontroller. The microcontroller collects and stores the data in the robot's memory. The data is transmitted to a central database using Bluetooth technology.

3.3 Theoretical framework

The theoretical framework for the Arduino-based agriculture robot project is based on the concept of precision agriculture, which involves using technology to optimize crop production while minimizing environmental impact. The use of an agriculture robot equipped with sensors and Bluetooth technology is a practical application of precision agriculture.

The project is based on the principles of the Internet of Things (IoT), which is the network of interconnected physical devices that can collect and exchange data. The agriculture robot acts as a physical device that collects data on environmental factors, which can then be analyzed and used to make informed decisions about crop management.

The project is also based on the Arduino microcontroller, which is an open-source platform that is widely used in electronics and robotics projects. The microcontroller provides a low-cost and flexible solution for controlling the agriculture robot's sensors and other components.

The theoretical framework of the project also includes the use of Bluetooth technology for wireless communication between the agriculture robot and a central database. Bluetooth technology allows for real-time data collection and analysis, which can help farmers make quick and informed decisions about crop management.

The project also draws upon the fields of machine learning and data analytics, which can be used to analyze the collected data and provide insights into the environmental conditions and crop management practices. Machine learning algorithms can be used to predict crop yields, identify areas of the farm that need attention, and optimize crop management practices.

The theoretical framework of the Arduino-based agriculture robot project is based on the principles of precision agriculture, open-source hardware and software, Bluetooth technology, and machine learning. These principles provide a solid foundation for the development of a practical and effective solution for optimizing crop production while minimizing environmental impact.

3.4 Statistical tools and econometric models

The Arduino-based agriculture robot project involves the collection and analysis of data on environmental factors such as soil moisture levels, temperature, and humidity. To make informed decisions about crop management based on this data, statistical tools and econometric models can be used to analyze the data and provide insights into the environmental conditions and crop management practices.

One statistical tool that can be used is regression analysis, which can help identify relationships between environmental factors and crop yields. This can be used to predict crop yields based on environmental conditions, and to identify areas of the farm that may need attention.

Another statistical tool that can be used is time series analysis, which can help identify trends and patterns in the data over time. This can be used to identify seasonal patterns in crop yields, and to identify trends in environmental conditions that may affect crop yields.

Econometric models can also be used to analyze the data and provide insights into the relationship between environmental factors and crop yields. For example, a production function model can be used to identify the inputs that are most important in determining crop yields, and to estimate the marginal productivity of each input.

The use of statistical tools and econometric models can help farmers make informed decisions about crop management. By analyzing the data and identifying patterns and relationships, farmers can optimize crop yields while minimizing environmental impact.

In addition to statistical tools and econometric models, data visualization tools can also be used to help farmers better understand the data. For example, charts and graphs can be used to visualize trends and patterns in the data over time, and to identify areas of the farm that may need attention.

The use of statistical tools, econometric models, and data visualization tools can help farmers make informed decisions about crop management based on the data collected by the Arduino-based agriculture robot. By analyzing the data and identifying patterns and relationships, farmers can optimize crop yields while minimizing environmental impact. The use of these tools is a key component of precision agriculture, and can help farmers take advantage of the latest technology to improve their farming practices.

IV. RESULTS AND DISCUSSION

4.1 Testing and Evaluation

Moisture level of the soil can be tested by soil moisture sensor and the pump gets ON automatically when the soil is detected dry. Obstacle detection can be done by ultrasonic sensor which allows the robot to stop when the obstacle is detected nearby. User could able to check whether the voice commands are given properly by checking the commands that are displayed on the mobile phone.

Figures

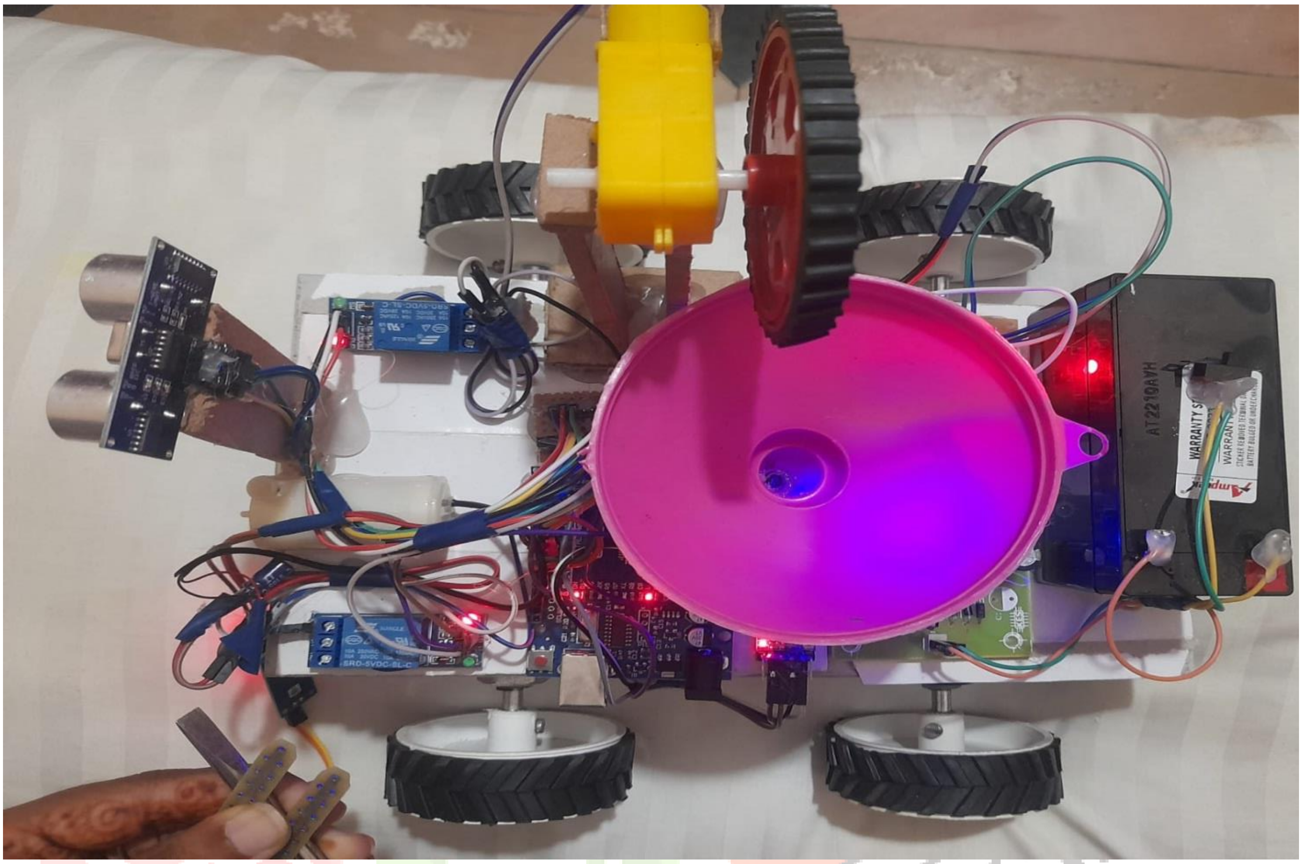

Fig 1 Final output of the robot

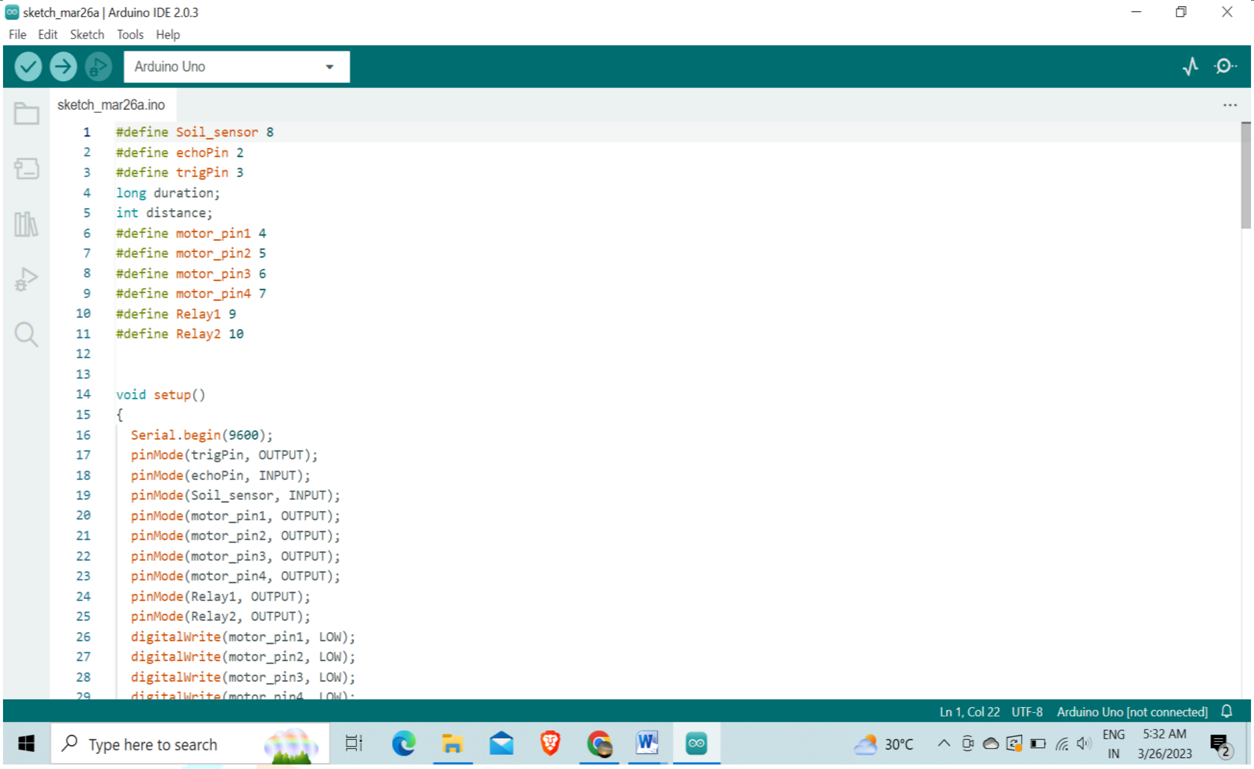

Fig 1 Robot Code Working

V. CONCLUSION & FUTURSCOPE

We are aware that farmers salaries are excessively high and that, after working all day in the fields, their output is lower. Hence, we created an automated robot that would assist farmers in the field. This prototype robot can give great efficiency in production and their cultivation, according to the existing situation. When farming is done manually, multitasking takes a lot of time. This robot can do it quickly. It has the ability to pump water and plant seeds. This endeavour may serve as a more effective replacement for the person who plants seeds and waters plants. This project is highly beneficial to farmers who want to engage in agriculture but are having trouble finding workers.

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