IOT Based Automatic Ploughing, Seeding, Watering Robot

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***Abstract*—More than 60 percent of the population in India do agriculture as the primary sector occupation. At present, due to increase in shortage of labor, interest has raised for the development of the autonomous vehicles like robots in the agriculture field. A robot called Agri-bot has been designed to minimize the labor of farmers in addition to increasing the speed and accuracy of the work.**

The Proposed system aims at designing multipurpose agricultural robotic vehicle for ploughing, seeding, pesticides spraying and watering depending upon soil moisture sensor. The system is powered by an Arduino microcontroller that coordinates all operations. Real-time data on soil conditions, temperature, and humidity are collected and transmitted to a cloud-based platform for monitoring and decision-making. The robot's mobility is managed using motor drivers for seamless navigation across the field.

I. INTRODUCTION

Agriculture is considered as the basis of life for the human species as it is the main source of food grains and other raw materials. It plays vital role in the growth of country's economy. It also provides large ample employment opportunities to the people. Growth in agricultural sector is necessary for the development of economic condition of the country. Unfortunately, many farmers still use the traditional methods of farming which results in low yielding of crops and fruits. But wherever automation had been implemented and human beings had been replaced by automatic machineries, the yield has been improved. "The discovery of agriculture was the first big step toward a civilized life". Is a famous quote by Arthur Keith. This emphasizes that the agriculture plays a vital role in the economy of every nation. Since the dawn of history agriculture has been one of the significant earnings of producing food for human utilization. Today more and more lands are being developed for the production of a large variety of crops.
The field of agriculture involves various operations that require handling of heavy materials. For example, in manual plugging, farmers make use of heavy ploughing machines. Additionally, while watering the crops farmers still follow the traditional approach of carrying heavy water pipes. These operations are dull, repetitive, or require strength and skill for the workers. In the 1980's many agricultural robots were started for research and development. Kawamura and coworkers developed the fruit harvesting robot. Grand and co- workers developed the apple harvesting robot. They have been followed by many other works.

The Internet of Things has continued to experience increased adoption, with numerous research efforts focusing on its deployment in various aspects of our daily lives. Similarly, robotics, which has been around for a while, has played a crucial role in diverse domains. However, there was a period during which both fields underwent significant development independently. It has now become evident that current scenarios require the integration of these two disciplines and a collaborative approach from their respective communities. Over the years, areas such as healthcare and agriculture have witnessed significant impacts from IoT and robotics. discussed how IoT and robotics have transformed healthcare services, including rehabilitation, assistive surgery, elderly care, and prosthetics. In another study by a model called Automatic Agricultural field Robot – Agro-bot was introduced, which utilizes robotics and automation to perform various agricultural operations such as soil digging, seed sowing, precise watering, spraying, and weeding.

II. PROPOSED SYSTEM

The IoT-based automatic ploughing, seeding, and watering robot aims to address the limitations of existing systems through automation and data-driven decision-making. Key features include:

III. METHODOLOGY

In this project, it is showing that the farm cultivation process in autonomous agriculture system controlled by microcontroller assembly. The method of seed preparation in ploughed land is according to row per column based on types of cultivation. The central part of the robot technique is the sensor part. The sensor works to detecting obstacles as well as the fulfillment of a farm for the land end and then turn the robot position either left or right or forward direction. The working of a dc motor is electromagnetic, to provide the energy to the robot vehicle. The driver circuit is utilized for providing the constant voltage to the DC motor and the motor will rotate in both the forward and in reverse direction. On starting the DC motor, the vehicle travels along the specific column of ploughed land for sowing, closing the pits and side by side sprinkling the water.

IV. IMPLEMENTATION

The architecture of the system contains a sensing unit for the collection of environmental data, a control unit for processing of data and decision-making, and an actuator and Seeding. The architecture of the system contains a sensing unit for collection of environmental data, a control unit for data processing and decision-making, and an actuator unit for performing activities like watering and Seeding. The system is destined for the automation of environmental control and monitoring for maximum ploughing, Seeding, and watering.

The components and connections of a low-cost, wi-fi enabled microcontroller system, likely used for environmental monitoring or control. The system utilizes an ESP8266 & Arduino uno microcontroller system, likely used for environmental monitoring as its core, interfacing with various sensors, a water pump, a relay.

ESP8266: Acts as the system's "brain, managing the connections and operations of the other components.

Soil moisture sensor: Measures the water content in soil, outputting an Analog voltage.

Water pump: A submersible pump circulates the nutrient solution in a h

Relay: Controls the water pump's on/off state, managed by the ESP8266.

Ploughing: its plough the soil when soil moisture detect low.

Seeding: its used to seeding the different dropping into the ploughing lines.

V. SOFTWARE IMPLEMENTATION

Software implementation for a project utilizing an ESP8266 &Arduino uno microcontroller for a sensor data acquisition, processing, and remote monitoring. It details the steps from setting up the Arduino IDE and including necessary libraries to implementing control logic, wi-fi connectivity, and an alert system. Key aspects include reading sensor data, converting it into meaningful units, controlling external devices based on sensor readings, and enabling remote access and alerts through a web interface or mobile app. The steps detailed are:

1.Arduino IDE: Use the ESP8266, ensuring the necessary board support package is installed.

2.Library inclusion: Incorporate required libraries for sensors (e.g.,servo.h) and the ESP8266's wi-fi capabilities.

3.Sensor data reading: Use Analog Read () for Analog sensors and digital
read () for digital sensors.

4. Data processing: Transform raw sensor readings into useful units such as Celsius, percentage, or soil moisture content.

5.Control logic implementation: Control external devices (e,g water pump) on sensor readings (e.g., low soil moisture, detection).

6.Wi-fi configuration: Set up the ESP8266 to connect to a wi-fi network.

7. Web interface/mobile application development: Design a platform for displaying sensor information and remotely accessing the system utilizing HTML, CSS, Java script, or an appropriate framework. ESP8266 can be employed to host a simple web server for this.

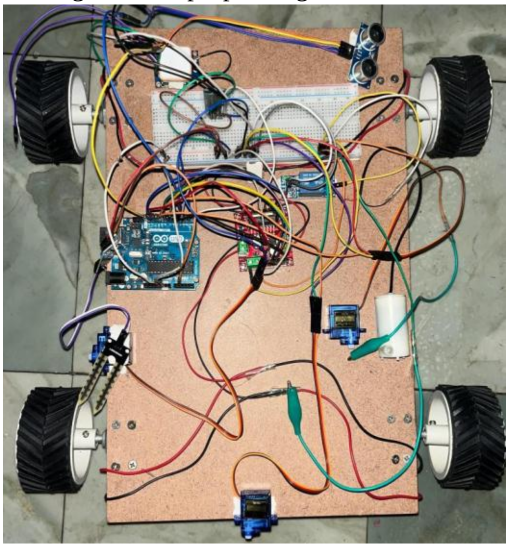
VI. RESULT

Project is built as a 4 wheeled robot based on Arduino, Moisture sensor, Bluetooth module, Water Pump motor, DC motor, Motor driver.

The Agricultural Robot is powered "ON". The Robot begins moving in the forward direction along with moisture sensor also being "ON". Auto mode Bluetooth interfaced android app is utilized to track the operation status of Robot. It is utilized to switch on the Robot and get it moving in forward, backward, left and directions. The key mechanisms are (i) Water pump is ON/OFF based on Moisture sensor by sensing the moistness of soil. (ii) Robot is switched ON/OFF through Bluetooth for ploughing land, seed sowing and spraying fertilizer.

This project is mainly focus on minimizing man power as well as cost of the equipment. Flexibility of automation system is high than traditional system. In this work a robot is built and established to carry out automatic Ploughing, Seeding, Irrigation, Fertilizer Spraying in an agriculture field.

Figure Multipurpose Agricultural Robot



VII. CONCLUSION

This paper focuses on reducing labor and equipment costs, making agricultural technology more affordable for all farmers. Most of the current successful Agri-bot models rely on large, fuel-powered internal combustion engines and heavy machinery. These not only require skilled technicians to operate but also contribute to environmental pollution and the depletion of fossil fuels.

To address these issues, this project introduces an automated, unmanned Agri-bot designed to carry out farming tasks with minimal human intervention. The robot is built with two main functions: the first is to navigate the vehicle itself, and the second is to perform farming activities such as ploughing, sowing seeds, and watering the land. Looking ahead, the project envisions incorporating predictive irrigation systems to make farming even more efficient.

We have developed an Agri-bot, a type of agricultural robot, that is capable of watering, planting, fertilizing, and applying pesticides. Using less energy and fewer people.

In agriculture, the chances for robotic productivity enhancement are immense and robots are coming on the farms. To enhance the efficiency in the agricultural sector there is a need of the mechanical control system. This can be done by the robots which can work faster with more productivity. In this project we have developed a farming robot which is capable of doing various operations like seeding, ploughing, pesticide spraying, watering and measuring the moisture in the soil and turn on/off the motor accordingly without the need for human intervention. The suggested multipurpose robot is designed to minimize man power in the agricultural sector and chemical hazards to health. Hence, a process is initiated such that the robot turns into an assistance to the farmers.

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