Smart Tractor Using ESP32

Vivek Vishwakarma *Krishna Thakur* *Kailash Singh* *Shashank Prajapati*

vishwakarmavivek-extc@atharvacoe.ac.in thakurkrishna-extc@atharvacoe.ac.in *singhkailash-extc@atharvacoe.ac.in* *prajapatishashank-extc@atharvacoe.ac.in*

Electronics and telecommunication, Atharva college of Engineering affiliated to Mumbai University, Malad West, Mumbai, Maharashtra.

Abstract- **The phrase "Internet of Things" (IOT) refers to how daily activities are connected via the internet. Devices and objects are interconnected according to the IOT concept. This technology's quick development caused the industry to transition from statistical to quantitative methods. IOT is also used in smart agriculture. We integrate IOT with smart tractors. It makes the whole system intelligent. An autonomous vehicle that integrates technological components is a smart tractor. It effectively completes tasks, controls them with intelligence, guarantees safe agriculture, and is suitable for people. Currently, as the population grows, so do the needs. To maximize productivity for farmers, it is critical to use the smart tractor in the sector of agriculture. When ploughing, we employ a smart tractor to detect the color of the soil. Plowing will take place here using a ploughing tool. Since the car is totally autonomous, voice instructions can cause it to do a number of things. Activities are managed by a personal computer (PC) or mobile device with internet access, and electronic devices such colour sensors, nodemcu, and servomotors will carry out the operation. The conventional agrarian tactics are being disrupted by these changes in farming, opening up new opportunities with a variety of challenges.**

Keywords: IOT, Smart Device, Tractor, Arduino, Automation, Farming.

I. INTRODUCTION

The majority of India's industrial fields are now impacted by IOT. All people are moving toward a smarter world. The Internet of Things (IOT) is a popular technology from the 20th century that is highly helpful in our daily lives. We develop our own ideas and use IOT to put them into practise. Intelligence will continue to have an impact on our lives in the future. It enables agriculture to have an impact on arable farming and our environment. It provides a thorough picture of the state of agriculture today. The description of various techniques, capacities, and applications is the function of IOT in agriculture. It focuses on the use of official protocol and communication technology. It addresses the primary issues raised by IOT in agriculture. Artificial intelligence, robots, autonomous monitoring, sensing, and control of farmland are all examples of "smart agriculture." It is the primary concern and a hot topic for all countries. Because industry 4.0 is entirely automated, automation in agriculture must be implemented. A different phrase for employing computers to calculate the value of prediction, detection, quality, and other characteristics is "digital agriculture." This essay tries to use Internet of Things (IOT) expertise in the realm of agriculture. We describe the details of IOT technology, protocols used in agriculture; challenges, opportunities and benefits of automation in the agricultural field.

According to a survey conducted by the United Nations Food and Agriculture Organization, global food production should be increased by 70% by 2050 to accommodate the growing population[XV]. Agriculture is the foundation of the human species because it is the primary source of food and plays an important role in the economic growth of the country. It also provides a large number of job opportunities to the people. Farmers continue to use traditional agricultural methods, resulting in low crop and fruit yields. Thus, crop yield can be increased by using automatic machinery. In order to increase yield, modern science and technology must be implemented in agriculture.

II. LITERATURE REVIEW

Paper Name:

SURVEY PAPER ON AgRo-Bot AUTONOMOUS ROBOT[I]. International Research Journal of Engineering and Technology (IRJET) Dec 2019, Punam K. Jadhav, Shivani S. Deshmukh, Prerana N. Khairnar

Work Done:

The making an android application that will control the robot. The Android application is also responsible for crop prediction, weather detection, and grass cutting. It is a movable robot and has a sensor mounted on it. WIFI or Bluetooth is used for wireless transmission and controlling robots. Weather prediction is also being done by our system as well as 360* spraying.

Conclusion:

The system has multiple features like grass cutting, weather detection, crop prediction, etc. System is overcoming the drawback of existing systems and also it's easy to use. Hence our system is one of the innovation that helps our farmers to grow, maintained and monitor the crops

Paper Name:

Smart Agriculture Robot for Sowing Seed International[Ⅶ] Journal Conference Paper Publishing 2021 Prakash Kanade, Ashwini P. Department of Electronics and Communication LeenaBOT Robotics, Bangalore, Karnataka, India

Work Done:

Proposed project is constructed as a 4-wheel robot using Arduino, Sensors, motor drivers and Bluetooth. This system gives a well design with low power cost effective and efficient output. Results of seed placement depend on the type of land which is tracked using sensors.

Conclusion:

The proposed robotic machine for Agriculture is an automated Seed sowing machine which has the ability to increase productivity. It has the capability to handle the weight of the complete setup properly performing all the operations. Seed sowing patterns are observed under different conditions. All the data in Robot is collected in an Android application and saved for future processes.

Paper Name:

Smart Tractors in Pistachio Orchards Equipped with RFID 2022 3rd International Conference on Electronics and Sustainable Communication Systems (ICESC)
Farshid Sahba Informatics Institute, National Academy of Sciences of Armenia, Yerevan, Armenia.
Zahra Nourani Computer Faculty, Raja University, Qazvin, Iran

Work Done:

The goal of this paper is describing a smart system which manages the pistachio orchard. In this system the RFID tags which are equipped with sensors are installed on the side of pistachio trees and will sense and save the temperature and humidity in Real Time mode. If the humidity or temperature is not in a good condition, a tractor equipped with a watering and poison tank, air conditioner and humidifier will be activated and sent to the tree.

III. CIRCUIT DIAGRAM

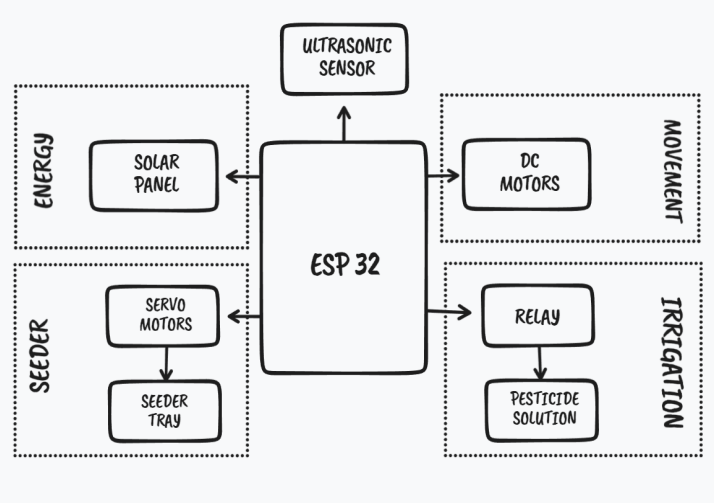

Fig 1. Block diagram of Smart Tractor

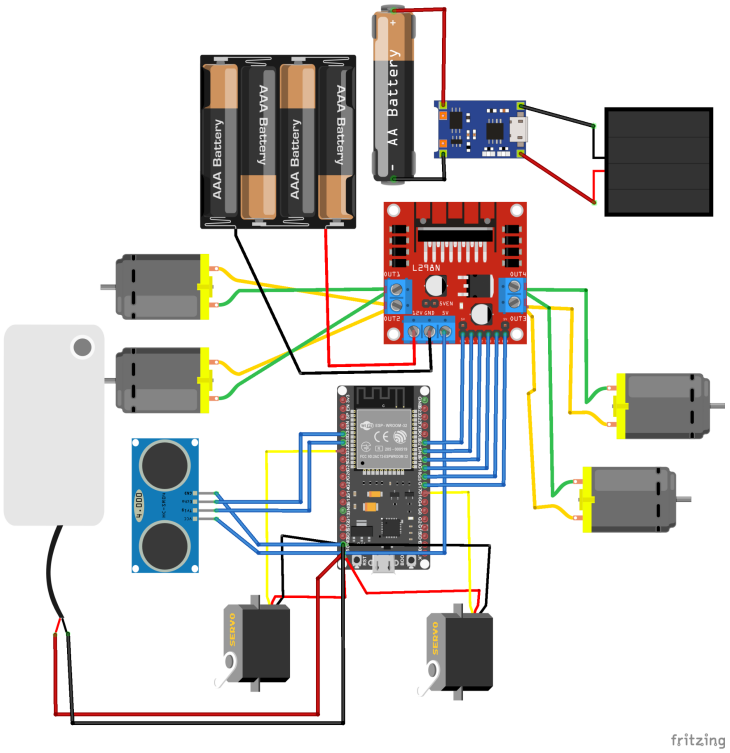

Fig 2. Circuit diagram of Smart Tractor

The ESP32 is the heart and brain of our project, as shown in the block diagram above. We are also powering and charging our circuit with solar panels. We use DC motors to rotate the wheels of our smart tractor, and a

bluetooth module to control its moments, as well as a relay to control all motors. We've also included an ultrasonic sensor to detect what's in front of the smart tractor and respond appropriately to various situations. We're also using servo motors to build a seeder and ploying mechanism that will be controlled via bluetooth input buttons from the phone. We also added a humidity sensor to check soil humidity and add the amount of water needed for the specific type of soil and crop.

We also have a water pump that is controlled[Ⅲ] by a phone via ESP32 and bluetooth to water the plants. As a backup power source, we have a 12V power supply. To make the smart tractor work, everything is connected via ESP32 and is in proper synchronization.

IV. COMPONENTS

1. ESP32

ESP32 is capable of functioning reliably in industry applications, with an operating temperature ranging from –40°C to +125°C. ESP32 can dynamically erase external circuit defects and adjust to changes in external conditions because of its sophisticated calibration circuitry. The ESP32 chip, designed for mobile, wearable, and Internet of Things applications, uses a variety of proprietary software to achieve extremely low power consumption. Modern features like fine-grained clock gating, several power modes, and dynamic power scaling are also included in ESP32. ESP32 can function as a full standalone system or as a slave device to a host MCU, which lessens the burden on the primary application CPU caused by communication stack overhead. Through its SPI/SDIO or I2C/UART interfaces, ESP32 may connect to other systems to provide Wi-Fi and Bluetooth capability.

2. DC Motors

Any of a group of rotating electric motors that use direct current (DC) electricity to create mechanical energy is referred to as a DC motor. The majority of types rely on the magnetic field's forces. For a portion of the motor's current to occasionally shift direction, almost all types of DC motors contain an internal mechanism that is either electromechanical or electronic. Because they could be supplied by existing direct-current lighting power distribution networks, DC motors were the first type of motor that was widely employed. A DC motor's speed can be varied across a large range by varying the supply voltage or the amount of current flowing through its field windings.

3. Servo Motors

The rotary actuator or linear actuator known as a servomotor (or servo motor) enables precise control of angular or linear position, velocity, and acceleration. It consists of an appropriate motor connected to a position feedback sensor. It also needs a rather sophisticated controller, frequently a special module created just for use with servomotors. Although the word "servomotor" is frequently used to describe a motor appropriate for use in a closed-loop control system, servo motors are not a particular sort of motor. Applications for servo motors include robotics, CNC equipment, and automated manufacturing.

4. Relay

An electrically controlled switch is a relay. It is made up of a set of working contact terminals and a set of input terminals for one or more control signals. Any number of connections in different contact configurations, such as make contacts, break contacts, or combinations of both, may be included on the switch. Relays are employed when multiple circuits need to be controlled by a single signal or when a circuit has to be controlled by a separate, low-power signal. In order to refresh the signal coming in from one circuit by transmitting it on another circuit, relays were originally utilized in long-distance telegraph circuits. To carry out logical processes, relays were widely utilized in early computers and telephone exchanges.

5. Ultrasonic Sensor

An ultrasonic sensor is a piece of technology that uses ultrasonic sound waves to measure a target object's distance and then turns the sound that is reflected back into an electrical signal. The speed of audible sound is greater than the speed of ultrasonic waves (i.e. the sound that humans can hear). The transmitter (which generates sound using piezoelectric crystals) and the receiver are the two major parts of an ultrasonic sensor (which encounters the sound after it has traveled to and from the target).

6. Solar Panel

A photovoltaic cell assembly installed in a framework is called a solar cell panel, solar electric panel, photo-voltaic (PV) module, or solar panel. Solar energy is harnessed by solar panels to provide direct current power[XVI]. A system of PV panels is known as an array, and a collection of PV modules is known as a PV panel. Electrical equipment is powered by solar energy from photovoltaic arrays.

V. CONCLUSION & FUTURE SCOPE

In this study, we suggest an intelligent Internet of Things (IoT) based agriculture system that aims to automate farming[Ⅷ] and increase crop output. The farmer can use this low-cost, straightforward solution to automatically regulate most farming needs. The system may evaluate sensor data that is transmitted through the cellular network to conduct corrective and preventive action. The results of this work will make it easier for farmers to use the improved technology. The method saves energy and uses less water by only managing irrigation when it is actually needed.

On the basis of a literature review, the following conclusions are drawn. In the present day, it is crucial to adopt IoT-based smart tractors in agriculture. It decreases working hours and manual labor, which lowers the possibility of human error. It reviews the most recent and cutting-edge agricultural technology applications. It suggests a technique that could produce messages on different platforms to inform or advise farmers. Using IoT in farming will address a number of issues. Our goal in this project is to deliver a working product that farmers can utilize immediately. Last but not least, our technology has been applied in an IoT-based smart tractor that is incredibly beneficial to both farmers and the environment.

It is able to support the weight of the entire setup while effectively carrying out all the procedures[Ⅱ]. Under various circumstances, seed sowing patterns can be seen. Robot's entire data set is gathered and preserved in an Android application for use in the future. The expansion of the nation's economy and rise in production are directly impacted by agricultural robotics. The primary goal of agricultural research experts is the complete replacement of laborers by robots. There is a lot of potential for farming to be completely automated[Ⅸ] in the future; however, only a few locations in India have robotic implementation. Farmers can benefit from the automated agriculture systems for farming. The farmer may remotely monitor the crop field with the use of these systems, saving him time, money, and effort. There are innumerable systems in use today that employ various automation and communication mechanisms. These systems, however, are incomplete and have several shortcomings. This essay has provided a summary of the various traits, benefits, and drawbacks of current systems. Existing systems have room for development, and this essay should be helpful in creating a more advanced automated agriculture system that is free from the majority of their flaws.

The system can be modified so that the farmer can operate it via an Android web application. Web servers that include machine learning can offer wise guidance for productive farming. In the future[Ⅳ], the system may potentially include automated fertilizer and insecticide application.

VI. ACKNOWLEDGMENT

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