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Survey on "Agritech" A multi-feature UGV for Enhanced Agricultural Productivity

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ABSTRACT: In India agriculture serves as a primary source of livelihood for 50% of the population, contributing substantially to the nation's GDP (Gross Domestic Product). This paper aims to design an agricultural device that can perform operations like ploughing, sowing of seeds, spraying pesticide, cutting grass, and with camera monitoring. This eliminates the problems farmers face using traditional farming methods by reducing labor costs, saving time and manual labor, and increasing agricultural productivity. User can control this device through his phone and they can choose which operation has to be performed thus the farmer does not need to be in the field personally. The user selects the desired operation through his phone all the motors are connected to the relay which is interface to node MCU. A relay is an electrically operated switch consisting of input terminals and a set of operating contact terminals. When the sowing operation is selected, the node MCU drives the relay associated with it and the other relay will be in off mode causing the operation to be performed. Due to its multitasking functional system, it is very beneficial compared to other agricultural vehicles by addressing labor shortages and offering smart technology, user-friendly controls, and surveillance capabilities, our project signifies a significant leap forward in agricultural innovation, empowering farmers to embrace a more sustainable and productive future.

KEYWORDS: Relay, Node MCU, Lead Acid Battery, Blynk app, ESP32 Camera, Drive Motor, Monitoring.

I. INTRODUCTION

In India, where agriculture is the primary livelihood for half of the population and a cornerstone of the economy, farmers grapple with persistent challenges stemming from traditional farming methods. Labor-intensive operations like ploughing, seeding, pesticide spraying, and grass cutting require substantial manual effort and time, resulting in inefficiencies and lower yields. Additionally, ongoing labor shortages exacerbate these difficulties, impacting overall productivity and economic sustainability. Existing agricultural vehicles often lack integrated functionalities, limiting their ability to address multiple farming needs concurrently. This paper proposes a cutting-edge agricultural device leveraging advanced robotics and automation. Our device integrates a comprehensive suite of operations ploughing, seeding, spraying, and grass cutting controlled remotely via a user-friendly smartphone or laptop interface. Real-time camera monitoring provides farmers with visual oversight and control, enhancing operational efficiency and reducing reliance on manual labor in the field. By harnessing sophisticated technologies, our project aims to revolutionize agricultural practices, enabling farmers to optimize productivity, mitigate labor costs, and effectively manage labor shortages. This innovative approach signifies a significant leap forward in agricultural innovation, fostering sustainability and resilience within India's vital agricultural sector.

II. METHODOLOGY

The AgriTech model offers a variety of capabilities, including plowing, cutting, seed sowing, and water spraying, making it versatile for various agricultural tasks. Fig 1 shows the block diagram of the UGV which is operated via WiFi connectivity, the vehicle utilizes a 7AH lead acid battery as its primary power source and ESP32 camera is utilized for monitoring. Control of the AgriTech model is facilitated through the Blynk App, allowing for seamless operation and overseeing of agricultural activities. Overall, these features aid in the advancement of a multi-feature unmanned ground vehicle (UGV) aimed at enhancing agricultural productivity.

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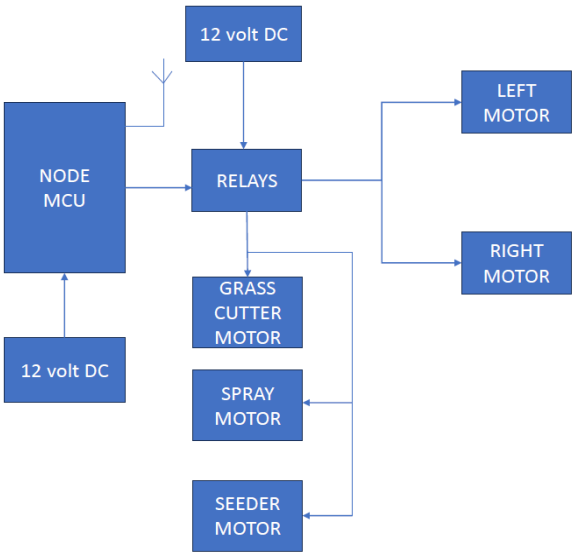

Figure 1: Block diagram of UGV (Unmanned Ground Vehicle)

III. LITERATURE REVIEW

Ranjitha B et.al [1] developed a sun oriented fueled multipurpose farming robot that was planned and created. This robot is intended to perform complex cultivating undertakings like seed planting, grass cutting and pesticide splashing. Seeds of two different sizes can be sowed. The advantages of robots are decreased human intercession and proficient asset use. Directions are passed to the framework utilizing. Bluetooth guarantees no immediate contact with people and in this way wellbeing of the administrator is guaranteed. The robot is sun powered fueled consequently it is a sustainable power source. The activities are performed utilizing an Android application. These highlights have a huge impact on horticulture. By utilizing this exceptional work, ranchers can save additional time and lessen a great deal of work costs. The ongoing seed planting, pesticide showering and grass-cutting strategies are troublesome, costly, and badly designed to deal with. So the farming framework in India ought to be supported by fostering a framework that will lessen the labor supply and time. The point is to configure, and foster a robot that can plant the seeds, cut the grass, and splash the pesticides.

Prof.Shweta Madiwalar et.al [2]] The exploration paper specifies the issues in the field of agribusiness, and creates arrangements by planning and fostering the performing of multiple tasks independent agrarian robot. The sped-up development in the ventures is one of the affecting elements for individuals to move to the urban areas. This prompts the deficiency of rural work as well as the interest for wages will likewise increment. The essential conveniences like food, garments, and different wares are expanding continuously. This makes the workers interested for additional wages yet it becomes exorbitant for the land proprietors. Given such factors, the ranchers are affected to pass on their property to be crude even though they have an interest in the horticultural exercises. This venture helps the ranchers at the beginning stages for example during the planting and preparing, similarly the further course of planting the seeds in 4 rackets at a single case. The proposed robot can supplant the human somewhat to play out tasks like planting, computerized development, seed giving, insect poison showering what's more, meadow injuring. This task assumes a significant part in taking care of the work issues. Rural computerizations are broadly utilized at the gathering stage, burrowing, developing, what's more, cultivating. This paper manages the exchange and improvement of minimal expense, low power, and less human exertion robots in agronomic applications.

Siddharth Gupta et.al [3] planned and fostered a multipurpose bot that can play out every one of the cultivating activities counting furrowing the dirt of the field, planting seeds in the furrowing region, making the field plain by utilizing leveler, preparing them, and to screen it by utilizing the camera. Conventional cultivating strategies consume a great deal of difficult work. A portion of the tasks are manual, while others are machines that work physically. In this way, no such robots can play out all tasks independently. Also, the rancher needs to take a look at the field for various reasons. By utilizing a camera we can screen the harvest growth, drip irrigation, fertilizing keeping up with temperature, and extra water evacuation This paper likewise advances the work cost for the ranchers and it rations the important opportunity to

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put resources into some different things like this, farming can be made more effective and in a precise way with the assistance of Agribot

Ravi Kant Jain[4] et.al In this exploration work an electronic application for a versatile robot utilizing the IOT stage is examined where a framework engineering is likewise intended for observing air quality in the climate and controlling the robot position. The versatile robot communicates with a microcontroller furthermore, a hub MCU for remote interchanges with the cloud network framework. In this cloud network framework, the information is put away effectively and can be gotten to somewhat through the electronic framework. By creating and working the versatile robot through a web application, it is exhibited that the robot can be controlled through versatile Android applications anyplace. This gives a decent answer for checking the modern loop mines, pipelines, burrows, and so on where the arrangement of the human is extremely challenging. During advancement, wheel wheel-based mechanical system is utilized and the four wheels are associated with the two engines where two haggle engines are associated at the front and another two haggle engines are associated with the backside. The development of wheels is controlled through a microcontroller.

Aishwarya K Telkar and colleagues [5], an observation robot has been meticulously planned and developed to function as a surveillance system, capturing crucial information about intruders in order to facilitate prompt pursuit by soldiers. The robot is armed with a laser firearm, enabling immediate response to intruders. Overcoming challenges related to short-range communication for robot control is achieved through the implementation of IoT technology. The robot's movements can be controlled manually using IoT technology or in automated mode via an Android phone or computer from anywhere across the globe. The project comprises five key stages, encompassing manual and automated control, remote night vision with live video streaming and sound communication, integration of PIR and Metal detection sensors, incorporation of GSM and GPS technology, and the inclusion of a laser weapon. The robot's execution initiates upon detection by the PIR and Metal detector sensors. The primary aim of the project is to minimize casualties and enhance safety in conflict zones. The robot's versatile capabilities extend to various applications, including bomb detection in public places, with the identified bomb's location tracked using GPS. Additionally, the robot proves useful in natural disasters like earthquakes, where it can identify humans trapped under structures through the PIR sensor.

Tanmay Nagdeve's [6] research focuses on the design and operational methodology of a mechanized seed planting system implemented in a seed planting robot. The primary objective of this system is to automate the seed planting process. Various designs of the seed picker have been developed to accommodate different types of seeds. Automation is a growing trend across various sectors, including agriculture. Traditionally, agriculture involves numerous repetitive tasks and manual labor with low efficiency for planting, irrigation, fertilization, monitoring, and harvesting over vast areas of crops. This robot is capable of performing these tasks with reduced reliance on human labor. Considering several challenges faced by cotton farmers such as labor shortages, high wage rates, and insufficient technical knowledge, part of the solution to these issues lies in automating the agricultural processes that are currently carried out manually.

Prajith A S et.al [7] Agrobot, the Automatic Agricultural Robot, powered by robotics and Arduino Mega 2560, improves traditional farming by minimizing losses. It precisely handles seed planting and soil digging, reducing labor, increasing production, and lessening environmental impact. Emphasizing agriculture's role in economic development, especially in places like India, Agrobot, controlled by Arduino and various sensors, offers features like Bluetooth data transfer, seedbed prep, and autonomous field coverage with ultrasonic sensors, GPS, and GSM modules. Driven by a mobile app, Agrobot streamlines operations with cameras and grippers, reducing human effort and enhancing efficiency in small to medium-scale agriculture. In conclusion, Agrobot emerges as an eco-friendly, cost-effective solution, addressing labor challenges in the agricultural field.

Imtiyaz Ahmed B K[8] et al.'s research explores various methods aimed at improving the quality of modern farming. Specifically, the integration of Artificial Intelligence with Robotics, along with advanced sensor technology, is proposed for the next level of advancement in agriculture. The significant aspects of precision farming, such as the use of automated vehicle guidance systems and various soil types and their management, are discussed to enhance crop yield. The application of basic Genetic Algorithms for seed planting and simulation results using MATLAB is presented, demonstrating the successful utilization of these algorithms and motor pattern approaches for optimal seed planting resulting in maximum yield. Additionally, the potential use of various interconnected mobile robots is suggested, which could aid in field mapping, seed or crop monitoring, crop management, and necessary actions. Furthermore, mobile robots are capable of monitoring weather conditions, a crucial factor for crop development and harvest time. By

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monitoring environmental factors and weather, the robots could provide valuable data on field conditions, such as watering and pesticide spraying for optimal plant growth.

Y Nikhil Kumar [9] et al.'s research involved the design and development of a mechanized seed-planting robot. The robot utilizes an ultrasonic sensor to detect obstacles, and when an obstacle is detected, the robot changes its direction to avoid it. Control of the robot is achieved through the Blynk application, allowing for switching between automatic and manual modes. Seeds are dropped using a cell feed mechanism, where seeds are collected and dispensed by cells positioned around the perimeter of a circular plate or wheel. The rotation of the wheel is controlled by a relay programmed to operate at specific intervals based on seed spacing. Solar energy is utilized to charge the battery, which powers the DC shunt motor, Arduino, and other components. An ultrasonic sensor placed at the front of the agribot detects obstacles, enabling the agribot to adjust its path accordingly. Instructions to the agribot are provided through a mobile application using the Internet of Things (IoT). The developed agribot has been tested in various fields and found to be highly accurate.

Farha Rafath [10] et al.'s research aims to collaborate with ranchers to facilitate their work and increase efficiency through multitasking features such as cultivating, planting, ploughing, and spraying pesticides with obstacle detection. These advanced features overcome the challenges faced by farmers in cultivating their land in any climatic condition. The primary objective of this project is to develop an embedded system-based application for multipurpose farming using a solar-powered robot. The robot incorporates a visual obstacle detector and a Bluetooth module paired with a smartphone application, allowing easy control and instructions for task execution. As a result, this low-cost robot is simple to operate without the need for physical presence in the field. It assists farmers in reducing human effort, saving time, and conducting farming operations efficiently in any weather condition, day or night. Compared to other robots, this agribot is highly beneficial due to its multitasking functionality and advanced techniques for smart farming.

G. M. Sharif Ullah et.al [11] Agriculture holds significant importance in Bangladesh's development, and the AGROBOT project aims to revolutionize the sector by combining the expertise of electrical and agricultural scientists. This robotic system, powered by clean energy sources like sun based power, focuses on tasks such as plowing, seeding, and fertilizing. The goal is to enhance agricultural productivity and minimize costs, making it accessible for traditional farmers. With Bangladesh's vast population and fertile lands, implementing AGROBOT commercially could boost the efficiency of the agricultural sector, contributing to economic development. The independent and cost-effective design of AGROBOT has shown desirable results during testing, suggesting its potential to bring about a revolutionary change in farming practices, not only in Bangladesh but internationally as well.

Abhishek M B et.al [12] In India, agriculture plays a key job in the economy, and there's a growing need for technology in farming. This new robot is developed to make farming tasks like digging, sowing, and irrigation easier, cutting down on labor costs and boosting productivity. It runs on solar energy making it eco-friendly but also reduces pollution. The robot can do various tasks like digging and leveling, and it uses image processing(digital) for precise seed spacing. By using solar-powered automation, this robot aims to make farming more efficient, saving farmers time and effort and contributing to the progress of Indian agriculture.

IV. EXPECTED RESULT

The AgriTech model offers a range of capabilities, including plowing, cutting, seed sowing, and water spraying with a camera making it versatile for various agricultural tasks. Operated via WiFi connectivity, the vehicle uses a 7AH lead acid battery as its primary power source. Regulation of the AgriTech model is facilitated through the Blynk App, allowing for seamless operation and administration of agricultural activities. Overall, these features support the advancement of a multi-feature unmanned ground vehicle (UGV) aimed at enhancing agricultural productivity.

V. CONCLUSION

In the implemented system, a prototype of vehicle has been developed to perform various agricultural tasks, including ploughing the field, sowing seeds, pesticide/water spraying, and cutting weeds. By addressing issues such as labor wages, improper seed dispersal, water wastage, and soil fertility loss, Agribot offers a solution to enhance agricultural efficiency. This multipurpose agricultural vehicle, significantly reduces the effort and time required by farmers compared to traditional cultivation methods. With its battery-operated system and Wi-Fi control, Agribot minimizes manpower and

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allows farmers to engage in secondary activities simultaneously, thereby increasing their income and contributing to the Indian economy's development.

The integration of vehicle in agriculture presents vast opportunities for enhancing productivity and addressing various challenges. The vehicle, with its versatility and efficiency, can help overcome obstacles associated with autonomous farm equipment. The use of smaller, more accessible machines offers advantages in terms of acceptability and efficiency, potentially transforming agricultural practices. By reducing the need for manpower and time, vehicle offers cost-effective solutions when manufactured on a large scale. This approach has the potential to address the pressing needs of Indian agriculture, contributing to the sector's advancement and overall improvement. In conclusion, the AgriTech project's development of a vehicle represents a significant step towards achieving enhanced agricultural productivity and addressing contemporary farming challenges in India.

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