IoT Integrated Agricultural Surveillance Bot

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Abstract- *The IoT Integrated Agricultural Surveillance Bot, a highly versatile and intelligent farming assistant designed to revolutionize conventional farming practices. IoT Integrated Agricultural Surveillance Bot integrates innovative features, including a camera gimbal, weed cutter, pesticide sprayer, sensors, and a robust four-wheel-drive system, offering a comprehensive and efficient approach to precision farming. The IoT Integrated Agricultural Surveillance Bot using camera gimbal employs computer vision algorithms to provide real-time field analysis, allowing farmers to monitor crop health, growth patterns, and detect anomalies. Simultaneously, the weed cutter utilizes Arduino and IOT based technology to remove invasive plants, ensuring the optimal growth of crops. The pesticide sprayer, equipped with precision spraying technology, accurately administers pesticides, reducing wastage and environmental impact. Furthermore, IoT Integrated Agricultural Surveillance Bot incorporates a diverse array of sensors, including humidity and temperature enabling farmers to gather essential data about soil conditions. This data-driven approach empowers farmers to make informed decisions, leading to resource optimization and sustainable farming practices. The four-wheel drive IoT Integrated Agricultural Surveillance Bot seamlessly navigates through challenging terrains, enhancing its accessibility and usability across diverse agricultural landscapes.*

Keywords- Arduino Mega 2560, Camera IOT, Multipurpose, Sensors

I. INTRODUCTION

In the era of technological advancements, the integration of Internet of Things (IoT) in agriculture has revolutionized traditional farming practices. The IoT Integrated Agricultural Surveillance Bot represents a cutting-edge solution that combines surveillance, real-time monitoring, and precision agriculture to enhance crop management and yield optimization. This innovative bot serves as a proactive guardian for farms, employing a network of sensors, actuators, and smart devices to create an intelligent and interconnected agricultural ecosystem. In addition to its monitoring capabilities, the IoT Integrated Agricultural Surveillance Bot can be programmed for autonomous actions. For instance, it can trigger irrigation systems, deploy pest control measures, or even perform routine maintenance tasks. This level of automation reduces the workload on farmers, allowing them to focus on strategic decision-making and other aspects of farm management. At its core, the IoT Integrated Agricultural Surveillance Bot is designed to monitor key environmental parameters such as temperature, humidity, and crop health. This enables farmers to make informed decisions promptly, preventing potential issues such as pest infestations, or adverse weather conditions that may impact crop productivity. The IoT Integrated Agricultural Surveillance Bot marks a paradigm shift in modern farming, leveraging technology to empower farmers with real-time insights, predictive analytics, and efficient crop management. This intelligent bot is poised to play a pivotal role in sustainable agriculture, ensuring higher yields, reduced resource wastage, and ultimately contributing to the global goal of food security.

As we continue to explore the capabilities of the IoT Integrated Agricultural Surveillance Bot, its versatility becomes increasingly apparent. Beyond its role in monitoring environmental parameters and executing automated tasks, this sophisticated system also facilitates data-driven decision-making. By collecting and analyzing vast amounts of data from the field, the bot provides valuable insights into crop growth patterns, soil health, and pest infestation trends. The Arduino Mega 2560 is a microcontroller board that is based on the ATmega2560. Arduino has 54 digital input/output pins, 16 analog inputs, and 4 UARTs (hardware serial ports). Arduino is a cross-platform which can be run on Windows, Linux, and macOS. This robot consists of a Universal camera unit where the phone, camera, and GoPro are versatile. The robot's acceleration is controlled by an Android application, and it also sends an alert message to maintain a secure system to protect the hardware parts of the robot. This robot is handled by the Bluetooth/Wi-Fi controller software Application, and we are using the GSM SIM module for the interfacing of Android mobile and system. As robotics technology continues to advance, there is potential for robots to take on even more complex tasks and operate in environments that are hazardous or inaccessible to humans.

II. LITERATUREREVIEW

In [1] we aim to create an agribot capable of performing various farming operations such as plowing, sowing, watering, and fertilizing the crops. Traditional farming methods consume a lot of manual labor, with some operations being entirely manual and others involving manually operated machines. Therefore, the agribot is designed to perform these operations autonomously and minimize or reduce the need for manual labor. Unlike existing products in this domain that provide only specific services, this system integrates all operations into a single machine, providing convenience and efficiency. IoT technology is extensively utilized for its benefits, including ease of use from any location. The bot is interfaced with DC as well as Servomotors for performing the farming operations.

In [2] we talk about the “green revolution” between 1950 and the late 1960s has caused a fundamental change in agricultural systems. To increase the crop yield, farmers started to adapt the use of hybrid seeds, fertilizers, and pesticides rather than relying on conventional agriculture techniques. To optimize the agriculture yield, farmers have to keep track of various factors, such as environmental (temperature, humidity, and CO2) terrestrial (insect detection and leaf chlorophyll), underground (soil temperature, soil humidity, and soil moisture), and irrigation (water flow and level). Along with open field agriculture, indoor farming is also getting attention because the environment cannot be controlledintheopenfield.Indoorfarminggenerallyreferredtoasgreenhousefarmingisauniquemodeofgrowingcropsundertransparentshelterstructures.Themainpurposeof greenhouses is to provide favorable growing conditions and to protect crops from unfavorable weather and various pests. Greenhouse farming also includes vertical, hydroponic, and aquaponic farming. In vertical farming, the specific crops are grown at various vertical stacked levels compared to only on single plan in an open field. In contrast, hydroponic farming does not require any soil for crop growth and relies on water and nutrients. Aquaponic combines cultivating fish with hydroponics where the aquaculture water is provided to hydroponically grown plants.

In [3] the number of hungry people has been mounting due to the COVID-19 pandemic, and surpassed 80 million in 2021, as reported by World Health Organization (WHO). Moreover, to handle the challenges of the aggravation of population ageing and acceleration of the pace of life, traditional labor-intensive and risky farmwork should be empowered by more automated control work for promising outcomes. In the aspect of academic study, many researchers have dedicated significant efforts to studying agricultural robots, especially duringtheCOVID-19pandemic. Therefore, it is reasonable to explore agriculture further using advanced technology in order to keep promoting the current status. It should be mentioned that agriculture robots and intelligent automatic systems are usually equipped with versatile sensing and fast learning units, which provide encouraging capabilities. In addition, much effort has been put towards achieving complete automation and improving the operating efficiency of agriculture robots.

In [4] the horticulture sector is more centered on the dirt culture creation. By the numerous provincial areas in India does not have the essential aptitudes, procedures and difficult work in cultivating that declines the advancement of creating nations. In this manner, the farmers are essentially required to move towards the innovation for sophisticating the field for furrowing, seed appropriating, and burrowing. By the Furrowing and seed conveying machines are worked physically, there is no robotization for both the employments. The customary strategy incorporates disseminating the seeds by hand and furthermore dibbling (burrowing the dirt and putting the seeds by hand) is performed. The fundamental thought of this paper is to do the activity of furrowing the field and seed sowing with the assistance of mechanization. By utilizing this procedure, craftsmanship can be diminished up to 95 percent. The utilization of this robot is chiefly for horticultural purposes. The robot can likewise catch the minute-by-minute work by rehearsing the camera.

III. PROPOSED SYSTEM

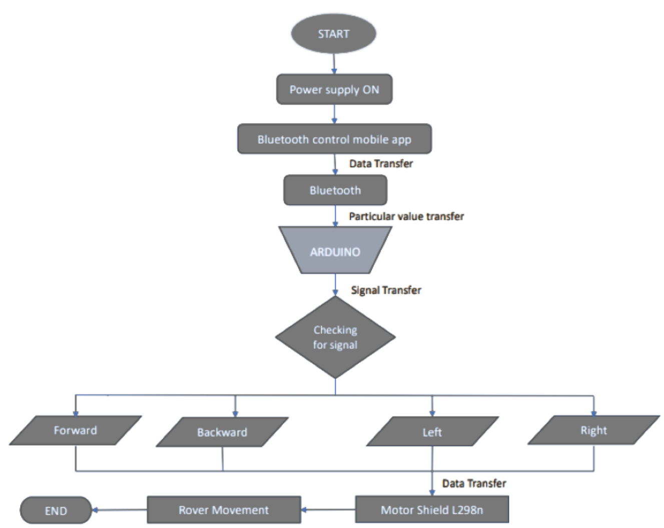

Fig 1: Flow chart for Motor directions

The Figure 1shows the flowchart which illustrates the step-by-step process for controlling the direction of a motor, likely for a rover or mobile robot, using a smartphone app. Let's delve deeper into each stage:

Power up: Switching on the power supply is the initial step in the process. This action ensures that all electronic components, including the Arduino board, motor driver shield, and Bluetooth module, receive the necessary electrical energy to operate. Upon powering up, the components undergo initialization procedures to ensure they are ready to receive and transmit data.

Bluetooth Connection: Once powered up, the system initiates a Bluetooth connection between the smartphone app and the Arduino board. Bluetooth technology facilitates wireless communication between the smartphone and the Arduino, establishing a reliable data transmission channel. The connection process involves pairing the smartphone with the Arduino's Bluetooth module, allowing seamless communication between the two devices.

Data on the Move: With the Bluetooth connection successfully established, data begins to flow between the smartphone app and the Arduino board. This data carries specific instructions regarding the desired direction (forward or backward) of the motor, as inputted by the user through the smartphone app.

Targeted Delivery: Upon receiving the data from the smartphone app, the Arduino board acts as an intermediary or middleman. The Arduino interprets the instructions received from the app and processes them to generate suitable signals for controlling the motor's direction.

Commanding the Motor Shield: Once the Arduino processes the received data, it transmits corresponding signals to the motor driver shield. The motor driver shield, such as the L298N shield, is designed to interface between the Arduino and the DC motor, providing the necessary power and control signals to drive the motor.

Motor in Motion: Based on the signals received from the Arduino via the motor driver shield, the DC motor begins to rotate. The motor rotates either forward or backward, depending on the specific instructions transmitted from the smartphone

Wrapping Up: After successfully controlling the motor's direction, the data transfer process concludes. The Bluetooth connection between the smartphone app and the Arduino is terminated, temporarily closing the communication channel until further commands are initiated.

IV. ADVANTAGES AND DISADVANTAGES

The Bot presents a multifaceted solution that holds several advantages for modern farming practices. Its integration of cutting-edge technologies such as camera gimbals, sensors, and precision spraying mechanisms enable a holistic approach to farming management. The incorporation of Arduino and IoT-based weed cutting technology ensures efficient removal of invasive plants, optimizing crop growth. Moreover, the precision spraying system minimizes pesticide wastage, thus promoting environmental sustainability. The inclusion of diverse sensors provides valuable insights into soil conditions, enabling data-driven decision-making for resource management.

Additionally, its robust four-wheel-drive system enhances accessibility across various terrains, making it adaptable to different agricultural landscapes. Overall, the IoT Integrated Agricultural Surveillance Bot signifies a significant leap towards precision farming, offering farmers the tools to optimize productivity while minimizing environmental impact.

Some of the issues which we may face is the range of the Bluetooth sensors and typically in the sensors which we have used doesn't provide a longer range for the bot to travel.

V. CONCLUSION

IoT Integrated Agricultural Surveillance Bot stands as a groundbreaking innovation poised to transform traditional farming methodologies. By amalgamating cutting-edge technologies such as IoT, and precision spraying mechanisms, it offers farmers a comprehensive toolset to optimize crop management and enhance productivity. The precision weed cutting and pesticide spraying mechanisms streamline farming processes, minimizing resource wastage and environmental impact. However, challenges such as initial costs, training requirements, and technical vulnerabilities underscore the need for careful implementation and ongoing support. Nevertheless, the potential benefits in terms of increased efficiency, resource optimization, and sustainability make the IoT Integrated Agricultural Surveillance Bot a promising solution for modern agriculture, paving the way towards a more technologically advanced and environmentally conscious farming future.

VI. FUTURE SCOPE

With increase in IoT devices and rise in technology we can implement much more features such as high range and signals for communication with the bot and surveillance, Having a higher range in the bot can be used to scale bigger farms and plots and also implementing a large battery capacity

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