Intelligent Robot For Pesticides And Water Spay

Y. Apparao[1], S. Shakeena[2], D. Jayanthi[3], I. Vara Lakshmi[4], P.S.S. Manikanta[5], P. Jagadeesh[6]

[1]AssistantProfessor, Department of Electronics and Communication Engineering, VSM college of Engineering, Ramachandrapuram, Andhra Pradesh, India
[2,3,4,5]UGStudents, Department of Electronics and Communication Engineering, VSM college of Engineering, Ramachandrapuram, Andhra Pradesh, India

Abstract
New approaches to problems encountered by farmers have emerged as a result of the advancement of agricultural technology. In this case, the project's goal is to use Arduino microcontroller technology to design and build a robot that sprays pesticides. The robot combines a number of different parts, such as DC motors driven by an L293D motor driver, servo motors, a relay module, and a water pump motor. The two primary functions of the robot are movement and pesticide spraying. A relay module turns on the water pump motor to initiate spraying, while the servo motor regulates the direction of the spraying mechanism. Through the use of two DC motors, the L293D motor driver makes it possible for the robot to maneuver across agricultural fields with ease.

KEYWORDS: Pesticide, spraying robot, Arduino microcontroller, Servo motor, Relay, Bluetooth module, Water pump, Dc motor, L293D driver, Agricultural technology Precision, agriculture Robotics, Sustainable.

INTRODUCTION

Microcontroller are widely used in Embedded Systems products. An Embedded product uses the microprocessor (or microcontroller) to done task & one task only. A printer is an example of Embedded system since the processor inside it perform one task only namely getting the data and printing it. Although microcontroller is preferred choice for many Embedded systems, there are times that a microcontroller is inadequate for the task. For this reason, in recent years many manufactures of general-purpose microprocessors such as INTEL, Motorola, AMD & Cyrix have targeted their microprocessors for the high end of Embedded market. One of the most critical needs of the embedded system is to decrease power consumptions and space. This can be achieved by integrating more functions into the CPU chips. All the embedded processors have low power consumptions in additions to some forms of I/O, ROM all on a single chip. In higher performance Embedded system, the trend is to integrate more & more function on the CPU chip & let the designer decide which feature he/she wants to use. In the quest for more sustainable and efficient agricultural practices, the development of smart technologies has become paramount. This project introduces a smart agriculture pesticides spraying robot designed to revolutionize pest control in farming. Traditional pesticide application methods can be labor-intensive, inefficient, and environmentally detrimental due to the overuse of chemicals. Our robot aims to tackle these issues by leveraging modern technology to provide a precise, automated solution for pesticide spraying.Central to the system is an Arduino Uno microcontroller, which orchestrates the operations of various components, including four DC motors for movement, an H-bridge for motor control, a DC water pump for pesticide application, and a relay for pump activation. The integration of an LCD screen enables real-time monitoring and feedback, while the Bluetooth module allows for remote control and management, enhancing convenience and user interaction.By employing precision agriculture techniques, the robot ensures targeted pesticide application, reducing chemical usage and minimizing environmental impact.

LITERATURESURVEY

We had the opportunity to study several initiatives, journals, articles, and books that were relevant to the project's title as it developed. We think that every item that was studied was beneficial to the overall development and design of the project that we ultimately decided on. A few of the similar projects that we have examined are included in this section.

A. SMART PESTICIDES ROBOT:

An overview of the developments in agricultural robots is given in this article, with a particular emphasis on field tasks including planting, harvesting, and spraying. It highlights how robotics has the ability to increase productivity, lower labor costs, and have a smaller negative impact on the environment by talking about the several robotic platforms, sensor technologies, and control systems used in agriculture.

The development of intelligent pesticide spraying robots for sustainable agriculture is reviewed in this study. It highlights these robots' potential to lower pesticide consumption, increase agricultural productivity, and safeguard the environment as it talks about the design considerations, sensing technologies, and control tactics used in them

B. ARDUINO BASED SYSTEM SMART ROBOTIC PESTICDE

The design and development of an agricultural robot with an Arduino platform, intended for pesticide application, is presented in this work. It covers the robot's hardware and software, including the sensors, actuators, and Arduino microcontrollers.

C. DEVELOPMENT OF AN ARDUINO BASED SMART PESTICIDES SPRAYER FOR SMALL SCALE FARMERS

The goal of this project is to create a smart pesticide sprayer for small-scale farmers using an Arduino platform. It goes into the design factors, sensor choices, and Arduino microcontroller programming to make a spraying system that is both user-friendly and reasonably priced.

The study assesses the sprayer's usefulness and efficacy in small- scale agricultural environments, emphasizing how it may help farmers with limited resources apply pesticides more effectively. The creation of a smart pesticide sprayer for small- scale farmers using an Arduino platform is the main goal of this project. In order to build a spraying system that is both inexpensive and easy to use, it covers design considerations, sensor choices, and Arduino microcontroller programming. In small-scale agricultural contexts, the study assesses the sprayer's usefulness and efficacy, emphasizing its potential to enhance pesticide application techniques for resource- constrained farmers.

D. SENSOR INTEGERATION:

An effective and user-friendly spraying system is created by integrating a number of components, such as Arduino microcontrollers, sensors, and actuators, to produce an Arduino-based smart pesticide sprayer for small-scale farmers. The system's primary processing units are Arduino microcontrollers, which use preprogrammed instructions to regulate the actions of sensors and actuators. These microcontrollers offer an affordable and adaptable foundation for creating automated farming systems.

The pesticide sprayer's functioning depends heavily on sensor integration. The use of obstacle detection sensors, such as ultrasonic sensors, enables the sprayer to go across fields without running into objects like plants or rocks. Moreover, the sprayer can be equipped with moisture sensors to identify the moisture content of the soil. This allows it to modify its spraying strength according to the soil's characteristics and maximize the use of pesticides

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EXISTED METHOD

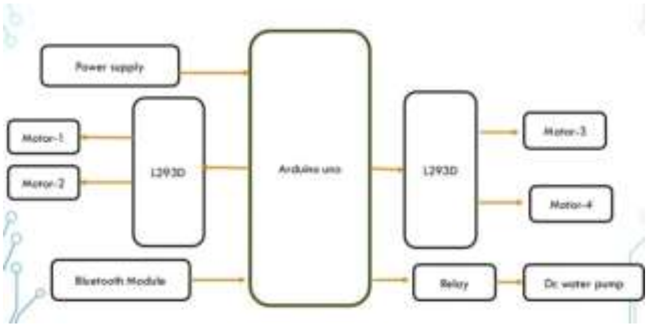
The existing system of Agricultural pesticide application, which has its roots in antiquated techniques that depend on labor-intensive manual labor and old spraying equipment, suffers a variety of difficulties. The main drawback of manual spraying is that it requires a lot of human work to apply over large agricultural areas. This inefficiency raises the risk of human mistake and results in longer spraying times, which might harm crops by distributing pesticides unevenly.

Moreover, conventional pesticide spraying techniques have significant negative effects on the ecosystem. Pesticide drift, which can be brought on by wind or ineffective application methods, contaminates nearby ecosystems, including soil, waterways, and creatures that are not intended targets. The pollution is a threat to human health, soil fertility, and biodiversity as it exposes agricultural laborers and the surrounding populations to dangerous chemicals. Further more , the resource- intensiveness of the traditional system is one of its main characteristics. The method uses a lot of fuel, water, and pesticides, which increases manufacturing costs, emissions of carbon dioxide, and depletes resources. Furthermore, the use of human labor for spraying duties makes it more difficult to ensure constant application rates and coverage and exacerbates the labor crisisin agriculture.

PROPOSED METHOD

The proposed system aims to Introduce a smart robot that sprays pesticides using Arduino microcontroller technology to overcome the shortcomings of the current pesticide application techniques. This creative strategy revolutionizes pesticide application in agriculture by utilizing automation, robots, and precision control.

Servo motors, a relay module, a water pump motor, and DC motors driven by an L293D motor driver are the main elements of the suggested system. Together, these parts allow for accurate spraying and the robot's independent mobility over agricultural fields.The Arduino microcontroller, which acts as the robot's brain and coordinates all of its activities, is the key component of the suggested system. Pesticide application may be uniformly and precisely targeted thanks to the servo motors that regulate the spraying mechanism's orientation. In the meantime, the water pump motor is turned on by the relay module, guaranteeing precise and effective dousing.



SOFTWARE

Physically, embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure

In general, "embedded system" is not an exactly defined term, as many systems have some element of programmability. For example, Handheld computers share some elements with embedded systems such as the operating systems and microprocessors which power them but are not truly embedded systems, because they allow different applications to be loaded and peripherals to be connected. Embedded systems spinal aspects of modern life and there are many examples of their use.

Embedded C is a specialized form of the C programming language designed for programming embedded systems, which are computer systems with dedicated functions within larger mechanical or electrical systems. It allows direct manipulation of hardware registers and ports, essential for controlling peripherals like GPIOs, timers, and communication interfaces such as SPI, I2C, and UART. Embedded C is optimized for memory and speed due to the limited resources typical of embedded systems. Additionally, many embedded systems require real-time performance, meaning the program must respond to inputs or changes in the environment within a strict timeframe.

Embedded systems are designed to do some specific tasks, rather than be a general- purpose computer for multiple tasks. Some also have real-time performance constraints that must be met, for reasons such as safety and usability; others may have low or no performance requirements, allowing the system hardware to be simplified to reduce costs. Embedded systems are not always standalone devices. Many embedded systems consist of small, computerized parts within a larger device that serves a more general purpose. For example, the Gibson Robot Guitar features an embedded system for tuning the strings, but the overall purpose of the Robot Guitar is, of course, to play music. Similarly, an embedded system in an automobile provides a specific function as a subsystem of the car itself.

The software written for embedded systems is often called firmware, and is usually stored in read – only memory or Flash memory chips rather than a disk drive. It often runs with limited computer hardware resources: small or no keyboard, screen, and little memory.

Embedded C extends the standard C language with features and functionalities specifically suited for embedded systems programming. It includes direct access to hardware-specific operations and low-level memory management, which are critical for developing firmware and drivers. Programs written in Embedded C often run on microcontrollers, which are integrated circuits that combine a processor core with memory and peripheral interfaces. This programming language provides control over hardware at a granular level, enabling highly efficient code that can operate on devices with limited processing power and memory. Furthermore, Embedded C supports real-time operation, ensuring timely responses to inputs or environmental changes, which is essential for many embedded applications. Its ability to directly interact with hardware, coupled with optimizations for resource constraints, makes Embedded C indispensable for developing reliable and efficient embedded systems.

In this context, the sensing and computation nodes are considered part of the sensor network; in fact, some of the computing may be done in the network itself. Because of the potentially large quantity of data collected, algorithmic methods for data management play an important role in sensor networks. The computation and communication infrastructure associated with sensor networks is often specific to this environment and rooted in the device and application-based nature of these networks. For example, unlike most other settings, in- network processing is desirable in sensor networks; furthermore, node power (and/or battery life) is a key design consideration. The information collected is typically parametric in nature, but with the emergence of low-bit-rate video [e.g., Moving Pictures Expert Group 4 (MPEG-4)] and imaging algorithms, some systems also support these types of media.

HARDWARE COMPONENTS

A. ARDUINO NANO

The Arduino Uno board come with a total resolution of 10 bits which measure the value from zero to 5V. It is a popular microcontroller board based on the ATmega328P microcontroller. Developed by Arduino LLC, it is widely used in various projects due to its simplicity, versatility, and ease of use.

The Uno board features a range of input/output pins, digital and analog, which can be easily programmed to interact with many electronic components. It also includes built-in components like LEDs and buttons for basic testing and prototyping

B. RELAY

The relay is the device that open or closes the contacts to cause the operation of the other electric control. It detects the undesirable condition and can control high voltage electronic devices using relays. A relay is actually a switch which is electrically operated by an electromagnet. Thus protects the system from damage.

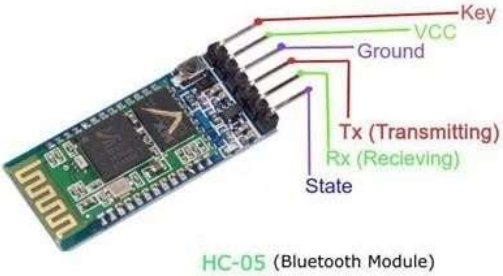
- Working voltage: 5v
- Operation Time (Max):15ms

C. WATER PUMP

Water pump motors are essential components in various applications, including irrigationsystems, water supply systems, and fluid transfer systems. They are specifically designed to pump water from one location to another efficiently and reliably. These motors operate within specific voltage and frequency ranges and are designed to be highly efficient, durable, and reliable. Some models offer control features like variable speed control for enhanced flexibility.

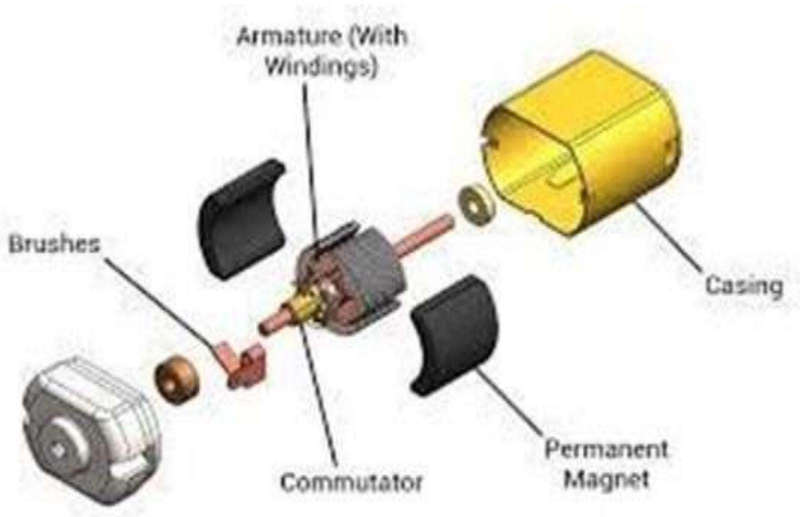
D. BLUETOOTH MODULE (HC-05)

The HC-05 is a class 2 Bluetooth module designed



For transparent wireless serial communication. It is pre- configured as a slave Bluetooth device. Once it is paired to a master Bluetooth device such as PC, smart phones and tablet, its operation becomes transparent to the user. All data received through the serial input

E. MOTOR



A submersible pump, also called an electric submersible pump, is a pump that can be fully submerged in water. The motor is hermetically sealed and close-coupled to the body of the pump. A submersible pump pushes water to the surface by converting rotary energy into kinetic energy into pressure energy.

F. SERVO MOTOR

Servo motors play a crucial role in electronics and robotics, offering precise control over angular position. Their construction typically includes a DC motor, gear train, control circuit, and feedback mechanism. Controlled via pulse-width modulation (PWM), they receive signals from microcontrollers ordedicated servo controllers. Feedback mechanisms, such as potentiometers or encoders, provide real-time position data for accurate control. Servo motors excel in applications requiring precise positioning, high torque output relative to their size, and versatility.

ADVANTAGES

- Precision Applications
- Efficiency
- Safety
- Data Collection
- Adaptability
- Environmental Sustainability
- Scalability

APPLICATIONS

- Precision Agriculture
- Crop Protection
- Weed Control
- Greenhouse Management
- Orchard Management
- Vineyard Agriculture
- Environmental Monitoring

EXPERIMENTAL RESULTS

CONCLUSION

In conclusion for small-scale farmers, the Arduino- based smart pesticide sprayer is a viable solution that tackles important issues related to crop management and pesticide application. The system minimizes its influence on the environment while increasing productivity and efficiency because to its precise control, resource optimization, and user- friendliness. Because of its adaptability and affordability, farmers in a variety of agricultural environments may use it, which encourages the use of sustainable pest control techniques. Farmers are empowered to make well-informed decisions and maximize crop yields by the system's integration of data-driven decision-making skills. All things considered, the Arduino-powered smart pesticide sprayer is a noteworthy development in agricultural technology that will help to further sustainable and precise farming methods.

FUTURE SCOPE

There is a lot of room for improvement and progress in the field of precision agriculture using the Arduino-based smart pesticide sprayer. The capabilities and uses of the system can be further expanded by pursuing a number of future research and innovation route the combination of data analytics capabilities and enhanced sensing technology is one area of future growth. Through the integration of sensors that enable in-the-moment monitoring of insect populations, crop health, and environmental variables, the system can provide farmers with valuable information to enhance pest control tactics and augment agricultural productivity. Furthermore, by utilizing artificial intelligence and machine learning algorithms, the system's capacity to anticipate insect outbreaks, maximize the use of pesticides, and automate decision-making procedures mayall be improved.

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