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Pesticide spraying robot

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ABSTRACT: This is an engineering solution to the current human health hazards involved in spraying potentially toxic chemicals in the confined space of a hot and steamy glasshouse. This is achieved by the design and construction of an autonomous mobile robot for use in pest control and disease prevention applications in commercial greenhouses. The effectiveness of this platform is shown by the platforms ability to successfully navigate itself down rows of a greenhouse, while the pesticide spraying system efficiently covers the plants evenly with spray in the set dosages The optimisation of carbon dioxide enrichment, temperature, humidity, root moisture, fertilizer feed, pest and fungus control allow greenhouses to produce fruits, vegetables out of season and ornamental flowers all year round. For example, carbon dioxide levels within a greenhouse are approximately five times the normal atmospheric levels. The optimal temperature and humidity levels of a greenhouse during the normal working hours of the day can be quite high (up to 38◦C), making it very hot and uncomfortable for someone wearing the heavy protective equipment.

KEYWORDS: Agricultural Robot, Image Processing Algorithm, Robot movement, spraying mechanism.

I. INTRODUCTION

The field of robotics has its origins in science fiction. The term robot was derived from the English translation of a fantasy play written in Czechoslovakia around1920. It took another 40 years before the modern technology of industrial robotics began. Early robots were confined to industrial applications, doing repetitive tasks like loading-unloading machines, welding, spray painting, etc. In the last two decades, robots have stepped out of industrial applications and ventured right in to our homes as pets, service robots, helpers, rehabilitation devises, etc. Today, we have both hard (physical) robots like manipulator arms, mobile robots, etc., and also soft (simulated) robots like virtual characters, virtual reality, etc., sometimes simply called bots In this chapter, we will survey some of the science fiction stories about robots and trace the historical development of robotics technology. Let us begin our chapter by defining the term robotics and establishing its place in relation to other types of industrial automation.

Automation and robotics are two closely related technologies. In an industrial context, we can define automation as a technology that is concerned with the use of mechanical, electronic and computer-based systems in the operation and control of production. Examples of this technology include transfer lines, mechanized assembly machines, feedback control systems (applied to industrial processes), numerically controlled machine tools and robots. Accordingly, robotics is a form of industrial automation.

II. LITERATURE SURVEY

[01]. Agriculture is a profession of farmers, which consists of many tedious processes and practices, one of which is the sprinkling of insecticides in the farm fields. A different farms field requires extensive spraying every 3-4 days in the summer and every 5-6 days in the rainy season. Already methods in use, we know are like: a person carrying a sprayer and manually actuating a to generate pressure and pump the pesticide through a tube or a mobile vehicle carrying an inbuilt compressor and sprayer unit which has to be including manually driven by a human operator. These methods are working under fuel consuming. Another major disadvantage in human operated systems is that the operator is exposed to the harmful chemicals while spraying. Long term exposure, can be extremely detrimental to the operator's health. In this paper is presented, aviable alternate to these methods. The Automatic sprayer is a four wheeled vehicle which spray spesticide in any given fields with almost zero human assistance. The vehicle is powered using an onboard solar powered battery which brings down the running cost. The control of the vehicle is achieved using an inbuilt micro controller unit which is programmed to respond to the Bluetooth device.

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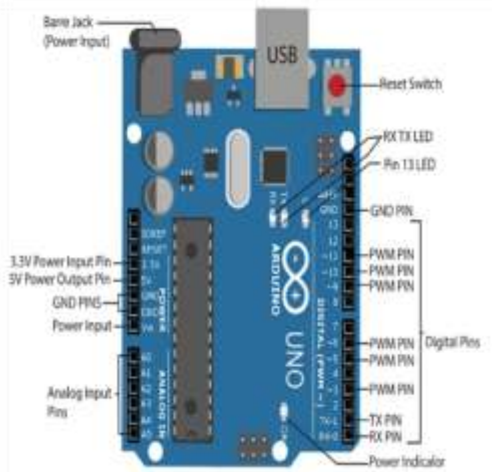
2.This paper describes the concept of an autonomous robot for harvesting cucumbers in green houses. A description is given of the working environment of the robot and the logistics of harvesting. It is stated that for a 2 ha Dutch nursery, 4 harvesting robots and one docking station are needed during the peak season. Based on these preliminaries, the design specifications of the harvest robot are defined. The main requirement is that a single harvest operation may take at most10s. Then, the paper focuses on the individual hardware and software components of the robot. These include, the autonomous vehicle, the manipulator, the end-effector, the two computer vision systems for detection and 3D imaging of the fruit and the environment and, finally, a control scheme that generates collision-free motions for the manipulator during harvesting. The manipulator has seven degrees-of-freedom (DOF). This is sufficient for the harvesting task. The end-effector is designed such that it handles the soft fruit without loss of quality. The thermal cutting device included in the end-effector prevents the spreading of viruses through the greenhouse. The computer vision system is able to detect more than 95% of the cucumbers in a greenhouse. Using geometric models the ripeness of the cucumbers is determined. A motion planner based on the A*-search algorithm assures collision-free eye-hand co-ordination. In autumn 2001 system integration took place and the harvesting robot was tested in a greenhouse. With a success rate of 80%, field tests confirmed the ability of the robot to pick cucumbers without human interference.



Technical specifications

1.Microcontroller: Microchip ATmega328P
2. Operating Voltage: 5 Volt
3.Input Voltage: 7 to 20 Volts
4.Digital I/O Pins: 14 (of which 6 provide PWM output)
5.Analog Input Pins: 6
6.DC Current per I/O Pin: 20 mA
7.DC Current for 3.3V Pin: 50 mA
8Flash Memory: 32 KB of which 0.5 KB used by bootloader
9.SRAM: 2 KB
10EEPROM: 1 KB
11.Clock Speed: 16 MHz
12.Length: 68.6 mm
13.Width: 53.4 mm
14.Weight: 25 g

GENERAL PIN FUNCTIONS :

1.LED: There is a built-in LED driven by digital pin 13.
the Arduino IDE
(Integrated Development Environment) via a type B USB cable.[4] It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo.[5][6] The hardware reference design is distributed under Creative Commons Attribution Share-Alike 2.5 license and is available on arduino website. Layout and production files.
In early days monitoring and analysis of plant disease is done manually by expertise persons, which require tremendous amount of work and also excessive processing time.
LED is on, when the pin is LOW, it's off.5V: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V) pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.

SPECIAL PIN FUNCTIONS

Each of the 14 digital pins and 6 Analog pins on the Uno can be used as an input or output, using pinMode(),digitalWrite(), and digitalRead() functions. They operate at 5 volts. Eac pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.The Uno has 6 analog inputs, labeled A0 through A5, each of which provide10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference() function

BASE BOARD ESP8266 :

NodeMcu is an open-source development board, based on famous ESP8266 chip, which is a 32-bit controller with built-in WiFi transceiver it is very low cost. Best of all, this board is Arduino IDE compatible, you can utilize the millions of example code and library on NodeMCU NodeMCU is an open source platform based on ESP8266 which can connect objects and let data transfer using the Wi-Fi protocol. In addition, by providing some of the most important features of microcontrollers such as GPIO, PWM, ADC, and etc, it can solve many of the project's needs alone Arduino uno is a micro-controller. It is based on a Microchip Atmega328P. It is developed by Arduino.cc. The chipset has set of digital and analog I/O pins, which is used to interface with various other boards and circuits. The board has 14 digital and 6 analog I/O pins. Arduino IDE is used to program this module. The microchip comes preprogrammed with a boot loader, so we don't need any external hardware programmer to upload the code. Here we use this module to handle all the processes of the robot. It works .

Memory:
The ATmega328 has 32 KB (with 0.5 KB occupied by the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read).

Base board ESP8266

FEATURES:
1.Easy to use
2.Programmability with Arduino IDE or IUA languages
3.Available as an access point or station
4.practicable in Event-driven API applications
5.Having an internal antenna
6.Containing 13 GPIO pins, 10 7.PWM channels, I2C, SPI, ADC, UART, and 1-Wire

Powering the Arduino Uno:
VIN. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
5V. This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it
3V3. A 3.3-volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
• GND. Ground pins.
IOREF. This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.

Input and Output:
Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode (), digital Write, and digital Read functions
They operate at 5 volts. Each pin can provide or receive 20 mA as. recommended operating condition and has an internal pull-up resistor (dis connected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.
Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt

POWER SUPPLY:

A battery can be defined as an electrochemical device (consisting of one or more electrochemical cells) which can be charged with an electric current and discharged whenever required. Batteries are usually devices that are made up of multiple electrochemical cells that are connected to external inputs and outputs. Batteries are widely employed in order to power small electric devices such as mobile phones, remotes, and flashlights. Historically, the ‘term’ battery has always been used in order to refer to the combination of two or more electrochemical cells. However, the modern definition of the term ‘battery’ is believed to accommodate devices that only feature a single cell. Batteries are broadly classified into two categories, namely primary batteries and secondary batteries. Primary batteries can only be charged once. When these batteries are completely discharged, they become useless and must be discarded. The most common reason why primary batteries cannot be recharged isthat the electrochemical reaction that takes place inside of them is irreversible in nature On the other hand, secondary batteries are the batteries than can be charged and reused for many charging-discharging cycles. The electrochemical reactions that take place inside these batteries are usually reversible in nature. Therefore, secondary batteries are also known as rechargeable batteries. When discharging, the reactants combine to form products, resulting in the flow of electricity. When charging, the flow of electrons into the battery facilitates the reverse reaction, in which the products react to form the reactants

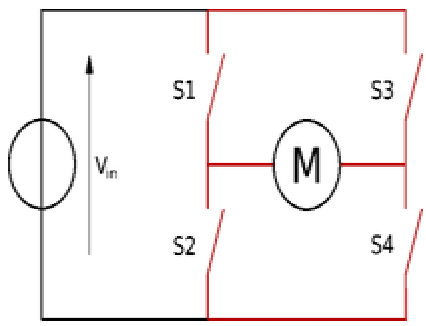
LI-ON2200 MAH

In 2200mAh battery 2200 means that the battery can provide 2.2A (2200mA) of current for 1 hour. It totally depends on the load, if it is pulling 1A current then it should last for 2.2 hours. can make a 12V battery pack by connecting three Lithium-ion cells(3.7V) in series, the voltage will be added in series which will make it 12V

L289N-Motor Driver: A motor driver module is a simple circuit used for controlling a DC motor. It is commonly used in autonomous robots and RC cars (L2938N and L293D are the most regularly utilized motor driver chips). A motor driver module takes the low voltage input from a controller like Arduino. This input logic controls the direction of DC motors connected to the driver. To put it in simple words, you can control the direction of DC motors by giving appropriate logic to the motor driver module.The motor driver module consists of a motor driver IC, which is the heart of the module. The IC alone can control the DC motor but using the module makes the int The L298N motor driver is based on the H-bridge configuration (an H-bridge is a simple circuit that lets us control a DC motor to go backward or forward.), which is useful in controlling the direction of rotation of a DC motor It is a high current dual full H-bridge driver that is constructed to receive standard TTL logic levels. It can also be used to control inductive loads e.g. relays, solenoids, motors (DC and stepping motor), etc. An Hbridge schematic looks like thiserfacing with arduino.

L289N-Motor Driver

This chapter refers to the final output of the robot. We can observe all the connections are made as per the circuit diagram. The Bluetooth module is used to send commands by which we can control the direction of robot. A 9V battery is connected as power supply.



H-Bridge circuit diagram

78M05 Voltage regulator will be enabled only when the jumper is placed. When the power supply is less than or equal to 12V, then the internal circuitry will be powered by the voltage regulator and the 5V pin can be used as an output pin to power the microcontroller. The jumper should not be placed when the power supply is

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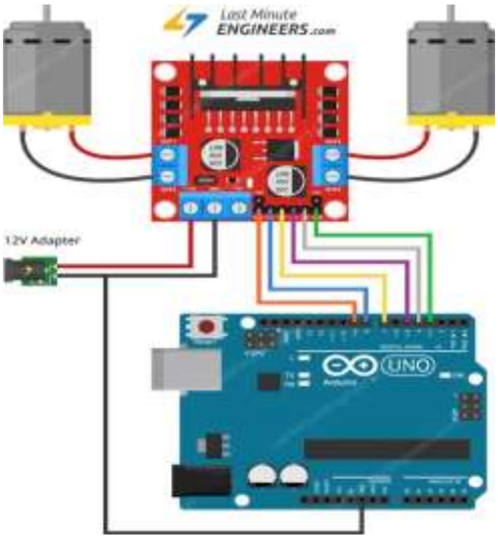
greater than 12V and separate 5V should be given through 5V terminal to power the internalcircuitry.ENA & ENB pins are speed control pins for Motor A and Motor B whileIN1&IN2 and IN3 & IN4 are direction control pins for Motor A and Motor B.

Connect power supply to the motors. In the robot we are using DC Gearbox Motors that are usually found in two-wheel-drive robots. They are rated for 3 to 12V. So, we will connect external 12V power supply to the VCC terminal. Considering internal voltage drop of L298N IC, the motors will receive 10V and will spin at slightly lower RPM.

we need to supply 5 Volts for the L298N's logic circuitry. We will make use of the onboard 5V regulator an derive the 5 volts from the motor power supply so, keep the 5VEN jumper in place. Now, the input and enable pins (ENA, IN1, IN2, IN3, IN4 and ENB) of the L298N module are connected to six Arduino digital output pins (9, 8, 7, 5, 4 and 3). Note that the Arduino output pins 9 and 3 are both PWM-enabled. Finally, connect one motor to terminal A (OUT1 & OUT2) and the other motor to terminal B

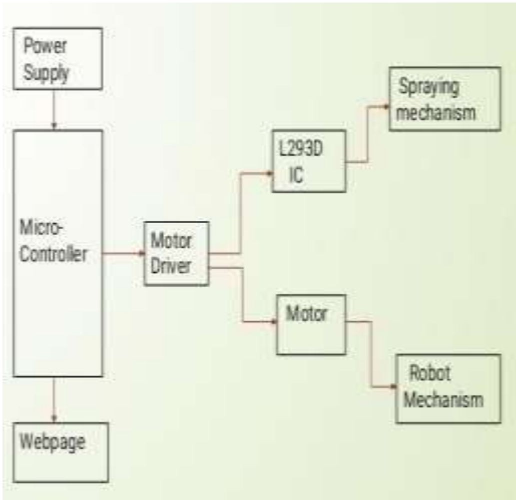
(OUT3 & OUT4). You can interchange your motor's connections, technically, there is no right or wrong way.



L298N Interfacing with Arduino Uno

"F" for Forward direction
"B" for Backward direction
"S" for Stop
"R" for Right
"L" for Left

III. BLOCK DIAGRAM



IV. RESULT

1. This Robot Works With The Help Of WIFI (local hotspot)
2. We will create a webpage containing movement buttons of Robot and as well as Sprayer.
3. These buttons are created with the help of digital pins present in the microcontroller.
4. L293D IC is an intermediate between the microcontroller and motor pumps.

When we click on the button spray on the webpages motor pumps starts Spraying. the farmers are increasingly under pressure to feed more people as the world population is increasing. Agriculture is

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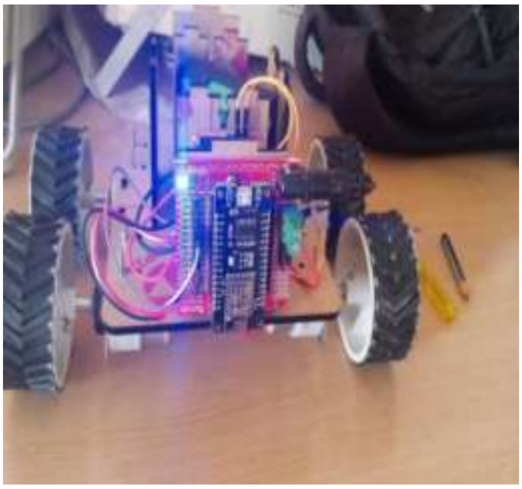
the main source of income to the country. The youths are turning away from the agricultural profession; thus, availability of human resource is becoming less. The robot technique can make the farming occupation an exciting Hi-Tech profession. And this may attract the people into agricultural profession and also bring back the people who left this profession. The agricultural robot can perform basic elementary function like picking the fruits/ vegetables, harvesting, weeding, pruning, seeding. grafting, spraying etc. But in this paper, we concentrated only on disease detection and spraying mechanism. In early days monitoring and analysis of plant disease is done manually by expertise persons, which require tremendous amount of work and also excessive processing time.



Pesticide spraying robot

V. CONCLUSION

We conclude that the use of machine learning and image processing helped to overcome the plant disease diagnosis. By this we minimized diseases within leaf, stem, plant by efficiently spray pesticide. Since this can be controlled from anywhere without working in the field and being exposed to pesticides, it will be a profit for the farmer. He will stay unaffected by his health condition. Apart from that, it does not require any supervision for operating. It only needs pesticide level refilling, recharging the battery. It can be operated with a rechargeable Mobile Power bank. Solar technology for self recharge can also be imported in future. This suggests the effective use of technology to meet the agricultural growth. This a cost effective and one time investment project.

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