FERTILIZER SPRAYING ROBOT

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Abstract

In present world autonomous robots widely used in so many fled like surveillance, defense, and medical, industrial and in so many fields. In our paper, the robot designed by us used to for spraying fertilizer on agriculture filed without more man power. This paper presents a technological solution to the current human health hazards involved in spraying of potentially toxic chemicals in the confined space of an atmosphere. This is achieved by the design and construction of an autonomous mobile robot for use in pest control and disease prevention applications in commercial Farm. The effectiveness of this platform is shown by the ability to successfully navigate itself down rows of a Farm, spray the fertilizer effectively while the farmer controls it from a far distance. And this fertilizer spraying system efficiently covers the plants evenly with spray in the set dosages. The main aim of our paper is to increase the productivity rate by decreasing the man power and time and to protect the crops from harmful insects and pests we are using a spraying fertilizers. In this system we are using a Bluetooth control the robot. The project intended to develop a prototype of autonomous fertilizer spraying.

CHAPTER 1

INTRODUCTION

1.0 Research Background

Robots that encounter most frequently are robots that do work that are too dangerous or non-consistent job for human being. Most of them can be found in auto, manufacturing, medical, agriculture and space industries. Robots have become more commonplace in commercial and industrial settings. Hospitals have been using autonomous mobile robots to move materials for many years. Warehouses have installed mobile robotic systems to efficiently move materials from stocking shelves to order fulfillment zones. Robots are also a major focus of current research and almost every major university has one or more labs that focus on mobile robot research. Robots are also found in industrial, military and security settings. [1][5] Domestic robots are consumer products, including entertainment robots and those that perform certain household tasks such as vacuuming or gardening. [2] The robots are also used in the agriculture field in many ways. In fact, there are over a million of these types of robots working today in the world. For examples like the Mars Rover Sojourner and the upcoming Mars Exploration Rover, or the underwater man-size jellyfish robot Cyro helps human explore and collect environment data of the places that are too dangerous or impossible for human to discover.[4][5]

This project proposes a wheeled robot with built in camera that would solve human problem in perform inspection under dangerous area or building. [3] Tunnel inspection

robotic car is a small designed remote control robotic car which can help tunnel inspector to perform better and convenient inspection job. There are many problems faced during inspection job such as narrow space which human are not capable to enter, damaged house which most of the structure are collapsed and radioactive area. [8]

It became a difficult and dangerous job for inspector to enter without having enough knowledge and background information of the area for inspection. [6] The problems mentioned above might causes insecure situation for inspector while performing maintenance or testing work. Tunnel inspection robotic car is designed to replace human especially in high risk job. Besides, tunnel inspection robotic car is useful in determine the damaged structure whether is completely collapsed or partially collapsed instead of entering by human. [10][11]

The main business of people in most of the countries like India is agriculture and the economy of the nation is decided by agriculture. The essential nutrients for plant growth are commonly generates in its surroundings. The plant development process depends on the conditions of the environment, where plant grows.[7] The plant development process depends on the conditions of the environment, where plant grows. The necessary parameters like, humidity, light, moisture, ambient temperature and CO2 etc. [9] are consists in the environment. Deep understanding of all these factors and their relationships can help the farmer to get much familiar with any of the potential problems that will affect the health of the plants and thereby more appropriate and accurate measures can be taken to get rid of these problems. The research presented in this thesis attempts to provide a fertilizer spraying robot a responsibility of controlling and managing the plant growth from early stage to mature harvest stage involves monitoring and identification of plant diseases, controlled irrigation and controlled use of fertilizers and pesticides. [13]

The fertilizer spraying robot is based on the principle of automatically help farmers for spray the fertilizers or pesticides in their lawns or farms. The main feature of this project is that it can control the amount of fertilizer to spray by the farmers. This is made possible by controlling the motion of the robot using smartphone applications. The applications works with the help of Bluetooth module which is a transreceiver that communicates through radio frequency. We used Arduino Uno as our main microcontroller as it is very reliable, low cost and can be easily interfaced with multiple peripherals.[11] A rover is also present that is controlled by a remote through radio frequencies which makes the fertilizer spraying robot movable.

Initially start the project by made algorithm for the automatic fertilizer spray. Then we designed our mechanical model and interfaced all the software part and the hardware part with it. Then made the algorithm for the remote control and made the rover model and continued with the software and hardware interfacing. [14]Thirdly attached the rover section with the automatic fertilizer sprayer which made our project a movable automatic fertilizer spraying robot which is very robust and efficient that can be used easily by the famers to take care of their farms and their crops.

1.1 Problem Statement

The responsibility of controlling and managing the plant growth from early stage to mature harvest stage involves monitoring and identification of plant diseases, controlled irrigation and controlled use of fertilizers and pesticides. It is because normally farmers use spray tank with bare hand to spray the fertilizer. This situation causes the first problem that is when use bare hands to spray the fertilizer it can cause diseases such as air borne. Because when use the fertilizer which is contains ammonia (NH3) that affect exposed skin and may cause respiratory problems through inhalation.[6][10] So that when they using the fertilizer spraying robot this problem can be solve because this robot will spray the fertilizer by itself. Farmers normally spray the fertilizer by walk so it will take too long of time but when they using this robot it can move fast to spray the fertilizer with help of 6dc motors.

1.2 Objectives

The objectives of this project are as the following:

a) To use the technology in agriculture field.

b) To create an environmental-free project.

c) To create fertilizer robot for the farmers.

d) To develop a system that is able to be operated using android smartphones.

1.3 Project Scope

Scope project is an important element to make sure the project can be finish like how the schedule runs. So, scope project has to be followed to prevent the project out from the objective. The scope of this project includes:

a) It has 2 6v motor dc with high quality wheel(x2)

b) The material used is 500ml water dispenser for contain liquid fertilizer.

c) The automatic chassis robot able to move into 4 direction using android application through Bluetooth module.

1.4 Significance of Project

The fertilizer spraying robot mainly made for farmers. This because of farmers are using fertilizer in huge range. The fertilizer robot help the farmers to spray fertilizer by using spray tank which have capacity to fill 500ml of fertilizer.

This robot also suitable to household wives who planting at their homes. They can control this robot by just sitting at one place so that they can done one work just by sitting at one place. They can easily use this robot, because it just like control a remote control car but this one is controlled by hand phones.

1.5 Project Limitation

This prototype usage has some limitations on its functions as it can only be operated by a single user at a time and can only be under the user's control up to certain distance. Then, the application used to move the chassis robot into 4 directions can only be downloaded in an android containing smartphone which is forward, backward, right turn and also left turn. The position of purging fertilizer is in one way straight to the ground.

1.6 Summary

This entire chapter was briefing about the basis of this prototype. Most of this prototype objectives and problem statement had been presented to ensure the path of this project outcome. The project based on creating a fertilizer spraying robot. The production of this fertilizer spraying robot is to prevent the problems that faced by the farmers. The fertilizers or pesticides causes some health issues to the farmers. With this production the health problems that faced by the farmers cause by the chemical fertilizers or pesticides will be less.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In the very early years the fields were cleared of weeds and prepared for planting by hand at great effort, using primitive hoes or digging sticks. The invention of the plough was started about 6,000 years ago and it was a great labor-saving device for humans - the beginning of systematic substitution of other forms of energy, in this case animal power, in replacement of human muscles. In Malaysia after the independence the demand of food increased drastically and in order to meet the heavy demand of food the farmers had to increase the productivity of the crops so that they can be made market ready as fast as possible. [16] To meet this need the farmers had to use more amounts of fertilizers. Fertilizers are mainly classified as organic and inorganic fertilizers. The organic fertilizers (animal wastes and plant residues) must be broken down into inorganic forms in the soil before plants can take up the nutrients required for growth and reproduction. They are relatively inefficient because they contain low concentrations of nutrients and hence, large volumes of material need to be transported and spread over fields to overcome deficiencies. [15] Also, organic fertilizers take time to breakdown into inorganic forms and become available to plants. In contrast, inorganic fertilizers have a high concentration of nutrients that are rapidly available for plant uptake. Relatively small quantities of inorganic fertilizers are required and transport and application costs are low. In addition, inorganic fertilizers can be formulated to apply the appropriate ratio of nutrients to meet plant growth requirements. [13][14]

2.1 System Architecture

The following sections describe the detailed system architecture of the prototype. It is important to note the primary use of generic prototyping components, specifically the Arduino platform, rather than designing and fabricating custom circuits. This allowed for the development of more features, less troubleshooting, and more simplified software development in higher-level programming language.

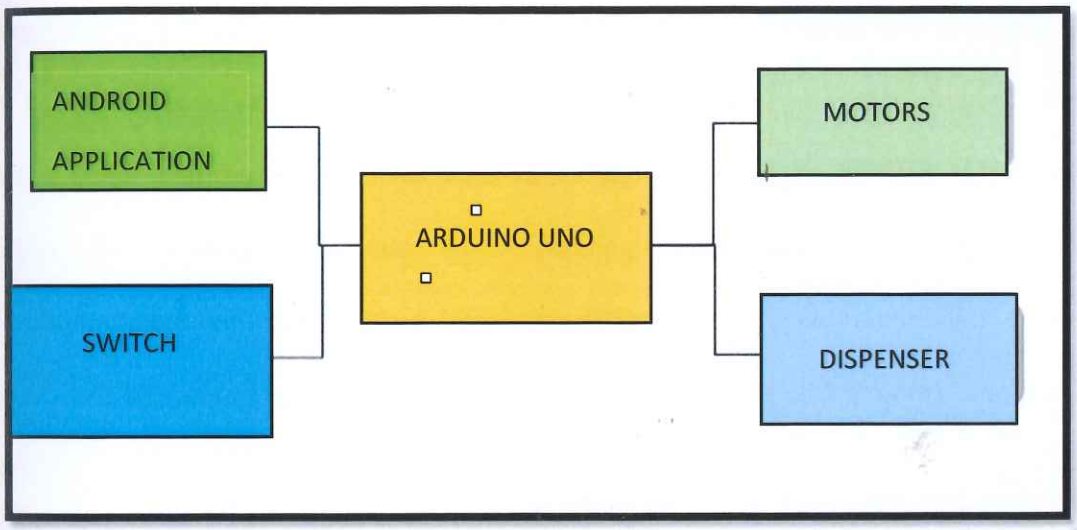

Figure 1: Block Diagram

2.2 Project Concept

2.2.1 Arduino Microcontroller UNO

Arduino is common term for a software company. Project and user community that designs and manufactures computer open-source hardware, open-source software and microcontroller- based kits for building digital devices and interactive objects that can sense and control physical devices.

The project is based on microcontroller board design, produces by several vendors using various microcontrollers. These systems provide sets of digital and analogue I/O pins that can interface to various expansion boards (termed shields) and other circuits. The boards feature serial communication interfaces including Universal Serial Bus (USB) on some models for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named Processing, which also supports the language C and C++.

The first Arduino was introduces in 2005, aiming to provide a low cost, easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats and motion detectors.

Arduino boards are available commercially in preassembled form or as do it yourself kits. The hardware design specifications are openly available, allowing the Arduino boards to be produced by anyone. Adafruit Industries estimated in mid-2011 that over 300,000 officials. Arduino had been commercially produced and in 2013 that 700,000 official boards were in user's hands. The microcontroller is the central processing unit for the device. It stores and executes the system software and interfaces with all of the peripheral devices. It is

also responsible for backing up the system memory to persistent storage in case of a power failure or disconnect. The prototype uses the Arduino Compatible Atmel UNO with USB B type Cable (Figure 2), an open source prototyping board based on the Atmel ATmega1280 microcontroller. Arduino UNO is one of the most famous board in Arduino family after Arduino Duemilanove. It is the latest design of the basic USB board. It comes with 6 analog inputs, 14 digitals output where 6 of them support PWM, and 16 Mhz clock speed. Arduino UNO comes with 6 analog inputs and 14 digital I/O where 6 of them are PWM outputs. It is running on an ATmega328 processor with 32kB flash memory. The clock speed of this Arduino board is 16 Mhz with the dimension of 68.6mm x 53.3mm. There are a lot of shields build to expend its functionality.

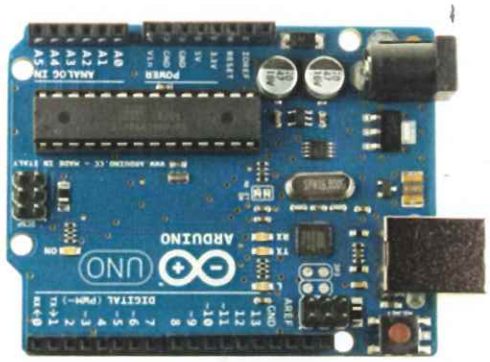

Figure 2: Arduino Uno

2.2.2 Motor Unit

Motors are arguably one of the most important parts of a mobile robotics platform. Over powered motors cause inefficiency and waste the already limited supply of power from the on-board batteries, while undersized motors could be short on torque at critical times. The optimal rotation speed and the available speed range of the motor must also be taken into consideration. Too high of an output rpm from the motor shaft will not be able to attain a suitable speed to meet the user's needs. The torque output of the motor also plays a role in the performance because if the torque is not sufficient, locomotion may not occur in certain situations. Therefore, much consideration was put into the selection of the proper motor for the platform.

Motors come in many shapes and sizes. There are electromagnetic direct current (DC) motors and electromagnetic alternating current (AC) motors and a number of variations of each. AC motors are typically used for large applications, such as machine tools, washers, dryers, etc., and are powered by an AC power line. Since the typical power supply for mobile robotic is a DC battery, and technology for transforming DC to AC is very expensive in both terms of monetary cost and power cost, AC motors where ruled out as an option for the robot.

DC motors are commonly used for small jobs and suited purposed of the platform very well. Figure shows the 6V DC motor use in fertilizer spraying robot. Motor units are organized slightly differently in invertebrates; each muscle has few motor units (typically less than 10), and each muscle fiber is innervated by multiple neurons, including excitatory and inhibitory neurons. Thus, while in vertebrates the force of contraction of muscles is regulated by how many motor units are activated, in invertebrates it is controlled by regulating the balance between excitatory and inhibitory signals.

In this prototype, a pair of Yellow Smart Car Robot 3v-6v Motor Dc with High Quality Wheels were used for the purpose of moving in different direction when they are controlled by the users. This full fills the requirement of our theme "Mobile Robotic" with a specific function of delivering medication to targeted people. These two kits make creating your own robot easier than ever. Available in 2WD and 4WD versions; each kit includes motors, wheels, tires and two pre-drilled mounting plates. These kits are ideal for an Arduino or pcDuino robotics project. Motor voltage is 5-10VDC while dimension of KR3160 2WD is 215(L) x 160(W) x 100(H)mm meanwhile the dimension of KR3162 4WD is 240(L) x 160(W) x 100(H)mm.

Figure 3: Motors and Wheels

2.2.3 Main Chassis

A chassis consists of an internal vehicle frame that supports an artificial object in its construction and use, can also provide protection for some internal parts. An example of a chassis is the underpart of a motor vehicle, consisting of the frame (on which the body is mounted). If the running gear such as wheels and transmission, and sometimes even the driver's seat, are included, then the assembly is described as a rolling chassis. In the case of vehicles, the term rolling chassis means the frame plus the "running gear" like engine, transmission, drive shaft, differential, and suspension. An under body (sometimes referred to as "coachwork"), which is usually not necessary for integrity of the structure, is built on the chassis to complete the vehicle.

For commercial vehicles, a rolling chassis consists of an assembly of all the essential parts of a truck (without the body) to be ready for operation on the road. The design of a pleasure car chassis will be different than one for commercial vehicles because of the heavier loads and constant work use. Commercial vehicle manufacturers sell "chassis only", "cowl and chassis", as well as "chassis cab" versions that can be outfitted with specialized bodies. These include motor homes, fire engines, ambulances, box trucks, etc.The main chasses has a structure that is designed to mimic that of a Lazy Suzan revolving shelf traditionally used to store medicines. All the components running the system are placed inside of the structure, and a detachable compartment is mounted to the top.

Figure 4: Chassis Set

2.2.4 Arduino HC05 Wireless Bluetooth Serial Port TX RX Module

This Bluetooth module can easily achieve serial wireless data transmission. Its operating frequency is among the most popular 2.4GHz ISM frequency band. It adopts Bluetooth 2.0+EDR standard. In Bluetooth 2.0, signal transmit time of different devices stands at a 0.5seconds interval so that the workload of Bluetooth chip can be reduced substantially and more sleeping time can be saved for Bluetooth. This module is set with serial interface, which is easy to use and simplifies the overall design/ development cycle. In Bluetooth Module HC-06 have 4 pin there are VCC, GND, TXD and RXD. Connect TXD of HC-06 Module to RXD of PL2303, RXD to TXD, GND to GND, VCC to VCC. PL2303 is a USB to serial bridge controller. Bluetooth operates at frequencies between 2402 and 2480 MHz, or 2400 and 2483.5 MHz including guard bands 2 MHz wide at the bottom end and 3.5 MHz wide at the top. This is in the globally unlicensed (but not unregulated) industrial, scientific and medical (ISM) 2.4 GHz short-range radio frequency band. Bluetooth uses a radio technology called frequency-hopping spread spectrum. Bluetooth divides transmitted data into packets, and transmits each packet on one of 79 designated Bluetooth channels. Each channel has a bandwidth of 1 MHz. It usually performs 800 hops per second, with Adaptive Frequency-Hopping (AFH) enabled. Bluetooth low energy uses 2 MHz spacing, which accommodates 40 channels [citation needed]

Originally, Gaussian frequency-shift keying (GFSK) modulation was the only modulation scheme available. Since the introduction of Bluetooth 2.0+EDR, π/4-DQPSK (differential quadrature phase shift keying) and 8DPSK modulation may also be used between compatible devices. Devices functioning with GFSK are said to be operating in basic rate (BR) mode where an instantaneous bit rate of 1 Mbit/s is possible. The term Enhanced

Data Rate (EDR) is used to describe π/4-DPSK and 8DPSK schemes, each giving 2 and 3 Mbit/s respectively. The combination of these (BR and EDR) modes in Bluetooth radio technology is classified as a "BR/EDR radio".

Bluetooth is a packet-based protocol with a master/slave architecture. One master may communicate with up to seven slaves in a piconet. All devices share the master's clock. Packet exchange is based on the basic clock, defined by the master, which ticks at 312.5 µs intervals. Two clock ticks make up a slot of 625 µs, and two slots make up a slot pair of 1250 µs. In the simple case of single-slot packets the master transmits in even slots and receives in odd slots. The slave, conversely, receives in even slots and transmits in odd slots. Packets may be 1, 3 or 5 slots long, but in all cases the master's transmission begins in even slots and the slave's in odd slots.

This module is used to enable the function of Bluetooth connection between the prototype and the user's smartphone. This connection only available when the robot is at a shorter distance from the users as the capability of Bluetooth is limited to a certain distance.

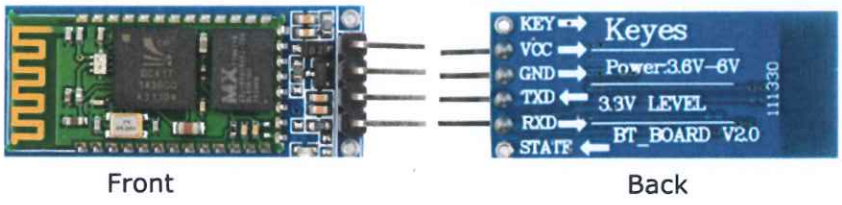

Figure 5: Bluetooth Module

2.2.5 Switch

In electrical engineering, a switch is an electrical component that can "make" or "break" an electrical circuit, interrupting the current or diverting it from one conductor to another. The mechanism of a switch removes or restores the conducting path in a circuit when it is operated. It may be operated manually, for example, a light switch or a keyboard button, may be operated by a moving object such as a door, or may be operated by some sensing element for pressure, temperature or flow. A switch will have one or more sets of contacts, which may operate simultaneously, sequentially, or alternately. Switches in high-powered circuits must operate rapidly to prevent destructive arcing, and may include special features to assist in rapidly interrupting a heavy current. Multiple forms of actuators are used for operation by hand or to sense position, level, temperature or flow. Special types are used, for example, for control of machinery, to reverse electric motors, or to sense liquid level. Many specialized forms exist. A common use is control of lighting, where multiple switches may be wired into one circuit to allow convenient control of light fixtures.

By analogy with the devices that select one or more possible paths for electric currents, devices that route information in a computer network are also called "switches" - these are more usually more complicated than simple electromechanical toggles or pushbutton devices, and operate without direct human interaction.

The most familiar form of switch is a manually operated electromechanical device with one or more sets of electrical contacts, which are connected to external circuits. Each set of contacts can be in one of two states: either "closed" meaning the contacts are touching and electricity can flow between them, or "open", meaning the contacts are separated and the