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A Review on Pest Controlling Robot for Detecting the Deficiencies in Plant for Proper Fertilizer Application

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ABSTRACT
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 . Boosting innovation and research in the agricultural sector is crucial if farmers are asked to produce more with less. Precision agriculture offers different solutions to assist farmers in improving efficiency and reducing labor costs while respecting the legal requirements. Precision spraying enables the treatment of only the plants that require it, with the right amount of products. The agriculture industry is one that is highly resource and labour-intensive. As such, farmers are increasingly turning to technology and automation to address this issue. However, agricultural robots are far too complicated, slow, and costly to be made publicly available. As a result, the agriculture sector still lags behind in integrating modern technologies. This research paper details the development of a low-cost agricultural robot for spraying fertilizers and pesticides in agriculture fields as well as for general crop monitoring. And this pesticide spraying system efficiently covers the plants evenly with spray in the set dosages.

Keywords: Pesticide Spraying System; Human Health Hazards; safety; fertilizer; crops; H-bridge circuit.

I. INTRODUCTION

A rough estimate shows that about one third of the world's agricultural production is lost every year due to pests despite the pesticide consumption which totalled more than 2 million tons. In India pests cause crop loss of more than Rs 6000 crores annually, of which 33 per cent is due to weeds, 26 per cent by diseases, 20 per cent by insects, 10 per cent by birds and rodents and the remaining (11 per cent) is due to other factors. The magnitude of the problem would accelerate further as more and more (newer) pests and diseases are likely to attack crops and the need to use pesticides in different forms will be necessary in the years to come. India is an agrarion country, where the majority of the total population resides in the it rural are and agriculture largely dependent as the source of their livehood the economy of the country' is mostly dependent of agriculture Reducing instability. In agricultural production has been a major policy concern over the years since the stability and growth in agriculture are vital for providing feed and nutrition security to burgeoning population. Grain crops are crop plants that being to the grass family (gramineae) generally grown or their edible starch seeds. They also are refer as cereal crops they include wheat, rice, maize, barely, rye, cats wheat and millet. Based on the studies conducted also, The World Health Organization (WHO) estimates approximately about 3 million cases regarding pesticide poisoning which happened every year, thus causing the death of 220,000 people who especially live in developing countries [1]. The UN Food and Agriculture Organization (FAO) and other research studies estimate that 20–40% of global crops are lost due to plant pests and diseases [2]. 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.

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II. MATERIALS AND METHODS

The concept design of the agricultural robot for fertilizer and pesticide spraying is a two-wheeled robot, consisting of a remote base that is controlled by an operator. The agricultural robot prototype was designed to be small and lightweight to ease manoeuvrability around crops in an agriculture field and to prevent damage to the crops and soil structure.

2.1 Robotic arm with sprying mechanism

The spraying mechanism utilises liquid fertilizers and pesticides instead of the granule or pallet types. This is because liquid fertilizers can be absorbed by plants through their leaves as opposed to being absorbed by their roots, which ensures that these nutrients are available to the plants almost immediately, compared to dry fertilizers which are slow-release and can take up to a month to be absorbed by the plants. Liquid pesticides, meanwhile, are far more efficient at targeting and destroying pests in a short amount of time. Various approaches have been proposed when designing a spraying robotic arm, mainly due to restrictions and possibilities of the operating environment. In greenhouses, two approaches have been identified: robots that move using the greenhouse piping system, and robots that navigate between rows without being mounted on those pipes. Moreover, the ability to spray selectively requires an accurate detection system, and therefore advanced sensors need to be mounted on the robot Finally, the spraying system (nozzles) could be mounted directly on the spraying platform, or it could be mounted on a robotic manipulator with various degrees of freedom (DOF). The manipulator used by had 3 DOF, the one used by 6, while the one from had 9 DOF.

2.2 Robotic chassis

First we started by designing the chassis for our robot. Our main challenge was to design an adjustable chassis which could carry a load of 20-25 Kgs, so for it we used iron as the metal for chassis. But the chassis itself weighed 5Kgs, so in order to avoid excessive weight of the device, iron has not been used as the only metal in the chassis of the device; whereas aluminum is used in most part of the chassis and iron has been used only in some places instead of aluminum as aluminum is a brittle metal. The image of chassis made with optimum use of iron and aluminum which runs of four wheels.

2.3 DC motors

Two D.C. motor are fixed in the backside with torque of 30Kg.cm. Two free wheels are fixed in front portion of the chassis. The shaft of these four wheels has been attached to a 7 cm diameter small wheel. The small wheel cannot run directly on field because in doing so, it is not possible to get complete ground clearance as the field is uneven. Hence, small wheel is attached with a bigger wheel of diameter 22 cm with the help of a chemical solution, Araldite. It should be noted that the motor shaft cannot be attached directly to the bigger wheel, therefore small wheel is used.

fig. DC motor

2.4 Microcontroller

Depending on the key pressed the controller will be transmitting the data. Here in this project we are using two micro controllers. One is AT89c2051 used in the transmitter and the second one is 89c51 used in the receiver. The controllers play a major role in the project, there by the following description mainly focuses about micro controller and its architecture because it is treated as heart of the project work. Today, there is no such instrument that can function without micro controller. Micro controllers have become an integral part of all instruments. Many tedious from simple to dedicated tasks are left over to the controller for solutions. The microcontroller used in this project work is atmel 89c51, basically this ic belongs to 8051 family.

2.5 Power supply

This is an important block why because all the components require power supply to be operating. Microcontroller requires +5v, relay and dc motors require +12v. In the transmitter a 9v battery is used and a voltage regulator in order to derive the required power supply for the 11 micro-controller i.e., 5v. And in the receiver as we require a maximum of 12v we are using a 12v battery to operate the relay and the dc motors.

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fig. Battery

fig. Microcontollar

2.6 Air compressor

An air compressor is a device that converts power (usually from an electric motor, a diesel engine or a gasoline engine) into kinetic energy by compressing and pressurizing air, which, on command, can be released in quick bursts. There are numerous methods of air compression, divided into either positive-displacement or negative-displacement types.

2.7 H bridge circuit

An H-bridge is an electronic circuit that switches the polarity of a voltage applied to a load. These circuits are often used in robotics and other applications to allow DC motors to run forwards or backwards. In particular, a bipolar stepper motor is almost always driven by a motor controller containing two H bridges.

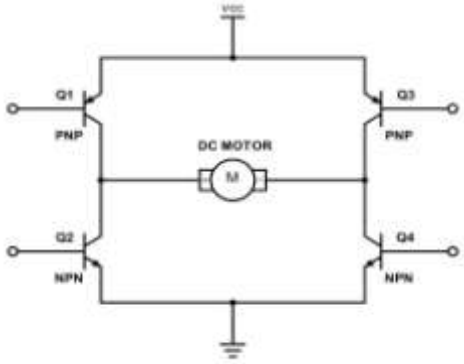

fig. H bridge circuit

III. RESULTS AND DISCUSSION

The main motivation behind this paper is that in the present indian farms, the farmer has to spray the pesticides manually. The manual spraying makes them easily susceptible to hazardous disease mostly like air borne and water borne. The process of pesticide spraying involves large amount of human labor thus making more number of humans to get prone by the diseases. There is no other alternative to manual spraying in Indian open farms. Over usage of pesticides can cause degradation in soil. This happens mostly because the farmer hires labor for the work and the labor is unskilled. Until now the technologies used in farms are outdated and the present farming needs revolutionary technique of farming.

3.1 Hardware configuration

TABLE. I. AUTONOMOUS PESTICIDE SPRAYING ROBOT SPECIFICATION

Item	Specification
Robot dimension	122 cm x 122 cm x 200 cm (L x W x H)
Robot weight	12 kg without payload
Drive system	4-wheeled drive system
Power supply	12 V DC lead-acid rechargeable battery
Ground clearance	12 cm from the ground
Payload	Max: 20 kg

3.2 Merits

1. Wireless operation will eliminate the health issues and would even save them from tedious work.
2. It will have less use of manpower.
3. Efficient and health conscious operation due to remote sensing.
4. With the help of live feed of spraying the farmer is expected to control the robot wirelessly from a distant place.
5. This Robot is expected to be an all terrain robot.

3.3 Demerits

1. During the rainy season the sloppiness would reduce the speed of the robot.
2. All the electronics components mounted on the chassis need to be covered properly else environmental changes could alter the output.
3. The system is bulky

3.4 Future scope

1. The spraying mechanism can be closely observed by using a camera which would be mounted near the robotic arm giving the farmer live feedback of the spraying.
2. Integrated GSM module which could control the start/stop and run operation of the robot.
3. SMS based system to start and stop the service
4. Preprogrammed GUI based navigation system

5. Android interface to navigate the robot
6. Programming based on crop type and amount

IV. CONCLUSIONS

The robot for agricultural purpose an agro-robot is a concept for the near the performance and cost of the product once optimized, will prove to be work through in the agricultural spraying operations. We have been successful in developing a robot whose construction is enough to with stand the challenges of the field. We are sure that once this concept is presented in a manner suitable to indian market, it will definitely help in bringing down the 15% modality rate found in the indian formers associated with the agricultural spraying operation

V. ACKNOWLEDGEMENTS

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