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Agricultural Robot

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ABSTRACT:-
The utility of insecticides and fungicides is one of the most important approaches in agricultural manufacturing and can have a good-sized impact on crop yield, fine, and in the long-run profitability. It is anticipated that approximately 30-35% of crop losses can be avoided whilst dangerous bugs and sicknesses are removed via making use of insecticides. At present, there are extraordinary sorts of pesticides sprayer but the approach for pesticide utility is a manually lever-operated backpack kind sprayer. Farmers who are spraying pesticides are tormented by it which makes them extra at risk of their health, eyes and they will also broaden lumbar ache because of the burden of the sprayer. This paper proposes a remotely operated spraying robot designed to lessen the time, reduce labour costs and prevent human hazards involved in spraying potentially toxic chemicals.

I. INTRODUCTION:-

India is agrarian economies and most of rural populations depend on agriculture to earn their livelihood. The farming methods at present are manual or semi-automatic with high involvement of labourers. In the recent years, the number of labour availability is reducing continuously along with increase in their wages. There is a requirement of higher productivity. Hence the device is to be designed which helps farmers to overcome the stated problem. Automated Robots can provide us the solution

The main application of robots in the commercial sector has been concerned with the substitution of manual human labour by robots or mechanized systems to make the work more time efficient, accurate, uniform and less costly. One may argue the social implications of such developments, for example, the effects on employment through loss of blue-collar jobs to the more efficient robotic counterpart; there are also ethical considerations that may be argued. Whilst there may well be some validity to the argument in some cases, this current project is unique in the number of stakeholders that are affected in a positive sense. The farmers benefits are found in more efficient maintenance of the crops and either less work for themselves or a decreased need for the employment of others (arguably, an expensive process). Increased demand on growers has begun to be met with increased specific automation in many fields, as producers believe that automation is a viable and sometimes necessary method to ensure maximum profits with minimum costs. Indeed, Hopkins argues that automation enables the expansion of a farm without having to invest more financial resources on labour. Merchants may benefit from increased sales due to a lower cost product; the consumers will benefit, likewise, from a lower cost product of comparable quality. The stakeholders that benefit most, at least from an ethical or social perspective, however, are the farm workers. This project presents the design and construction of an autonomous robot that seeks to address some of the human health concerns associated with farms. This robot is designed as a base for developing systems to enable the automation of farming processes such as the spraying of pesticides, picking of fruit and the caring for diseased plants. The system is designed to be as modular as possible, enabling the development and/or modification of any of the individual tasks.

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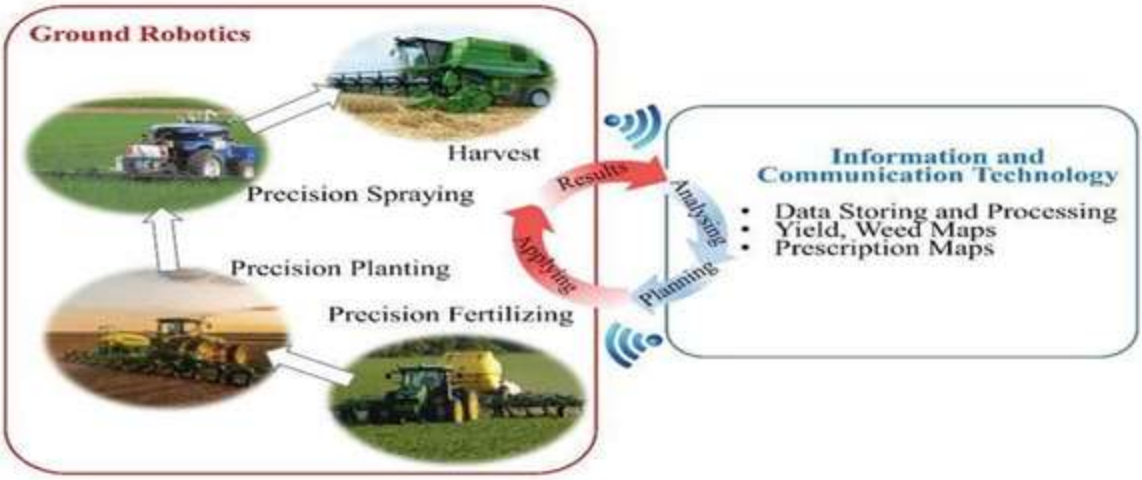

1.1 Pesticide spraying

The pesticides have a vital influence of the agribusiness. Nearly 35% of crops have been safeguarded from the insects using pesticides. The pesticides are needed for agriculture field to increase the efficiency but they are also injurious to human and also to the environment. In the current methods, the farmers use the backpack sprayer which is manually operated by the human along the crop fields. They used to spray the pesticides in the targeted way manually. Here the sprayer is connected to the back of the tractor and this tractor was driven by the human. The pesticides were sprayed to the crops along the field. This method does not uses the selective spraying and the pesticides are spread to the field.

In spite of the utilization of pesticide assurance gear (individual head veil and focal filtration framework for the manual and automated spraying strategies, separately) the human is as yet presented to unsafe pesticides that can cause negative medical problems.

Figure1.2: Manual Pesticide spraying

II. LITERATURE REVIEW:

2.1 Pesticide spraying

With flourishing technology that is introduced in this 21st century, there is numerous types of robots been used in agricultural activity starting from the cultivation process to the production process. The autonomous robot had been introduced in various application such is in underwater, rescue, line following robot based on metal detection. In agriculture field, the usage of robotics in agriculture operation able to help to increase the production process and improve efficiency. One of the types of the robot used in agriculture is for the purpose of pesticide spraying

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with the ability to navigate in the farm, recognize the target and regulate the spraying mechanism.

The use of autonomous robot pesticide sprayer as the substitution of the worker who used conventional pesticide sprayer can be applicable. Besides, the demand for the agriculture robot also stimulates the consciousness of how important its role in the current and future generations. The survey conducted shows that the demand for robots and drones in agriculture will be expected to be rose from 2018 to 2038. Hence, the usage of the autonomous robot is assumed to rise thus replacing the current labor worker. This granular20 years market forecast covers all the aspect of the agricultural robots and drones for 16 market categories with the expectation by the end of 2038, market of the robots and drones in these categories is predicted will close to 35 billion with the viable technology and ongoing market demand by considering its technology and application.

Nevertheless, the common problem with an autonomous robot use in agricultural activity is the navigation method used to able the robot fully-operated with decision making capability. In order to navigate through all the field, there are some research has been done. It can be done through infrastructure ready or to be without infrastructure. Some research on RFID based navigation are conducted to be implemented as navigation tools.

As artificial intelligence (AI) starts to emerge, the current robot should be able to navigate the next movement by the adaptation of the surrounding environment and decide which path it will take. The typical method used in the detection is based on the targeted object orientation or repelled signal emits from the sensor itself then calculates the distance in between it. Other than that, there is also the robot that uses the vision observation then accumulates all the acquired data to generate the data fusion that enables the robot to navigate itself through the farm. The second problem with the agricultural robot is due to the dissemination of the pesticide to the crops. Unregulated spraying during the disposition of the pesticide to the crop can lead to the low rate of coverage on leaves, wastage of pesticide and hazardous exposure to workers due to disperse pesticide to the desired target.

With regulated spraying by the pump, the higher coverage of dissemination to the crops can be achieved whereby the positioning of each crop wasvaried from one another in the farm. Furthermore, instead of hiring the workers to do miscellaneous work on the farm which can affect themselves, it can be done by an autonomous agriculture robot thus save the expenses on the labor worker.Lastly, the designed robot used in agriculture having the difference performance index depends on the variable they want to achieve. Certain researchers may focus on UAV based pesticide spraying, localization and motion control of agriculture mobile robot,pest image identification and else. This also same goes to the type of the plant being used as the target which differs from one another in terms of size, leaves density and height.

OBJECTIVES:

*The major objectives are the attributes which the device must meet. They are:
*To reduce human effort in the agricultural field with the use of small machine.
*To perform all operations at single time, hence increases production and saves time.
*It should perform all operations on command.
*It should be safe and simple to control.
*It should be reliable.
*It should be durable and economical.
*To reduce human effort within the agricultural field with the employment of small robot.
*To perform all the operations at single time, hence increases production and decrease idle time.
*To complete great amount of labour in less time.
*Farmer can control the robot through remote by sitting at one side and operate easily.
*The usage of solar may be utilized for Battery charging. because the Robot works within the field, the rays of the sun may be used for solar energy generation.
*To reduce the dependence on grid power, the solar energy is employed and therefore a battery is placed to store the energy and use it whenever required.

COMPONENTS:

HARDWARE COMPONENTS REQUIRED:

1. HC-05 Bluetooth module
2. Arduino Uno
3. L293D driver
4. Solar panel
5. DC motors
6. Linear Actuators
7. Mobile app
8. Battery
9. Manual Switch
10. Plywood
11. Clamps
12. Nutsand Bolts
13. Wires
14. Wheels

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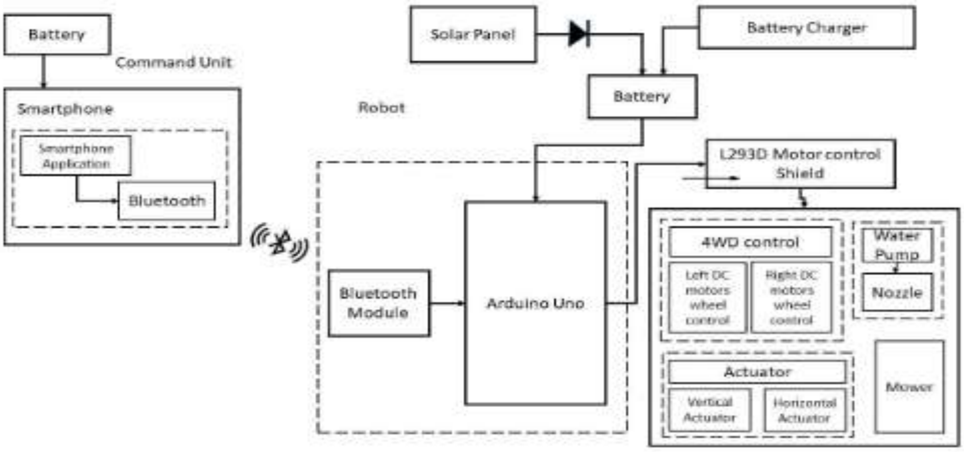
15. Resister
16. Pump
17. Mower Blade
18. Storage tank
19. Pipes
20. Nozzles
21. Personal Computer

III. PROPOSED SYSTEM:

This system is a robot designed for a agricultural purpose.



Block diagram of proposed system

IV. WORKING:

Manual Operation

First make sure that the program for the robot is successfully uploaded into the Arduino board and all the connections between electrical components and the Arduino are given exactly as mentioned in the above chapter.

Then install the RC Bluetooth application from the App store of the smartphone.

Switch ON the connection between Battery and the Arduino board. On doing this a bright green light will appear on the Arduino board and a slow blinking red light will appear on the Bluetooth module. This means that the Arduino board, Motor shield and the Bluetooth module are now active.

Now open the RC Bluetooth car app in the smartphone and open settings. Select the option that says “Connect to car”. Then the Bluetooth module HC-05 will be visible. Click on that to pair the smartphone with the robot. When the robot is paired the blinking of the red light on the Bluetooth module will be faster.

Before giving any movement to the robot, adjust the vertical, horizontal actuators and nozzle according to the requirements of the field.

For the movement of robot keys are provided.

When the “Forward” key is pressed then all the 4 DC motors rotate in the same direction (assume clockwise) which in turn rotates the wheels and the robot moves forward.

When the “Reverse” key is pressed then all the 4 DC motors rotate in the same direction (but this time assume anti-clockwise) which in turn rotates the wheels and the robot moves reverse.

When the “Left” key is pressed then the front and rear DC Motors on the right side of the chassis move faster than the left ones and thus the robot moves Left.

When the “Right” key is pressed then the front and rear DC Motors on the left side of the chassis move faster than the right ones and thus the robot moves Right.

Using the keys mentioned above the robot is placed at such a position that when the pump is switched ON using the “Pump: ON/OFF” key, the nozzle sprays the pesticide directly onto the affected plants. By using the movement keys the whole field can be covered with pesticides.

When the spraying of pesticides is done, the pump is switched OFF using the same key.

The Mowing or Harvesting operation can also be performed. Using the movement keys mentioned above the robot is placed at such a position that when the Mower is switched ON using the “Mower: ON/OFF” key, the unwanted

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weeds or harvested crops are cut off by the blades of the mower. The clearance of the blade from the ground is adjustable. So, we can control the level of grass field to be maintained if needed. By using the movement keys the crops or weeds in the whole field can be Mowed.

When the Mowing operation is done, the Mower is switched OFF using the same key.

When all the operations are done, the robot is called back and the connection between the Battery and the Arduino board is switched OFF and the robot is preferably placed in an environment with sunlight so that the battery can be recharged.

V. EXPERIMENTAL ANALYSIS:

In order to evaluate the performance of the system, several trials were performed on the robot. We have evaluated different functions that are to be performed by the robot. The functions are listed below.

1. Pesticide spraying
2. Mowing operation
3. Robot's movement
4. Battery performance

The results of the tests for each function are given below in detail.

Pesticide spraying

Pesticide spraying has two aspects,

1. The distances and areas covered by the actuation setup
2. The distances and areas covered by the sprayer

<u>The distances and areas covered by the actuation setup:</u> The position of the Nozzle is with the help of the combination of Horizontal and Vertical actuation, this combination is referred as the actuation setup. This is done so as to increase the work volume of the robot. The actuation setup is designed in such a way that it has 4 Degrees of Freedom, viz

1. Vertical actuation on Y Axis
2. Horizontal sliding motion provided for Nozzle on X Axis
3. Rotation of the Nozzle in the YZ Plane about X axis
4. Rotation of the Horizontal actuating setup in XZ plane about Y axis The distances and areas covered in each degree of freedom.

VI. FUTURE SCOPE:

Mechatronics is playing an enormous role in agricultural production and management. There is a desire for autonomous and timesaving technology in agriculture to possess efficient farm management. The researchers are now aiming towards different types of farming parameters to style autonomous multipurpose agricultural robots because of traditional farm machineries and topological dependent. Till date the multipurpose agricultural robots have been researched and developed mainly for harvesting, fertilizer spraying, picking fruits, sowing, solar energy and monitoring of crops. Robots like these are brilliant replacements for manpower to a better extent as they deploy unmanned sensors and machinery systems. The agricultural benefits of development of these autonomous and intelligent robots are to improve repetitive precision, efficiency, reliability and minimization of soil compaction and chemical utilization. The robots have the potential of multitasking, sensory measures, idle operation as well working in odd operating conditions. The study on multipurpose agricultural robot system had been done using model structure design along with various precision farming machineries. With fully automated farms in the future, robots can perform all the tasks like ploughing, seed sowing, pesticides spraying, monitoring of pests and diseases, harvesting, etc. This allows the farmers to just supervise the robots without the need of manual operation. In the future robots may also run on PLC and SCADA with automatic systems. In this paper, overview of mechatronics approach of our multipurpose agriculture robot for precision Agriculture in India and worldwide development is reviewed

VII. CONCLUSION:

*The prototype gave a fairly good rate of area coverage with a reasonably low operating cost. The system addresses the issue of dearth of agricultural labour and ensures safe agricultural practices by completely eliminating, handling of harmful chemicals, cutting crops and extensive labour by the farmer as it can be operated remotely.

*The proposed spraying & mower robot is suitable for small and medium scale farmers. Large scale production of the spraying unit will reduce the cost significantly giving partial thrust to Indian agriculture practices.

*The unit can be scaled up based on the requirement. The developed system can not only be used for spraying fertilizer, pesticides, fungicides, lawn watering and crop cutting , weeding and lawn

mowing but also for maintenance of sports fields like cricket ground.
*With the proposed design of the robot in this project, the above mentioned gaps can be eliminated completely. This project integrates two of the major activities in agriculture which are Pesticide spraying and Crop Cutting (or Weed Removal).

Workload on the farmers is decreased and health problems also. Successful in constructing robot which can be travelled on rough, uneven surfaces also and weighing enough load of pump and other equipment. Successful in developing a robot whose construction is enough to withstand the challenges of the field.

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