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IOT Based Smart Pesticides Sprayer Robot

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Abstract: *Agriculture is a profession of many tedious processes and practices, one of which is the spraying of insecticides in the vineyards. A typical vineyard requires extensive spraying every 4-5 da ys in the summer and every 3-4 days in the rainy season. The conventional methods are: a person carrying a sprayer and manually actuating a lever 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 manually driven by a human operator. These methods are fuel consuming and susceptible to human errors. Another major drawback in human operated systems is that the operator is exposed to the harmful chemicals while spraying. Long term exposure, as in this case, can be extremely detrimental to the operator's health. This is a project which can be viewed as a viable alternate to these methods. The Automatic sprayer is a three wheeled vehicle which sprays pesticide in any given vineyard with almost nil 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 microcontroller unit which is programmed to respond to the bluetooth device*

Keywords: Microcontroller, Battery, LCD, LDR, Motors, Relays, Bluetooth device

I. INTRODUCTION

The population of India is increasing rapidly in order to fulfill their diet & needs, the production of foods must be increased. But this must come at affordable to everyone. In India farming is done by traditional ways beside that there has been larger development of industry and service sector as compared to that of agriculture sector. To mechanization of agriculture in India some equipment has been developed. The pesticide sprayer is one among them and it is done by traditional farm workers by carrying backpack type sprayer, which requires human effort or by using electric pump. To improve the agriculture system and to reduce the human effort and problems associated with the backpack sprayer new equipment is fabricated which will be beneficial to farmers. The equipment utilize renewable energy source which is eco-friendly to function. The solar panel (Battery) gives out electric supply to system. Also minimize the wastage of pesticide and time. Our contribution on our project is by using eco-friendly reliably available solar energy as a main source of energy making this multifunctional sprayer device by advancing the spraying methods which make friendly to use and operate which can be useable in different spraying stages of farming as per process requirement. It can be operated in small farming land with the standard spacing decreasing the labor cost and human effort. In this project we are trying to make a prototype model for farmers and cultivators for whom spraying of insecticides is harmful and hazardous.

II. LITERATURE REVIEW AND OBJECTIVE

2.1 Objective

- Develop a solar-powered pesticide sprayer prototype to address the growing need for efficient and eco-friendly agricultural equipment in India.
- Enhance agricultural productivity by minimizing labor costs and reducing reliance on traditional fuel sources through the utilization of renewable energy.
- Improve the effectiveness and precision of pesticide application by incorporating advanced spraying methods and nozzle technology into the design of the sprayer.

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- Increase the portability and maneuverability of the sprayer by implementing a wheel-driven mechanism, enabling farmers to cover larger farming areas with ease.
- Conduct rigorous testing and optimization of the prototype under diverse farming conditions to ensure reliability, durability, and practicality in real-world agricultural settings.
- Collaborate with farmers, agricultural experts, and industry stakeholders to gather feedback and insights for continual refinement and enhancement of the sprayer design.
- Facilitate the adoption of sustainable agricultural practices by providing farmers with access to innovative and cost-effective spraying equipment tailored to their needs and operational requirements.

2.2 Literature Review

Shailesh Malonde et al [1] Pesticide spraying is the necessary procedure in cultivation of the crops. The present idea deals with the designing and fabricating a pesticide sprayer which will be useful and affordable to the farmers which will assist to increase the productivity of crops. Though this project an attempt has been done to improve the method of spraying the pesticide that will enhance the productivity and increase the farmer's income. So we have designed a pesticide spraying machine which will not only increase productivity but also will reduce the effort of the farmers. The machine will save the time of the farmer as well as efficiency in spraying. This model carries multi nozzle pesticides sprayer pump which will perform spraying at maximum rate in minimum time. Constant flow valves can be applied at nozzle to have uniform nozzle pressure.

Pandurang Lad et al [2] "Solar Operated Pesticide Sprayer" IJARSE Volume 04ASolar Operated Pesticide Sprayer is a pump running on electricity generated by photovoltaic panels or the thermal energy available from collected sunlight as opposed to grid electricity or diesel run water pumps. The operation of solar powered pumps is more economical mainly due to the lower operation and maintenance costs and has less environmental impact than pumps powered by an internal combustion engine (ICE). Solar pumps are useful where grid electricity is unavailable and alternative sources (in particular wind) do not provide sufficient energy. The solar panels make up most (up to 80%) of the systems cost. The size of the PV-system is directly dependent on the size of the pump, the amount of water that is required and the solar irradiance available. The solar sprayer has many advantages. Besides reducing the cost of spraying, there is a saving on fuel/petrol.

Also, the transportation cost 9+for buying petrol is saved. The solar sprayer maintenance is simple. There is less vibration as compared to the petrol sprayer. The farmer can do the spraying operation by himself without engaging labor, thus increasing spraying efficiency

Dr. H. ErdalOzkan et al. [3]The main goal of this study was to design and develop software and hardware for an intelligent sprayer that can control variable-rate spray outputs through the nozzles based on availability of a target in sight and density level of the canopy sprayed. This has been accomplished to a large degree. However there is still some ineffectiveness associated with the operation of this sprayer that can be addressed by future studies.

C.Umayaal et al. [4]This paper deals with the exposition of how robotics can be applied to various phase of agriculture. One of the most important occupations in developing country like India is agriculture. It is very important the efficiency and productivity of agriculture by replacing labours with intelligent machine like robots using latest technologies. The paper proposes a new strategy to replace humans in various agricultural operations like detection of presence of pests, spraying of pesticides, spraying of fertilizers etc thereby providing safety to the farmers and precision agriculture.

Poratkar et al. [5]The working of this manually operated multi nozzle pesticides sprayer pump is based on the principles of motion transmission due to chain and sprocket arrangement and plunger cylinder arrangement. The operator first stand behind the trolley. He will grab the handle and lift it and push the trolley forward. As trolley move forward, the wheel rotates in counter clockwise direction. As sprocket is mounted on same shaft of wheel, it also rotates in counter clockwise direction. This motion is transferred to freewheel via chain drive arrangement. The free-wheel, thus, also starts rotating in counter clockwise direction. As freewheel and big spur gear are mounted on same shaft, it also start rotating in anticlockwise direction.

A.S. Wankhede et al. [6] The Equipment is especially made to work in row crops such as cotton pulses etc. of an agricultural field. The economic condition of farmers and the cost of labor, owing to such conditions, this equipment

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can find its application. The equipment is intended to perform three important operations done in fields, namely, Spraying pesticide, spraying herbicide and applying urea. All the three operations can be performed simultaneously or individually. Application of urea to the crops is not being focused much by various agriculture equipment producing firm and the equipment available are mostly suitable for large field which are in hectors. Moreover, whatever methods are available for applying urea results in high wastage of urea, we have focused on the same..

III. MATERIALS AND METHODS

To develop the smart pesticide sprayer is one of the improved models of pesticide sprayer pumps. Sun is the source of all energy on the earth. It is most abundant, inexhaustible and universal source of energy. All other sources of energy draw their strength from the sun. India is blessed with plenty of solar energy because most parts of the country receive bright sunshine throughout the year except a brief monsoon period. India has developed technology to use solar energy for cooking, water heating, water dissimilation, space heating, crop drying etc. 2 Most used pesticide sprayer available in market is petrol engine sprayer, which is bulky to carry, needs lot of maintenance (to engine and carborators) and cost incurred to maintenance, petrol to operate is noticeable. The another model which is inspired us to take this project is electrical pesticide sprayer in which battery is charged using conventional electricity but operates only for four hour once battery is fully charged. So improving operating time and solar energy harvesting is motivation of project.

Our system contains following steps:

The sun rays are collected by the solar panel, where it converts solar energy into electrical energy and it is stored in the storage battery. We use here automatic solar panel rotation system according to intensity of light to catch maximum solar energy. By using Bluetooth we send instructions/commands to the microcontroller unit. The operation takes place in the microcontroller unit to display commands on LCD display therefore we can operate the complete operation such as sprinkler motor, solar movement, mixer, solenoid valve and L293D motors for movement of the prototype.

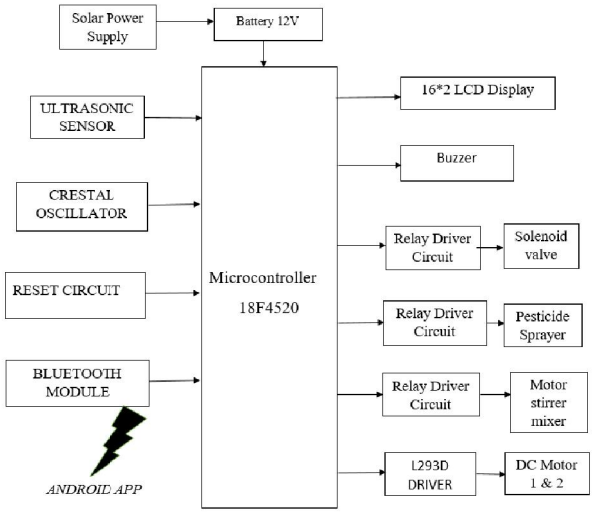

Fig 3.2.1. System Architecture

The basic block diagram of the based pesticide sprayer is as shown in the figure. It consists of solar panel, buck and boost converter, battery charging kit, limit switches, dual battery, DC motor, pesticide tank, spray nozzles, etc. Microcontroller is the brain of the desired system. It consists of two sections one is transmitter section and another is receiver section. In transmitter section it consists of Bluetooth device whereas Bluetooth, Solar panel, ultrasonic sensor, level sensor, LDR and Storage battery which works as input. In receiver section it consists of Microcontroller, LCD, LDR, L293D Motors driver IC, Relays, Buzzer, Stirrer Motor, Sprinkler motor, Solenoid Valve, DC motor.

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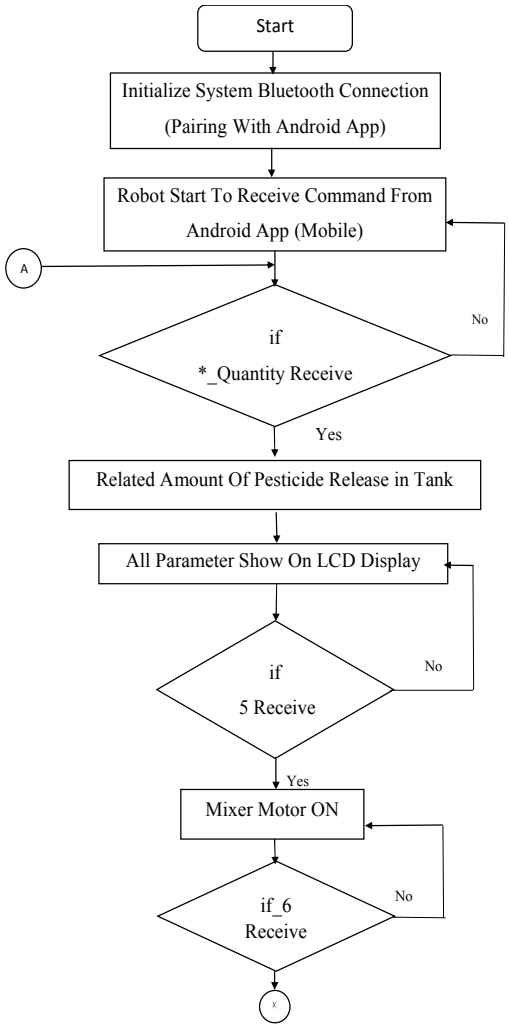
ALGORITHM:

- Start the project.
- Initialize system bluetooth connection (pairing with android app).
- Robot start to recive command from android app (mobile).
- If *_quantity receive related amount of pesticide release in tank all parameter show on lcd display.
- If 5 receive mixer motor on if 6 receive mixer motor off.
- If 1,2,3,4 receive robot rotate forword,reverse,left,right accordingly.
- If obstacle detect ultrasonic sensor sense obstacle in front of vehicle vehicle stop buzzer blow.
- If 7 receive spray pump on if 8 receive spray pump off.
- If 0 receive all motors turn off.
- End the process.

FLOWCHART:



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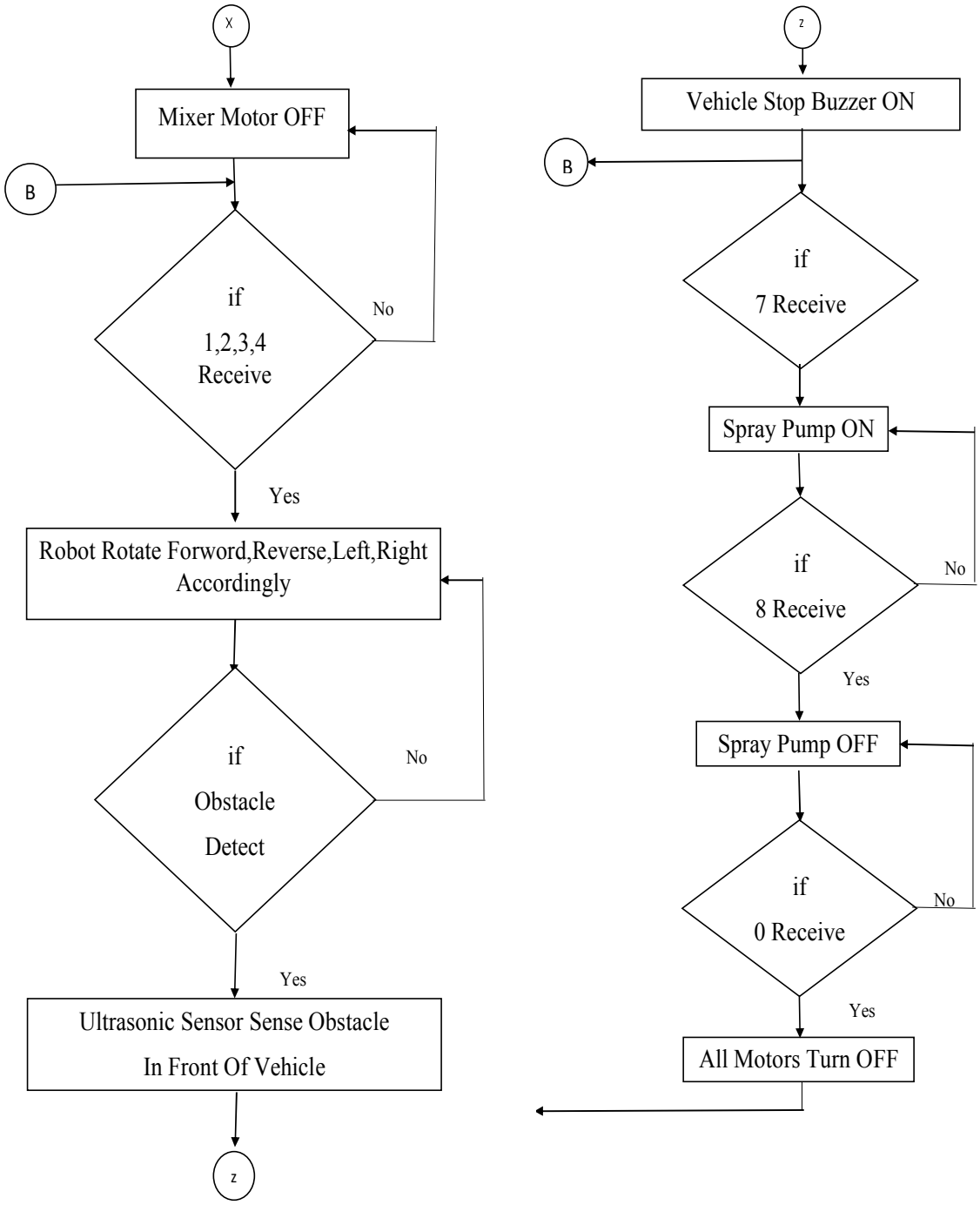

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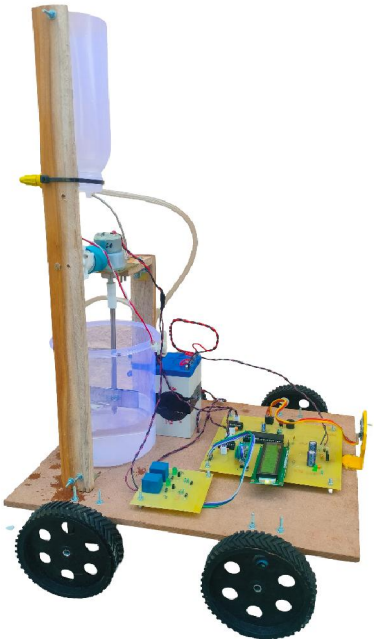
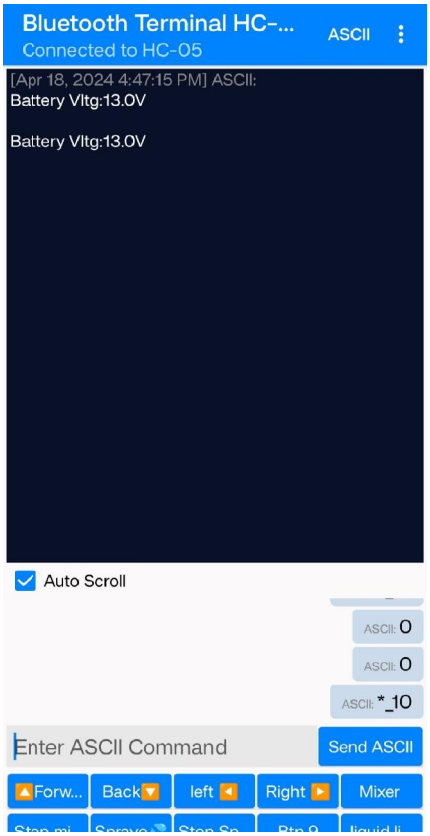
IV. RESULTS AND DISCUSSION



Actual prototype model is shown in following photograph.



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V. CONCLUSION

The proposed system of the prototype results that it was successfully able to fulfill the human need for spraying the pesticide in vineyards. While comparing with the previous pesticide sprayers this is more efficient and we can overcome health hazards. This project demonstrates the implementation of robotics and mechatronics in the field of agriculture. This being a test model the robustness of the vehicle is not very high. The performance is satisfactory under laboratory condition. The model gave a fairly good rate of area coverage and the cost of operation as calculated was also reasonably low. In addition the safety and long term health of the farmers is ensured by eliminating human labour completely from this process. It does not compromise the performance of a petrol based pesticide sprayer.

ACKNOWLEDGEMENTS

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