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Solar Powered Pesticide Sprayer Robot

Rahul More[1], Mohan Talavar[2], Tanmay Mahamuni[3], Biru Sonatakke[4]
Students, Department of Mechanical Engineering[1,2,3,4]
JSPM's Rajarshi Shahu College of Engineering, Pune, Maharashtra, India

Abstract: *There has been larger development of industry and service sector as compared to that of agriculture sector. To automate agriculture some equipment has been developed. The pesticide sprayer is one among them and it is done in a traditional way by the farm workers, that is by carrying backpack sprayer, using an electric pump or using a tractor but it requires too much human effort and it is also costly. 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 and affordable to farmers. The equipment can be powered either by solar energy or by using batteries. Installed radio-controlled transmitter and receiver on the system helps to minimize drudgery of farmers. We are focusing on making the robot fully automated. It will be able to spray the entire yard on its own. Our aim is to make use of solar energy as a main source of energy making this multifunctional sprayer device by advancing the spraying methods which will make it user friendly and which can operate in different spraying stages of farming as per process requirement.*

Keywords: Pesticide Sprayer Robot, Solar power, Autonomous Robot

I. INTRODUCTION

Agriculture plays a vital role in the Indian economy. Over 70 per cent of the rural households depend on agriculture. Agriculture is an important sector of the Indian economy as it contributes about 17% to the total GDP and provides employment to over 60% of the population. Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. The nation is striving to find ways and means to keep its burgeoning population adequately fed. On the one hand it is facing the problem of declining productivity and on the other, challenges posed by liberalization.

Farmers are the one who provide the basics for all of our food needs as well as in changing the agricultural landscape. By managing farming practices, farmers also assure the sustainability of the whole flora and fauna. They protect the farm product from the time of sowing to the time it reaches the market. Their hard work is the reason that most of us have food on our tables every day.

Agriculture growth is becoming stagnant due to lack of productivity and farmers dealing with a lot of problems. To find out the problems we visited the grape yards in our village and we found some of the problems stated as carrying the backpack pesticide sprayer consuming a lot of human effort and compromising with their health. Still in many rural areas farmers are unable to buy a truck to work. So, we started to build a robot (Solar powered Pesticide Sprayer) which will simplify the work of farmers and ultimately increase productivity and help in agricultural growth.

1.1 Problem Statement

In India farming is done in traditional ways. Besides that, there has been larger development of industry and service sector as compared to that of agriculture sector. To mechanize 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 and another one is using a tractor but it is too costly which is not affordable by middle class farmers. So, there is a need for such a product which will satisfy both the conditions and fulfill the aim. Mainly we are focusing on grape yard farmers who have to travel much more with pulling heavy loads of pipes if they are using STP pumps. And this pulling causes chest pain of the formers (we got this information via on field survey)

As we know that 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 an affordable price to everyone. India is an agricultural country and its

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allied activities act as the main source of livelihood for more than 80% of the population of rural India. The problems faced by the farmers are as follows: -

- More human efforts and manpower needed.
- Tractors are not affordable by middle class formers
- Tractor drivers face health issues due to vibrations, noise and pesticide infection.
- More time required to complete this work.
- Sometimes pesticides fungal infection occurs
- Pulling STP's heavy pipes for spraying the grapes yard it may require 2-3 persons and it may cause chest pain.
- For grapes yard we require lots of pesticide sprays (after 1-2 days daily)
- Daily diesel/ petrol required to spray the yard it's too costly.
- Diesel, petrol creates pollution
- Spraying sanitizer in go downs or warehouses are mandatory.

Figure 1: Problems while pesticide spraying

1.2 Proposed Solution

Robot utilize renewable energy source (Solar energy) which is eco-friendly to function. The radio-controlled transmitter and receiver minimize drudgery of farmer and we protect them from health issues due to vibrations, noise and pesticide infection. We are focusing on to make it fully atomized means, no need of any human to control it. Robot will spray yard alone. Mainly we are focusing on grapes yard, greenhouses and warehouses. It minimizes the wastage of pesticides and time. Our contribution on our project is by using eco-friendly reliably available solar energy as a assist 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 efforts.

1.3 Aim

Reduce the drudgery of formers and secure the health issues faced by them while spraying pesticides in agriculture.

1.4 Objective

The design of multipurpose agricultural equipment machines will help Indian farmers in rural and small farms. It will reduce the cost of buying separate equipment for farming, and will help to increase the economic standard of an Indian farmer. It will reduce the hard work of farmers by using robots.

- ECO friendly (Because we are using solar power and charged battery for operation)
- More effective.
- More economical. {affordable for middle class farmers}
- Easy to clean and maintain.
- It works on a renewable energy source called solar energy.
- It does not create air pollution & noise.
- Easy to handle.
- Does not require fuel for working hence operation is cost reduced.

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II. METHODOLOGY

Robots utilize renewable energy sources (Solar energy) which are eco-friendly to function. The solar panel gives out electric supply to the system, pesticide spraying robot using the radio-controlled transmitter and receiver minimize drudgery of farmers and we protect them from health issues due to vibrations, noise and pesticide infection. We are focusing on making it fully atomized, no need for any human to control it. Robot will spray the yard alone. Mainly we are focusing on grape yards, greenhouses and warehouses. It minimizes the wastage of pesticides 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 it friendly to use and operate which can be usable 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 efforts.

2.1 System Block Diagram

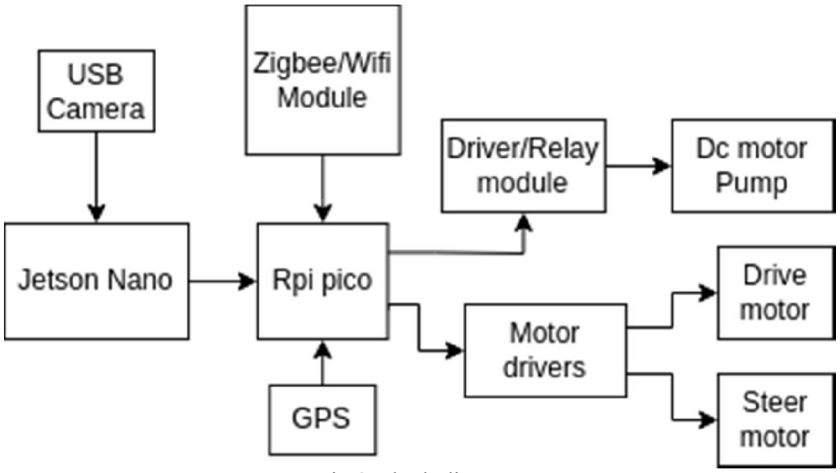

Fig.2 Block diagram

2.2 Experimental Output

Fig .3 Structure building, sprayer integration Electrical connections and wireless manual testing

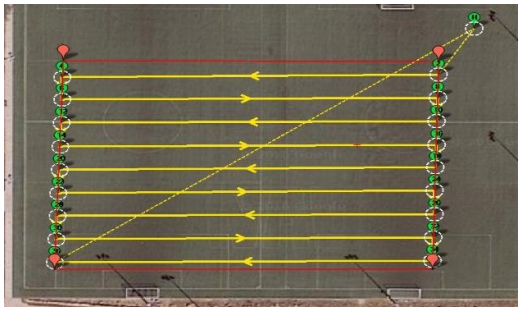

Fig.4 Autonomous implementation(Software)

2.3 Future Scope

- Multipurpose (Other crops, Warehouses, etc)
- Agricultural automation
- IOT (Soil monitoring, Spraying statistics)
- Making the robots more economical

2.4 Technologies Used

- Robot Operating System (ROS)

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- GPS (Localisation)
- Waypoint navigation (Mission planner)
- Computer vision
- Fusion 360 (Design and analysis)
- Zigbee/Wifi

III. 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 robots 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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