

Article Info

Received: 17 Jan 2020 | Revised Submission: 20 May 2020 | Accepted: 28 May 2020 | Available online: 15 Jun 2020

Design and Implementation of Pesticide Spraying Robot using IOT

Ravi Gorapudi*, Bhargava Rama Sai Pavan Rudrapaka** and Aadi Seshu Valluri***

ABSTRACT

India is an agricultural based country. Spraying of pests is an important task for every Farmer. In ancient days Farmers have used hand operated or fuel operated spray pump for this task as a result carbon dioxide emitted as pollutant during the operation of such pumps has a unpleasant effect in the environment. Also there is a chance of directly getting in touch with of pesticides with human body which will be harmful. Hence, these conservative sprayers are not much appreciated. This paper designed a pesticides spraying robot using raspberry pi. Fossil Fuels operated Sprayers are eliminated by DC pump which results in the reduction of vibrations and noise. This makes spraying system eco-friendly. To implement the idea a vehicle is made which is electronically operated by a remote (mobile app). Sprayer is fitted the robot so that it can spray pesticides uniformly covering a large area in less time. The main advantage in this paper is sprayer Height is Adjusted According to the Plant Height.

Keywords: Solar powered; Pesticide sprayer; Robotic system.

1.0 Introduction

India is the farmland with a population of 3/4 in agriculture. In accordance with the climate and other resources accessible to them, farmers will grow multiple plants in their field. But some technological assistance are required to achieve high output and excellent quality.

The increase in the demand of labour in the agriculture fields is increasing day by day as the people now a days are less interested in agriculture so all we need is a robot which can replace humans. Pesticide spraying plays a key role in protecting the field. Many people are not interested in spraying pesticides as they are getting harmful skin infections and breathing problems also carbon dioxide emitted as pollutant during the operation of such pumps has a harmful effect in the environment. Another important factor is human error which leads to unexpected issues while spraying. For instance, Due to lack of awareness human labor may spray extra dosage to the plants that leads severe damage to the field. We

can find some of the robots available for pesticide spraying in the market but what makes robot presented in this paper different from them are firstly we are designing a robot which is totally controlled by humans through mobile app using IOT, secondly live monitoring is the extra feature added to this paper which gives more accuracy and uniformity in spraying this may increase the yield also.

2.0 Literature Review

As indicated by WHO there are roughly 3 million instances of pesticide poison in consistently and up to 2.2 million deaths, essentially in creating nations. The potential well being impacts of pesticides incorporate asthma, sensitivities, and touchiness, and pesticide presentation is additionally connected with malignant growth, hormone interruption, and issues with propagation and fetal advancement. Kids are at more serious hazard from presentation to pesticides due to their little size:

*Corresponding author; Department of Electronics and Communication Engineering, Andhra Loyola Institute of Engineering and Technology Vijayawada, Andhra Pradesh, India (E-mail: ravigorapudi234@gmail.com)

**Department of Electronics and Communication Engineering, Andhra Loyola Institute of Engineering and Technology Vijayawada, Andhra Pradesh, India (E-mail: bhargavrudrapaka@gmail.com)

***Department of Electronics and Communication Engineering, Andhra Loyola Institute of Engineering and Technology Vijayawada, Andhra Pradesh, India (E-mail: akhilvalluri5588@gmail.com)

comparative with their size, youngsters eat, drink, and inhale more than grown-ups. Their bodies and organs are developing quickly, which additionally makes them increasingly defenseless; truth be told, youngsters might be presented to pesticides even while in the womb.

2.1 Effects of organophosphates and pyrethroids

Intense organophosphate and carbonate presentation causes signs and manifestations of abundance acetylcholine, for example, expanded salivation and sweat, narrowing of the students, queasiness, loose bowels, decline in circulatory strain, muscle shortcoming, and weakness. A few organophosphates additionally have a postponed neurological response described by muscle shortcoming in the legs and arms. Among the most encouraging options in contrast to organophosphates were engineered pyrethroids.

Be that as it may, pyrethroids can cause hyper-excitation, forcefulness, uncoordination, entire body tremors, and seizures. Intense exposures in people, typically coming about because of skin introduction because of poor taking care of methods, as a rule resolve inside 24 hours. Pyrethroids can cause an unfavorably susceptible skin reaction, and some pyrethroids may cause malignancy, conceptive or formative impacts, or endocrine framework effects. In China, it's assessed that 500,000 individuals endure pesticide harming yearly, and around 500 of them bite the dust. Youngsters appear to be enormously helpless to the lethal impacts of pesticides. The Natural Resource Defense Council has gathered information which recorded higher rate of youth leukemia, mind malignant growth and birth abandons. These outcomes related with early presentation to pesticides.

2.2 Effect on mothers and babies on exposure to pesticides

Figure 1: Harmful Effects of Pesticides



Introduction to certain pesticides can be 'hellfire' for a pregnant woman as it can undoubtedly prompt passing of infant and regardless of whether the infant is created will have loads of clutters or even loss of limbs.

2.3 Methods followed to overcome the problem

There are different techniques that are executed today in different pieces of the world to diminish the outcomes caused to people (manual pesticide sprayers).

The ones being used today are:

1. Tractors (Deere) furnished with GPS system and tremendous sprayers which can automatically spray from the ground.
2. Using of a Remote Piloted Vehicle (RPV) for spraying pesticides (a RC helicopter). This technique effectively utilized the pesticides (10-15% more proficient than manual showering) and furthermore could substitute 50 specialists. Tragically this venture was dropped some time in the past.
3. Greenhouse pesticide splashing through pipelines and nozzle system.
4. Robot have been proposed to be a substitute.

3.0 Existing System

In the existing system The solar panel creates DC power that is associated with a battery through booster circuit and charge controller so as to keep the battery charged. A four wheeled vehicle is made to carry the pesticide container. DC motors are associated through engine driver with the wheels for movement of the vehicle. They have utilized 3 Watt sun powered board where output from the panel is around 9.5 V with the utilization of booster circuit the output is boosted to 12 V and associated with battery-powered battery. The framework utilizes Arduino microcontroller which is on ATmega 328.

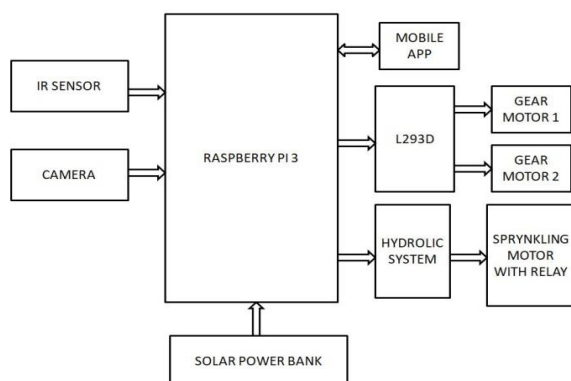
An adapter circuit is utilized to divide the voltage to 12 V and 5 V, to get 5 V for Arduino and 12 V for DC engine. Arduino UNO has an operating voltage of 5 V. For the movement of entire system 60 rpm 12 V DC engine is utilized which is controlled by IC L293D, LCD is utilized to show the status of the device. They have utilized 16 x 4 LCD display. GSM is utilized to communicate with the robot through SMS. Relay circuit is utilized to introduce so that necessary separation required by the rover and

furthermore it sends signal to work the dc pump. Ultrasonic sensor is utilized to recognize the objects/obstacles. While moving in the predefined path, in presence of obstacles in the way, the robot will stop moving to keep away from damage and communicate through SMS. Motor driver is utilized to drive the engines as indicated by the data given by the Arduino. Sprayer splashes the pesticides through the Nozzle.

4.0 Proposed System

In the proposed work a robot is made with solar energy for the spraying of pesticides with hydraulic lifting system and controlled using mobile app. The following figure shows the block diagram of proposed system.

Figure 2: Block Diagram of Proposed System



4.1 Power supply module

In this paper for power supply a power bank with solar panel is chosen. The solar panel will get charged by sun light and the energy is stored in a power bank . This Stored energy is used to drive raspberry pi.

4.2 Control module

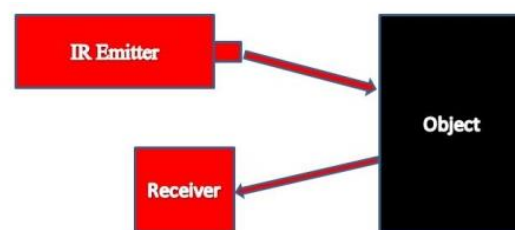
The Raspberry pi is a scaled down PC which is structured in a solitary board with all the fundamental segments required for running a working framework. All models of raspberry pi include a Broadcom framework on a chip (SoC) with a coordinated ARM good central processing unit (CPU) and on-chip graphics process unit (GPU). Processor speed ranges from 700 MHz to 1.2 GHz for the Pi 3 and on-board memory extend from 256 MB to 1 GB RAM. Secure Digital (SD) cards are

utilized to store the working framework and program memory in either SDHC or Micro SDHC sizes. It contains 40 pins in which four supply pins two 3.3v pins, two 5v pins, 7 ground pins and 29 GPIO pins. It gets energy from the solar power bank for its functioning. The Pi board will accept the inputs from the IR sensor and Camera module, based on the inputs and commands from the user through mobile app it will control the output devices like gear motors and spraying mechanism.

4.3 Obstacle avoidance module

Infrared radiation is an EM wave with wavelength of 700nm to 1 mm. It is radiated by objects with temperature over 0 kelvin. Moreover power and wavelength of infrared radiation relies upon the temperature of the item. These kinds of sensors utilize intelligent property of IR. The transmitter transmits an IR shaft which is reflected by the objects. The reflected IR is the recognized by the receiver. At any point an objects is recognized by the sensor it will advise it to the controller then the controller will automatically stops all the engines and inform to the user that a obstacle is detected.

Figure 3: Reflectance IR Sensor

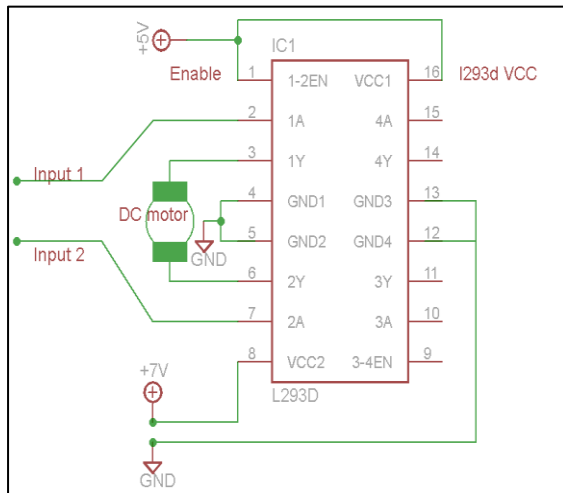
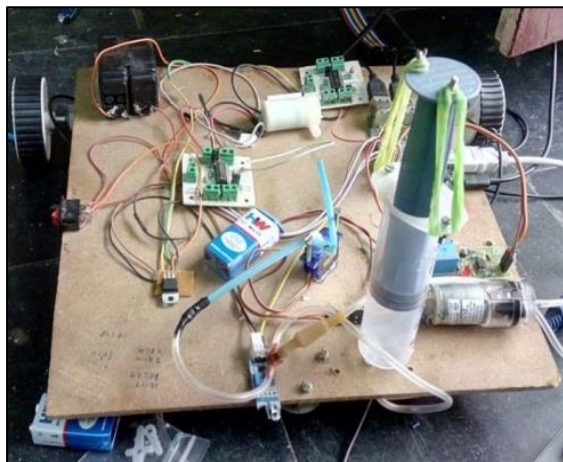
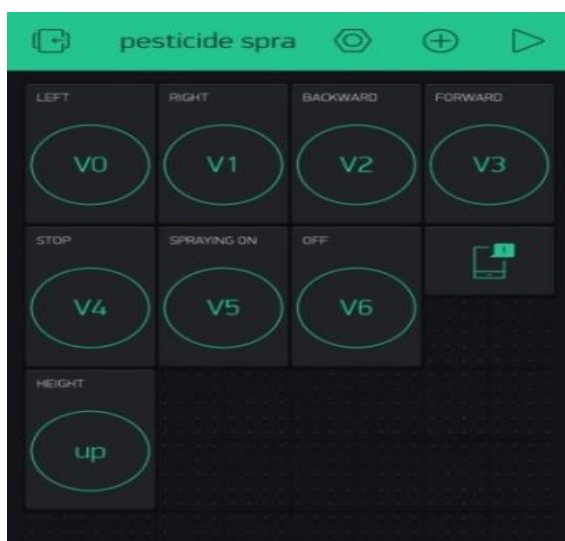


4.4 Live monitoring module

Camera is attached for Live tracking of objects or obstacles in the path of the robot. In this paper IP address of the camera is identified and it is connected via IOT. So that it can be accessed from anywhere i.e we can monitor the camera display from anywhere using the internet.

4.5 Driver module

L293D is a Motor driver or Motor Driver IC which permits DC motor to drive on any direction which might be advances or in reverse. L293D is a 16pin IC which can control a two DC motors at the same time toward any path. It implies that you can control two DC motors with L293D IC. The L293D can drive small and large motors also. It works on the principle of H-bridge.

Figure 4: L293D Circuit Diagram**Figure 5: Prototype of Proposed Work****Figure 6: Blynk App**

H-bridge is a circuit which allows the voltage to be flown in either directions as voltage need to alter its direction having the option to rotate the engine clockwise or anticlockwise, Hence H bridge IC are perfect for driving a DC motors. In the proposed work two L293D modules are utilized one for controlling the gear motors for the movement of the robot and the second one is for spraying pump. It is the key component in the proposed paper as it supports the movement of the robot. It also plays a Vital role in spraying mechanism.

4.6 User control module

In this Paper an IOT based app called Blynk is designed in which there are set of virtual keys. These keys are used for operating the Hardware. The user can control the entire robot by using this app. User can make the robot to move in any direction he wants for example if he want to make it to move in forward direction he will press forward like wise in all the directions i.e left, right, and backwards. There are some other specific buttons for the sprinkling on/off and for the height adjustment also.

4.7 Height adjustment module

The main advantage of this paper is sprayer height is adjusted according to the plant height which is achieved by using Hydraulic mechanism. This mechanism works under three stages of heights in this paper. In stage 1 we can get some height is raised by the hydraulic lift in the similar fashion we have stage 2 and stage 3. In each stage we can raise the sprayer height.

4.8 Spraying module

A Relay driver is an electro-magnetic switch that will be utilized at whatever point we need to utilize a low voltage circuit to turn a light ON and OFF which is associated with 220V mains supply. The necessary current to run the hand-off loop is more than can be provided by different incorporated circuits like Op-Amp, and so forth. Relays have interesting properties and are supplanted with solid state switches that are stronger than solid state devices.

So as to drive the relays, we use transistor and just less force can be utilized to get the relay driven. Since, transistor is an amplifier so the base lead gets adequate current to make more current flow from Emitter of Transistor to Collector. The conduction of transistor can be controlled using base current and thus the spraying.

In the Proposed Work a prototype of solar based pesticide spraying robot using internet of things is made which can be controlled through a mobile app. The prototype looks given by figure 5. For controlling of this proposed work an app is made using Blynk server which is given by figure 6.

5.0 Conclusions

As indicated by this framework, proposed design turns out to be progressively independent with fast transmission of information by utilizing IOT. The main advantage in IOT is, in any event, when customers are not in the hub arrange, information will be sent, at whatever point a customer is associated with that hub, they can ready to see the information which has been sent as of now.

A smart robot system spraying pesticides is controlled through a remote option in an alternative to manual fulfillment of cross spray, lessening direct contact to pesticides and the human body, decrease pesticide harm to individuals, and improve productivity. In future, Robot can be grown further with hands to shower pesticides. Likewise the System can be refreshed to rotate with that pesticides will be sprayed in all directions.

In future by introduce the machine learning algorithm to be used to process the data and reduce the complexity of the hardware. hardware resources in agricultural information networks are combined into resource pool by utilizing vitalization technology, accomplishing dynamic distribution of resources and equalization of burden, altogether improve productivity. Our task can be improved by utilizing a sensor to take note of the soil ph value such that use of unnecessary Fertilizers can be reduced. A water meter can be introduced to evaluate the measure of water utilized for irrigation and giving a cost estimation. Further, it additionally decreases the investment of farmers.

References

- [1] Solar Powered Automatic Pesticides Sprayer, International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS-2017), 978-1-5386-1887-5/17/\$, 2017 IEEE, 3438-3441.
- [2] Design and Implementation of Semi-autonomous Anti-pesticide Spraying and Insect Repellent Mobile Robot for Agricultural Applications, 2018 5th International Conference on Electrical and Electronics Engineering, 978-1-5386-6392-9/18/, 2018 IEEE, 233-237.
- [3] Certain Investigation of Precision Agriculture Robot Using Lab Viewx, International Conference on Current Trends in Engineering and Technology, ICCTET'13, IEEE Coimbatore, India, 2013, 319-322
- [4] Review of Agriculture Robotics: Practicality and Feasibility, 2016 IEEE International Symposium on Robotics and Intelligent Sensors (IRIS2016) 17-20 December 2016, Tokyo Japan, 978-1-5090-6084-9/16/2016 IEEE,194-198.
- [5] J Gutiérrez, JF Villa-Medina, A Nieto-Garibay, MÁ Porta-Gándara. Automated Irrigation System Using a Wireless Sensor Network and GPRS Module, in IEEE Transactions on Instrumentation and Measurement, 63(1), 2014, 166-176.
- [6] SO Al Mehairi, H Barada, M Al Qutayri. Integration of Technologies for Smart Home Application, IEEE/ACS International Conference on Computer Systems and Applications, Amman, 2007, 241-246.
- [7] A Hanggoro,MA Putra, RF Sari. Green house monitoring and controlling using android mobile application, International conference on QiR, Yogyakarta, 2013, 79-85
- [8] D Stipanicev, J Marasovic. Networked embedded greenhouse monitoring and control, in Control Applications. CCA. Proceedings of IEEE Conference, 2(2),2003, (1350-1355).
- [9] L Atzori, A Iera, G Morabito. The Internet of Things: A survey, Computer Networks, 54, 2010, 2787- 2805.
- [10] Agriculture Robotic Vehicle Based Pesticide Sprayer With Efficiency Optimization, IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development (TIAR 2015), 978-1-4799-7758-1/15/2015 IEEE, 59-65.

- [11] A Smart Agriculture Assisting Robot using Internet of Things, International Journal for Trends in Engineering & Technology, 33-36.
- [12] Design and Fabrication of Crop Analysis Agriculture Robot, International Journal of Advanced Scientific Research and Management, 1(1), 2016, 19-22.
- [13] Design and Operation of Agriculture Based Pesticide Spraying Robot, International Journal of Science and Research (IJSR), 2013.
- [14] Agriculture Robot For Seeding and Forming, ISAR - International Journal of Electronics and Communication Ethics – 1(2), 2018, 7-12.
- [15] Design and Fabrication of Solar Powered Semi Automatic Pesticide Sprayer, International Research Journal of Engineering and Technology (IRJET), 2073-2077.