IoT BASED SOLAR POWERED AGRI SPRAYING ROBOT USING LORA

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Abstract:

A majority of the population of developing countries is associated with agriculture directly or indirectly. The liaison of engineering technology and Sustainable Development Goals (SDGs) can build a bridge for farmers to enhance their skills regarding advancements through future generation agriculture trends. The next-generation trends include better soil preparation, intelligent irrigation systems, advanced methods of crop nutrient inspection, smart fertilizers applications, and multi-cropping practices. This work proposes a smart Decision Support System (DSS) that acquires the input parameters based on real-time monitoring to optimize the yield that realizes sustainability by improving per hectare production and lessening water seepage wastage in agribusiness. The proposed model comprises three basic units including an intelligent sensor module, smart irrigation system and controlled fertilizer module. The system has integrated sensors, cloud employing decision support layers, and networking based DSS to recommend cautions for optimum sustainable yield. The intelligent sensors module contains a temperature and humidity sensor, NPK sensor, soil moisture sensor, soil conductivity sensor, and pH sensor to transmit the statistics to the cloud over the internet via Long Range (LORA) using Serial Peripheral Interface (SPI) communication protocol. Moreover, an android application has been developed for real-time data monitoring according to GPS location and node information (accessed remotely). Furthermore, the DSS contemplates the accessible information from sensors, past patterns, monitoring climate trends and creating cautions required for sustainable fertilizer consumption. The presented results and comparison validate the novelty of the design as it embraces smart irrigation with smart control and smart decision-making based on accurate real-time field data. It is better than existing systems as it transmits the data over the LoRa that is an open-source communication with long-range transmission ability up to several kilometres. The sensor nodes helped in advancing the yield of crops, which resulted in achieving inclusive and sustainable economic goals.

Introduction:

In India, Agriculture is a vocation of farmer's. Agriculture in India constitutes more than 60% of the occupation. It serves to be the backbone of Indian economy. The Economic Survey says that there is a need to improve farm mechanization in the nation. It is very important to improve the efficiency and productivity of agriculture by simultaneously providing safe cultivation for the farmers. Insects are largely responsible for the crop destruction. The farmers are facing significant issues in managing pest infestation. Pests are undesirable insects or germs that interfere with human activity and can bite, ruin food plants or make life more hard for farmers.

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A key point in crop management is early detection and avoidance of pests.Effective control of pests needs some understanding of pests and their habitats. Insecticides or pesticides, a man made or natural preparation are used to kill insects or otherwise control their reproduction. These herbicides, pesticides, and fertilizers are applied to agricultural crops with the help of a special device known as a "Sprayer," sprayer provides optimum performance with minimum efforts. Operations like spraying of pesticides, sprinkling of fertilizers are very tedious. Though spraying of pesticides has become mandatory it also proves to be a harmful procedure for the farmers. Farmers, especially when they spray pesticides, take too many precautions like wearing appropriate outfits, masks, gloves etc. so that, it does not cause any harmful effects on them. The main disadvantages withregard to this method are : the pesticide may come into contact with the farmer during spraying, which may trigger skin cancer and asthma illnesses. Increased pesticide spraying can impact consumer health as it enters the food chain.

Pesticides are also sometimes sprayed on non-affected crops resulting in the same waste. We have therefore created an automated robotic system that can spray pesticides in restricted quantities only if pests are discovered to solve the above- mentioned problems.

This project involves usage of Arduino Uno to control the movement of robot with the help of navigation buttons and a receiver (LORA Module). The wireless camera mounted tracks the path taken by the robot. This cost effective robotic vehicle can improve productivity, safety in agricultural applications and meet the demand for labour. An automatic vehicle which is used for main or secondary agricultural task is said to be a service unit. A vehicle capable of detecting obstacles on its way and intimates farmer regarding the intruder detected.

The methodology is based on providing security to the farm in the absenceof the farmer and keeps the farmer updated about the whereabouts of the farm. Agri-Bot is implemented with IR sensor, LORA module and pesticide pump is devised which focuses on the control of Agri-Bot with respect to a reference trajectory. Process of pumping pesticide can be controlled by the farmer using thenavigation buttons. Meanwhile our project uses simpler components such as a ESP32 camera, android application, LORA module, IR sensors, temperature/humidity sensor, ultrasonic sensor ,pump and DC motor to implement a cost effective agriculture robotic vehicle for spraying pesticides thereby protecting the farmers from the harmful effects of the chemicals and provide security to the farm.

Literature Review:

DESIGN AND DEVELOPMENT OF THE SOLAR ASSISTEDAUTOMATED PESTICIDE SPRAYER

The design and development of the solar assisted automated pesticide sprayer paper was published by R.Sushant Kumar Sahu, N.Senthil Kumar in the International Research of Engineering Research &Technology(IRJET),Volume6

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,Issue16,March2018.

Protecting crops against weeds, insect pest, and germ is becoming a biggest challenge for the farmers .To overcome this issue, agricultural chemicals(pesticides)are applied to crops .For this purpose a pesticide sprayer is employed .Although many sprayers are commercially available, none is optimised in terms of pesticide consumption, spray characteristics and cost of sprayer. In this context ,we have proposed an innovative sprayer model for optimized spray applications with minimum losses and cost. The proposed working model of automated pesticide sprayer was designed, fabricated and then analyzed for the performance tests. An added advantage of this automated pesticide sprayer is that it does not have any impact as far as farmers health is concerned and also it is free from greenhouse gas emissions. It has also been proven itself to be an efficient, reliable and economical one to spray pesticides for agriculture applications.

REMOTE CONTROLLED SOLAR POWERED MULTIPURPOSE PESTICIDE SPRAYER AUTO MATEDROBOT

The remote controlled solar powered multipurpose pesticide sprayerautomated robot paper was published by Mr.Arvind M.S, Mr. Arunakumara ,Mr.PrajwalS.P.,Mr.SajithK.MinIEEE,onDecember05,2020.

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 toreduce 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 (Solar energy) which is eco-friendly to function.

The solar panel gives out electric supply to system, the radio controlled transmitter and receiver at least minimize drudgery for the farmer. Also minimizethe 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 withthe standard spacing decreasing the labour cost and human effort.

SOLAR AUTOMATIC PESTICIDE SPRAYER USING ZIGBEE

The solar automatic pesticide sprayer using zigbee paper was published by

S. Kiran , R. Madhan Raj , A. Manikandan , S.N. Khissor Khumar , A. Sridhar inInternational Journal of Engineering

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Science and Computing(IJSEC),Volume7
, Issue4, April2017.

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 Zigbee wireless device. The proposed system Automatic Pesticide Sprayer Robot which is expected to achieve better results compared to the previous methods without any nil human assistance. This would be an automatic mechanical model that would work automatically powered by solar energy and reduce drudgery . And also protect the farmers and cultivators from harmful pesticides and chemicals.

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 labor completely from this process. It does not compromise the performance of a petrol based pesticide sprayer.

DEVELOPMENT OF SMART PESTICIDE SPRAYING ROBOT

The development of smart pesticide spraying robot paper was published by P vr Chaitanya, Dileep Kotte, A. Srinath ,K.B. Kalyanin International Journal of Recent Technology and Engineering(IJRTE),Volume-8,Issue5,January 2020.Indiais the farmland with a population of three-fourths in agriculture. In accordance with the climate and other resources accessible to them, farmers will grow multiple plants in their field. But some technical abilities along withtechnological assistance are then required to achieve high output and excellent quality. Disease is recognized in crops as the shift or deficiency of the plants ordinary functions that will generate certain symptoms. The disease that causes agents in plants is mainly defined as any agent's pathogens Most of the empathogenic agents signs are seen in the leaves, stems and branches of the crops. Consequently, the diagnosis of disease and the proportion of disease produced in crops is compulsory for effective and successful plant cultivation. This can be done through taking input images using camera, analyzing them using machine learning process. This displays the disease presented ,stem or plant. This also displays the exposed are at o disease and also predicts the remedies, turn on the pesticide sprayer which sprays the respective pesticide on the expose dare a to disease. This is very necessary for effective spraying of the pesticide. The movement of robot is done with L293dmotor driver and the process or embedded system is done through Raspberrypi3.We use python code for machine learning which trains the robot with pre-defined images. Since this can be controlled fromanywhere without working in the field and being exposed to pesticides, it will be a profit for the farmer. He will stay unaffected by his health

condition.

PESTICIDE SPRAYER WITH SECURITY SYSTEM BY USINGSOLAR ENERGY

The pesticide sprayer with security system by using solar energy paper was published by Amaresh A.M, Anagha G Rao , Fenaaz Afreen in International Journal of Recent Technology and Engineering (IJRTE) , Volume-8 ,Issue 11,March2020.

This paper deals with the exposition of how IoT can be applied to various fields of agriculture. Smart farming is a modern technology used to increase the quality and quantity of agricultural products. Farmers in21stcentury have access to GPS, soil scanning ,data management and IoT technologies. The main objectiveof smart farming is to a meliorate the quality of human life in terms of comfort, efficiency and productivity. The sensors installed are designed to detect and measure movement.

This article presents a comprehensive survey on various features like GSM based intruders, scanning, security and proper irrigation facilities, pesticide sprinkler is controlled by using an android application. The Bluetooth acts as a communicating device between the android application and the pesticides sprinkler. Various sensor nodes are deployed at different locations in the farm. These parameters are controlled using remote devices, internet services and the operations are performed by interfacing sensors, cellular data, and camera with micro controller. This project is matriculated to enhance the farmer's efforts smartly.

Existing And Proposed System Of Agri Spray Robotusing Lora

EXISTING SYSTEM OF AGRI SPRAYING ROBOT USIN GLORA

This paper is based on the implementation of an agriculture robot vehicle which navigates in between the crops based on the instructions given by the farmer using android application. This vehicle uses cheaper components, so that the vehicle becomes cost effective. The farmer can use any android smart phone for this application to move the robot and track any in trader if detected in the field. Farmer will receive a picture of his farm when an in truder is detected. He will obtain a message or notification from Agri bot about the event occurred in the farm. Farmer can control pesticide sprinkling device through IOT application.The robot, as it is placed in the field captures the image of the intruder, provide away to view the crops or path of the robot using wireless camera. The signal is received at the operating end and viewed using mobile. Thus identification of the traders made very much possible and simple as well, the image and send sit tothe farmer.

The robot is placed in the farm and is switched on through IoT and its direction is controlled by Android application. The spraying of pesticides, which can be done with the help of pesticide sprinkling pump, this can be periodically sprayed whenever there lay switch is on.
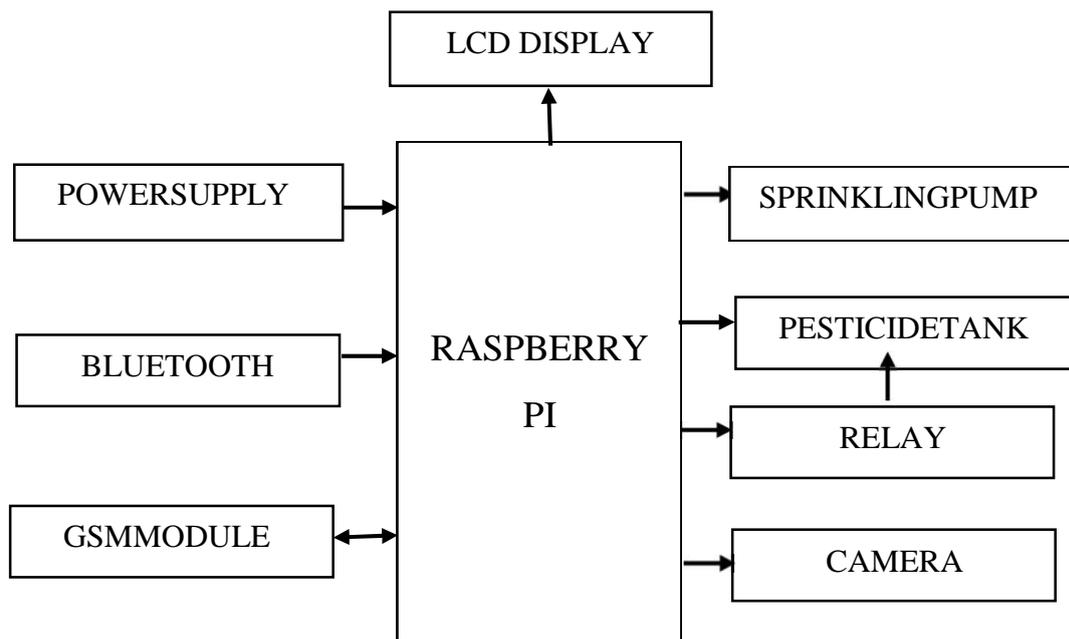
Block Diagram of Existing System

Figure 1 Block Diagram of Existing System

InFig. 1,the system focuses on the design, development and the fabrication of the agricultural robot with pesticide spraying system in addition to security system using IOT. The agricultural robot is used to control the function like pesticide spraying and controlled through Bluetooth module which will communicate between and roid application and robot with low budget. The system is provided with dc motors for moving the robot and an intruder detection sensor, whenever the intruder is detected then a message is sent to the farmer, if the farmer's smart phone is in silent mode then a voice announcement is played about the event occurred at the farm. The farmer can take the photo of the intruder using IOT technology and view the farm.

3.1 PROPOSED SYSTEM OF AGRI SPRAYNG ROBOT USING LORA

The proposed system uses the LORA module to have the communication between the and reduplications and sprinkler pump to make the pesticide sprayingoperation.

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In Fig. 2 ,we have proposed an innovative sprayer model for optimized spray applications with minimum losses and cost. The proposed working model of automated pesticide sprayer was designed, fabricated and then analyzed for performance tests. This sprayer operates on electrical power supplied by solar panel with battery of designed capacity. Spraying pesticide/fertilizer directly on to individual lesions minimizing wastage leading to reduced consumption of chemicals. Prevents biological hazards of spraying powder pesticide by means of conventional methods .Can be able to operate the robotic vehicle anywhere using the IOT.
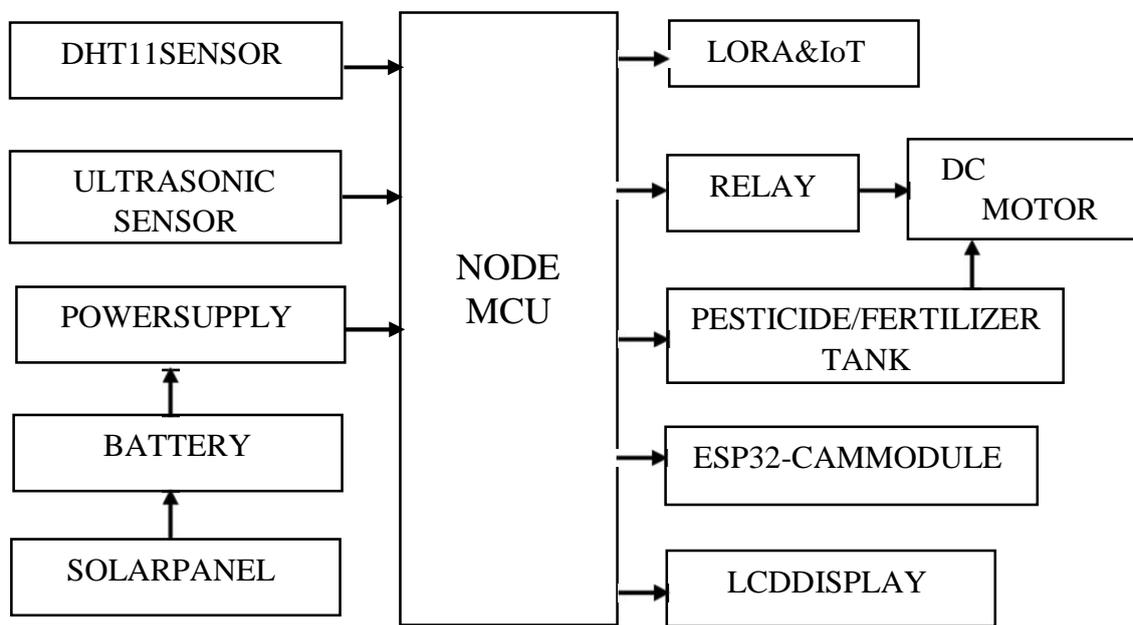
BLOCK DIAGRAM OF PROPOSED SYSTEM

Figure 2 Block Diagram of Proposed System

The designed robot will perform the pesticide/fertilizer spraying operation which is powered by solar panel .The robot is operated using Blynk app and LORA which isomerase communicating device sends the signals to the robot for required mechanisms and movement of the robot .Ultrasonic sensor is used to avoid the obstacle when navigating in between the paths of the crops and ESP32 cam as used for video monitoring .DC motor pump spray the pesticide/fertilizer to the crops by relay and LCD displays sensor data.

The robot model is controlled through the Blynk application. Belknap

,there will be buttons like forward , reverse , left , right . These buttons help to move the robot to the desired position. There also a stop button, in case we need to stop in certain place . To spray the pesticides/fertilizers to the crop , the spray button is there, we can spray until we Off it. The Arduino ide software shows the detailed information about the sensor data and the .

The proposed system is very efficient and can be used in agricultural field very effectively.

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This developed system can be used for spraying the fertilizer &pesticides , and fungicides and also for ground surface watering .Also this robotcan be used at very remote place where fuel and power are not available.

Conclusion:

The prototype of the project has shown that the farmer is able to spray the pesticides to the crops by this robotic model without any harm. This project solves real time crucial problem faced in agriculture. This system is quite affordable and feasible and also is adjusted according to the need of varieties of crop to spray pesticide. This project is economical and can be easily implemented in real time,thus balancing both the cost and benefits.

In future, this proposed model can be enhanced by adopting new advanced computer technology, we can make a full automatic spray. And implementing thetelescopic nozzle we can adjust the length of the spray required . Also using the hydraulics system to the wheel, helps in varying the ground clearance.

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