ISSN 2278-9723
DOI:10.31838/ijccts/09.01.07

Research Article

Implementation of Lora based Autonomous Agriculture Robot

SPOORTHI A S[1], SUNIL T D[2], M Z KURIAN[3]
[1]M. Tech (Digital Electronics) Student, Dept. of ECE, SSIT, Tumkur, 572105, India
[2]Assistant Professor, Dept. of ECE, SSIT, Tumkur, 572105, India
[3]HOD, Dept. of ECE, SSIT, Tumkur, 572105, India
Email: spoorthias22@gmail.com[1], sunil.tumkur@gmail.com[2], mzkurian@yahoo.com[3]
Received: 06.07.21, Revised: 11.08.21, Accepted: 17.09.21

ABSTRACT
Agriculture is the primary occupation in most of the developing country like India. In order to decrease the efforts of farmers, agricultural system should be facilitated with advanced techniques. Agriculture has obtained more awareness from researcher. Now a days, robotics in agriculture field with its performance is newly appearing technology. In this work, agriculture robot is specifically designed for seed sowing, grass cutting and pesticide spraying. There is necessary to upgrade the efficiency and agriculture products by put back laborers with intelligent machine-like robots. In recent years, due to the capability to execute agricultural tasks in systematic manner without human intervention, the use of robots in agriculture field has been increased rapidly. Here, it is presented about the design and development of agriculture robot which is simple in design and also a new technology called LORA is used for long distance communication in agriculture farming. So, that robot can operate using Lora which sends signal to robot for required mechanisms. Then efficiency of the operations like seed sowing, grass cutting and pesticide spraying will increase. It also decreases the problem occurred in manual planting. The main aim is to design a multipurpose agriculture robot that can run automatically and to increase the speed and accuracy of the work which also reduces manual work by mankind.

Keywords: Agriculture, Autonomous, Robot, Lora, solar panel.

1. Introduction

Agriculture plays a major role in development of economy of India. About 70% of Indian population choose agriculture as the primary occupation. But nowadays the number of people involved in agricultural field is reduced due to different reasons. Production of agriculture is very much in focus and the demands to the growing industry. As the population in India is increasing day by day, need for food production is also increasing, where the environmental impact of human activities is decreasing. As a result, it is necessary to come up with modern techniques. As earlier methods require a greater number of labors, consume heavy time and a lot of human energy. To overcome the problems that are noticed earlier, use of robot is the best solution. Some of the agricultural operations such as seed sowing, grass cutting and pesticide spraying are very tedious. Though pesticide spraying is compulsory which is a dangerous procedure for the farmers. Along with the technology development, there comes a challenge in executing the advanced technology in agricultural field. A good and an appropriate strategy has to be developed for handling and processing a very huge agriculture land. Lora (Long Range) is a low power wide-area network (LPWAN) protocol developed by semtech, USA. It was developed by cycles of Grenoble, France and acquired by semtech, the founding member of LORA alliance. Lora is the fastest technology. Long life battery, long distance communication and low-cost application specific devices are the reasons for engineers to use Lora.

2. Related Works

Ranjitha B and Nikhitha M N [1], Solar powered autonomous multipurpose agriculture robot using Bluetooth/Android application. In the agricultural field many operations are performed like seed sowing, grass cutting, ploughing etc. The main aim is at design and development of the robot where complete system is powered by solar energy. The efficiency of those operations is increased and also minimizes the fault occurring in manual planting. The interest of the robot is decreased human involution. Commands are passed to system using Bluetooth which is secure for safety operation by not having direct contact with human. Android app is used to perform operations. In this work, labor cost is saved and more time will be saved.

Jerosheja B R and Mythili C [2], Solar powered automated multi-tasking agricultural robot. The paper aims at designing automatically running multitasking vehicle for agriculture that increases the

speed, accuracy of the work and minimize the labor of farmers. The attack of pest and weeds can be controlled by spraying pesticides by the robot. Also, solar panel is kept above the vehicle in order to recharge the battery. By using internet, an application is built to control and keep track of all the operations from any part of the world. By switching ON the button this IoT shows the field status, sensor data and live video of the field. Hence, an autonomous robot has developed for entire functioning of the farm with least use of man power.

S. Umarkar and Anil karwankar [3], this team developed automated seed sowing agribot using Arduino. Presently, changes in the environment of agricultural production is high in focus and demands. Thus, farmers have to use the advanced technology for cultivation tasks. This team aims at developing a system that minimize the cost of working, reduces digging time and seed sowing operation by using solar energy. There are so many seed sowing methods, some are cost effective but more man power is required as well.

M. Saari and P, Sillberg [4], author discussed about LoRa technology which is a wireless technology. Lora is the common LPWAN technology. Advantage of Lora is long range capacity. Hundreds of square kilometers can be covered by a single base station but the range depend on environment. Lora technology most used because of low power devices with batteries or solar power. Some of the Lora technology applications such as air pollution, agriculture processing, home security, indoor air quality, smart parking, fire detection and waste management are discussed.

3. Proposed Design of Multipurpose Agriculture Robot

A. Transmitter section

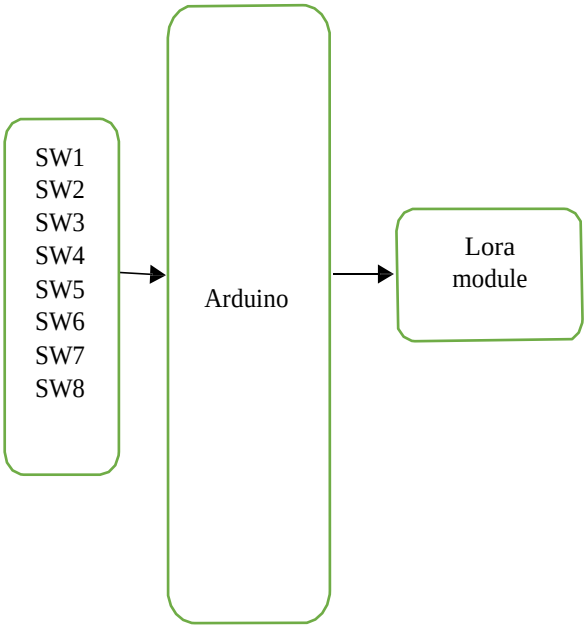

Fig.1: Block diagram of transmitter section

B. Receiver section

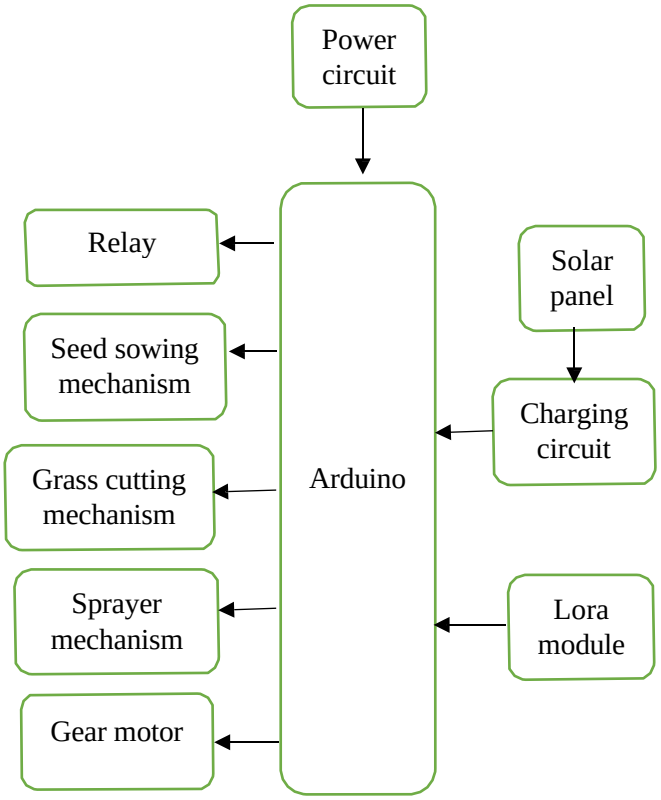

Fig.2: Block diagram of receiver section

3.1 Methodology

Block diagram consists of Arduino micro controller, relays, motors, LCD for display and also LORA technology for communication between the Remote Control and the Robot. As soon as the user press the start button the robot will starts moving in the forward path. As it starts moving in the forward path after few distance it stops and then it starts sowing with the help of a mechanism designed along with grass cutting mechanism and spraying mechanism based on the requirement. There are Relays used to control the different mechanisms that are designed as per the requirement. Through this arrangement the seeds are being dispensed in the soil, Unwanted weeds are cut and also pesticides can be sprayed. Until the user does not switches off the circuit the same series of steps continues. All these processes are displayed on LCD. The automated agricultural robot has significant possible to increase efficiency. The structure holds the battery and the hardware scaled on robot which is able to execute all performance victoriously. All the information collected from robot sent to receiver and controlled successfully. As we can perform multiple operations in a single system it grants an efficient system.

3.2 System requirements

3.2.1 Arduino Microcontroller

Arduino Atmega328 microcontroller is used to command the various components. It consists of 28 pins. It has 13 I/O digital pins, of which 5 can be used as PWM outputs and 5 as analog input pins.

3.2.2 Solar panel

The solar cells are also called photovoltaic (PV) cells where the name suggested (photo meaning "light" and voltaic meaning "electricity"), convert sunlight directly into electricity. A module is a group of cells connected electrically and packaged into a frame (commonly called as a solar panel).

3.2.3 Lora Module

Lora (Long Range) is a low-power wide-area network modulation technique. It is based on spread spectrum modulation techniques derived from chirp spread spectrum (CSS) technology. It is used to control the entire system.it is used for long range communication.

3.2.4 Motor Driver L293d

The working speed and the direction of two motors are controlled by the motor drive. It gives the bidirectional drive current at voltages ranging from 5v to 36v. this L293D IC is a typical motor drive IC that allows the DC motor to drive in any direction.

3.2.5 Relay

A Relay is electrically operated switch. It has a set of input terminals for a single or multiple control signals. This switch can have any number of contacts in multiple contact forms, such as make contacts, or break contacts.

4. Result And Discussion

The designed robot will execute the seed sowing, pesticide spraying and grass cutting operations at the same time. The sunlight will be converted into electricity as the solar panel gets heated up. This electrical energy is flow into the charging circuit. The voltage is given to battery in order to charge it. The voltage sensors are used to control the charging of battery. Since battery is bidirectional it will charge and at the same time voltage is supplied to Arduino.

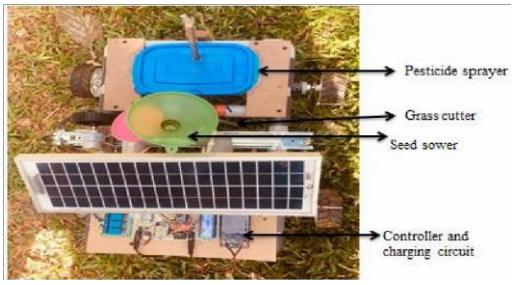

Fig 3: Snapshot of Automated Seed Sowing, Grass Cutting and Pesticide Sprayer Robot Using Lora.

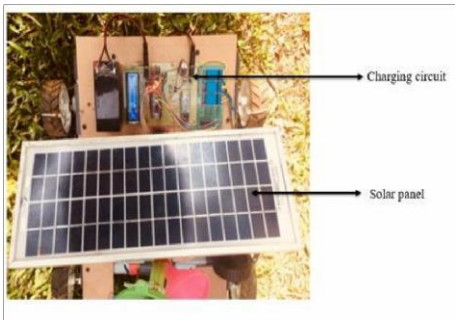

Fig.4: Snapshot of solar charging.

In seed sowing mechanism it helps in sowing the seeds in the field at prescribed uniform distance from each other. Depending on the type of the seed the distance between the seeds are pre-decided. In order to achieve the distance, the speed of the Dc motor is varied as per which the horizontal movement of the seed tray is controlled. The signal to initiate the sowing process is issued using the LORA transmitter and the same is received by the Microcontroller and the same is converted into a digital signal which is fed to relay, where the relay is connected to the DC motor with an input of 12v. A wheel is connected to the DC motor which converts the circular movement into a horizontal movement which in-turn opens and closes the passage to drop the seeds. There by achieving the required task.

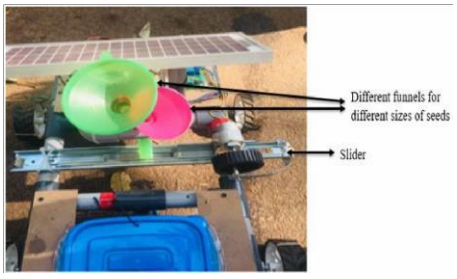

Fig.5: Snapshot of seed sowing mechanism

The grass cutting mechanism helps to cut the unwanted weeds grown in the field; this is achieved by using 3 sharp blades which are connected to a central hub pin which is directly stuck to the high-

speed DC motor. The on and off operations are controlled using the relay with an input voltage of 12v. These signals are issued by the Microcontroller to the relay and therefore to the motor as per requirement. Sharp blades spinning at a high speed because of the DC motor will cut the grass and push it to both the sides.

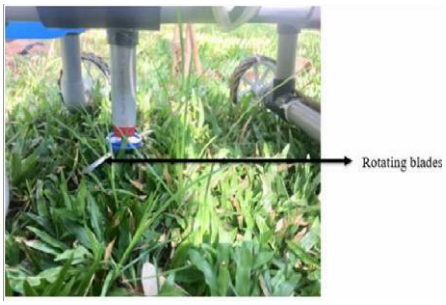

Fig.6: Snapshot of Grass cutting mechanism

The mechanism is used to spray pesticides or water to a certain distance based on the requirement. This is achieved using a Microcontroller which issues a digital signal to either stop or start the operation through the relay which is connected to the submersible pump which operates at 12v input signal. This Submersible pump has a pipe connected which sprays on the required direction.

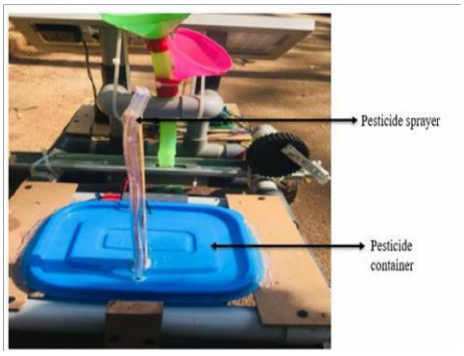

Fig.7: Snapshot of seed Pesticide sprayer mechanism.

3. Advantages

- The mode of operation of this machine is very simple even to the lay man.
- Labor problem can be reduced.
- Wastage of seed is less.
- It can be used also for various seed.
- The existing System will be removed successfully in this automatic machine.
- It saves operating time and saving on cost of operation as compared to Conventional method of behind country plough.

4. Conclusion

The LORA technology can be employed for long range communications for farm fields. The proposed agriculture robot is capable of doing the works performed by farmers within less time and low cost. This paper is more concerned about the problems that are facing in agricultural field and bring about the solution by designing and developing the multipurpose agriculture robot. The availability of the labor is decreasing as the people moved to cities due to the growth of industries and also the demand for stipend will also increase which becomes unaffordable for the land owners. A robot is designed to reduce the man power which makes the work easier for farmers. Also, it increases the efficiency and reduces the number of labors. It will perform task like seed sowing, cutting weed and pesticide spraying. Solar energy is used to charge the battery which is an added advantage that saves cost.

References

1. RanjithaB, Nikitha M N, “Solar Powered Autonomous Multipurpose Agricultural Robot Using Bluetooth/Android App”, IEEE 2019.
2. S. Umarkar and A. Karwankar, “Automated Seed Sowing Agribot using Arduino," in IEEE Conference on Communication and Signal Processing, April 2016, pp. 1379-1383.
3. H. Pota, R. Eaton, J. Katapriya and S. D. Pathirana, “Agricultural robotics: A streamlined approach to realization autonomous farming,” in IEEE conference on industrial and information systems, 2007, pp. 85-90.
4. S. Kareemulla, E. Prajwal, B. Sujeshkumar, B.

Mahesh, and V Reddy, “GPS based Autonomous Agriculture Robot,” in IEEE International conference on design innovations for 3Cs compute communicate control, 2018, pp. 100-105.

5. HC-05 - Bluetooth Module, Available: https://components101.com/wireless/hc-05-bluetoothmodule", accessed on September 2018.
6. P.V.S. Jayakrisna, M.S. Reddy, N.J. Sai, N. Susheel and K.P. Peeyush, “Autonomous seed sowing agricultural robot,” in IEEE Conference on advances in computing, communications a S. Kareemulla, and E. Prajwal, “GPS based Autonomous Agriculture Robo” IEEE 2018.
7. Jerosheja B R and Mythili C “Solar powered Autonomous multitasking Agricultural Robot” International Conference on Electronics,Communication and Aerospace Technology ICECA 2017
8. Amer, M.Gopinath, S.AjithSundaresh “Multipurpose Autonomous Agricultural Robot”, IEEE 2019
9. Kashiwazaki, K Srikanth1, P Bhargav “Multipurpose Autonomous Agricultural Robot” International Conference on Electronics,Communication and Aerospace Technology ICECA 2017
10. k Durga Sowjanya, R Sindhu “Multipurpose agriculture robot” International Conference on Electronics, Communication and Aerospace Technology 2017.