Alinteri J. of Agr. Sci. (2022) 37(2): 119-126
e-ISSN: 2587-2249
info@alinteridergisi.com

http://dergipark.gov.tr/alinterizbd
http://www.alinteridergisi.com/

Smart Agriculture with IoT-Integrated Solar Agribot for Efficient Seed Sowing and Irrigation

Parvatham Sathish[1], Ravula Suresh[1], Hanuja Korukonda[1]

[1]Department of Electronics and Communication Engineering

[1]Sree Dattha Group of Institutions, Sheriguda, Hyderabad, Telangana

ABSTRACT

Farmers spend a lot of money on technologies that reduce labour and boost crop output. We launched the Agricultural Robot for autonomous ploughing and sowing. This article aims to create a robot that can plough, dispense seed, and spray water. Robots can be controlled automatically using IOT modules. The AVR At mega microcontroller controls everything. The robot ploughs the land and dispenses seeds simultaneously. Device operated by IOT provides data to microcontroller continually. IOT module for b\robot direction control. Dc geared motors plough soil, release seed, and sprinkle water for autonomous planting in agriculture. Arduino controls all components. The Raspberry pi Pico micro controller processes input and output using ARDUINO IDE for embedded C programming. Regulated power supply provides 5v DC for operation.

Keywords: Seed Plough, Sprinkle System, Agribot, IOT, Arduino IDE, Raspberry Pi Pico Micro-Controller.

1. INTRODUCTION

Agriculture is the backbone of India. Robotics play a major role in industrial, medicinal and military applications, etc. Agricultural robotics is the use of automation in bio-systems such as agriculture, forestry and fisheries. Some of the major problem in Indian agricultural are rising of cost, non-availability of skilled labors and lack of water resources. Applying automation to this field helps to create advancement to the industry and farmers, to save money and time. Robots are being developed for the process such are ploughing, seed dispensing, fruit picking, etc. But all these functions are not yet performed using a single robot. Conventional techniques depend on human power for lifting, dragging, weed control, fruit picking. Humans are prone to work in hazardous environment while spraying chemicals and pesticides. The tractors that compact the soil are larger in weight and cannot move in terrain conditions. These methods cannot identify the crop and soil in close proximity. An automated agricultural system (which uses field robot) is exemplified from above problems. Robots can work restlessly in all environments as they are programmed to perform the desired activities. The light weight of robot is a major advantage, since they do not compact the soil as large machinery does.

2. LITERATURE SURVEY

The development of our agricultural robot and the idea used to implement them, started with the study of various papers. Designing, employing, and examining an autonomous multipurpose vehicle [1] with safe, reliable and economic operation. This autonomous vehicle goes through the crop lines of Agricultural land and performs duties that are tiresome and/or unsafe to the farmers. First, it's been prepared for spraying, but other configurations are also designed, such as: a seeding, plug system to reach the most notable area of the plants to execute different tasks (pruning, harvesting, etc.), and a truck to move the fruits, crops and crop waste products. The wheels of this robot are designed so that it can travel easily in soft and wet soil.

An automatic robot for agricultural purposes [2]. As one of the styles of development on automation and

cleverness of agricultural equipment in the 21st century, all types of agricultural robots have been explored and developed to apply lots of agricultural development in many countries. This bot carries out primary functions like picking, harvesting, weeding, pruning, planting, grafting. They developed a robot to perform various activities in farm like cutting and picking. Image processing is used to identify grass in the field and also the height of the crop. A container is used to place the cut grass and harvested crops. Pesticide spraying is also equipped in the robot.

Improvement in agriculture techniques like automatic planting of seed products on ploughed land by using automatic robot [3]. A robotic vehicle having four tires and steered by DC motors was developed. The seed planting device is fixed on the automobile to seed the seed products in even manner. The device will cultivate the plantation by considering particular rows and specific column at predetermined distance depending on different seed products. The obstacle recognition is considered and sensed by an infrared sensor. The complete assemblage is driven by a 12V rechargeable battery pack. The battery pack can be recharged by using solar power which is also attached to robot. This robot can perform bed preparation, seed mapping, seed placement and reseeding operations.

The design, development and the fabrication of the automatic robot [4] which can dig the ground, put the seed products, levelers to close the soil and sprayer to apply water, these complete systems of the automatic robot work together with the power supply and the solar powered energy. Steering operation of robot is done using rack and pinion mechanism. Relay switch regulates power input for motor. Obstacle detection is done using IR sensor. A lot more than 40% of the populace on earth selects agriculture as the principal occupation; lately the introduction of the autonomous vehicles in the agriculture has experienced increased interest.

An automatic robot [5] capable of carrying out procedures like programmed seeding, irrigation, and fertilization. In addition, it provides manual as well as auto control. The primary component is ARDUINO that supervises the complete process. Currently, robots are significantly being built-into working tasks to displace humans especially to execute repetitive job. Seeding is main steps in farming. In this process seeding is carried out in every row of the farming plot. In irrigation process, the soil sensor is used for monitoring environmental condition. It checks this level and alerts the farmer, then gradually applies little bit of water to the planted seed in every row of the farming plot. The fertilization process is identical to irrigation process however, many plants need fertilizers when the seed germinates and the seed starts to develop. The automatic robot works on solar technology.

An automatic robot which targets employing all the farming process especially on onion crop [6] within a bot by using firebird V automatic robot. The fire bird V robot uses ATMEGA 2560 as master controller, ATMEGA 8 as slave controller, IR, gripper design and other accessories. The suggested system prototype is applied by selecting an area which taking into consideration the agricultural field of any sort of onion crop. The automatic robot picks up the planting area by using detectors and seed products to be planted in the related field using gripper set up of the automatic robot.

Amritanshsrivasatava [6] etal, these worked on DTMF Based Intelligent Farming Robotic Vehicle. The main objective of machine can also be used to reach the places where farmers make harder efforts for farming such as hill areas, mountains etc. where land is not plane. This is how we can use this robot in different fields as well as for research purpose by further manipulation in programming it can be modified accordingly. R.suresh [7] etal, this extensive work on automatic feeding device in rotary cultivator blade shaft welding equipment. It can achieve automation of grab, feeding and placement of all blade holders and assures that the blade holder feeding device and other devices in welding equipment work coordinate automatically. it can replace a universal robot to realize welding automation of the shaft weldment. Moreover, the biggest advantage of it is easy to operate and low cost. Amrotasneja [8] etal, in this research paper agricultural robot for automatic ploughing and seeding. The concept of fruit picking and pesticide spraying is described under the process domain. Farmers today spend a lot of money on machines that help them decrease labor and increase yield of crops but the profit and efficiency are very less. Hence automation is the ideal solution to overcome all the shortcomings by creating machines that perform one operation and automating it to increase yield on a large scale.

Simon Blackmore [9] etal, in this paper robotic agriculture the future of agricultural mechanization. Developed agriculture needs to find new ways to improve efficiency. One approach is to utilize

available information technologies in the form of more intelligent machines to reduce and target energy inputs in more effective ways than in the past. Precision Farming has shown benefits of this approach but we can now move towards a new generation of equipment. The advent of autonomous system architectures gives us the opportunity to develop a completely new range of agricultural equipment based on small smart machines that can do the right thing, in the right place, at the right time in the right way. Sajjadyaghoubi [10] etal, autonomous robots for agricultural tasks and farm assignment and future trends in agro robots. This article is the logical proliferation of automation technology into bio systems such as agriculture, forestry, green house, horticulture etc. Presently a number of researches are being done to increase their applications. Some of the scientist contributions are mobile robot, flying robot, forester robot, Demeter which are exclusively used for agriculture. A brief discussion is being done about the types of robots which increase the accuracy and precision of the agriculture.

3. PROPOSED METHOD

The project involves both hardware and software. Arduino (UNO) acts as a brain of the hardware circuit, receives the data from the transmitter by using IOT module and helps in performing automatic ploughing, seeding and watering. Block diagram consists of two sections i.e transmitter section and receiver section.

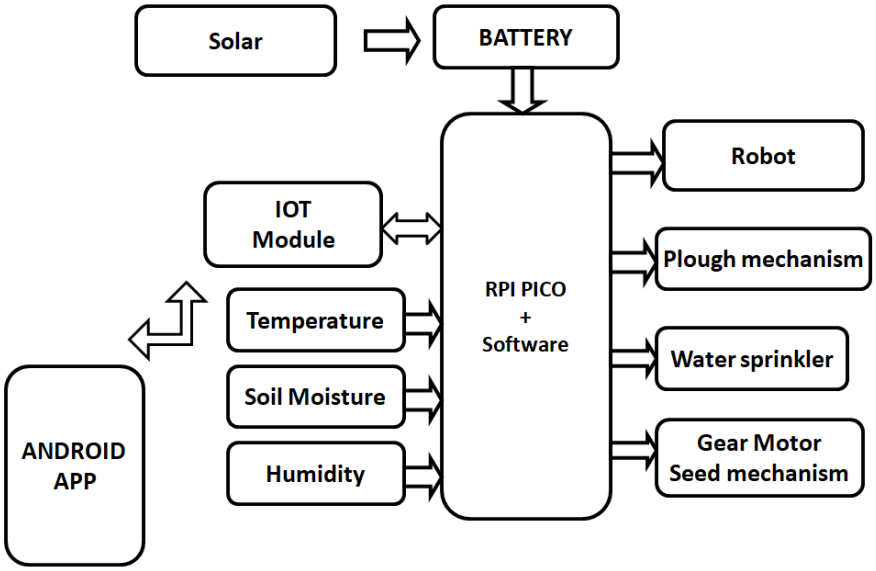


Figure 1 Block diagram of Agricultural Robot for automatic ploughing, seeding and sprinkling.

The transmitter section of the robot consists of HT-12E Encoder IC, RF Transmitter and DC battery of 5V. HT-12E is an encoder IC that is often associated with RF Transmitter module. It converts the 12-bit parallel data to serial data. The 12-bit data is divided into address and data bits. The movements of the robot depend on the commands given by the user. The data through the command given by the user will be been coded with the help of then coder.

The receiver section of the robot consists of an Arduino UNO, RF Receiver, HT-12D Decoder IC, L293D Motor Driver IC and a robot chassis with four motors connected to wheels and 2 more are connected for the seeding and water pouring mechanism. HT-12D is the decoder IC that is often associated with RF Receiver. It converts the serial data received by the RF link into parallel data. L293D motor driver IC is used to provide the necessary current (for both forward and reverse directions) to the motors. Pins 1 and 9 are the enable pins and are connected to VCC (+5v) along with Pin 16 (which is the logic supply). The Arduino forms the brain of the machine and controls all the operations like ploughing, seeding and watering. Arduino is programmed in

such a way that when it receives the decoded message from the receiver, it gives the given command to the respective motor drivers. Thus, the Agribot acts as an IoT device.

Block diagram explanation

1. **Ploughing**

   The Ploughing tool is interfaced with the Arduino. The ploughing tool can be operated in two modes namely on and off. The microcontroller will receive the command to work on any of these two modes and it directs the ploughing tool to plough the field accordingly.

2. **Seed dispensation**

   The seeds are stored in a small container and it is closed with a small flip. This flip is controlled by the servomotor to open and close the container. The servomotor is capable of rotating to 180 degrees. Meanwhile, when the servomotor is at 180 degrees, it automatically opens the container and hence the seeds are sown in the field.
   robot.

3. **Watering**

   After dispensing the seeds, the robot starts watering. This can be done with the help of relay and solenoid valve. The relay makes the solenoid valve to allow and stop the flow of water to the field.

4. **Motor Driver IC (L293D)**

   L293D is a dual H-bridge motor driver, i.e. by using one IC we can control two DC Motors in both clock wise and counter clockwise directions. The L293D can provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. IC is designed to drive inductive loads such as dc motors, bipolar stepping motors, relays and solenoids as well as other high-current or high-voltage loads in positive-supply Applications. The main purpose is for driving the

5. **DC Motors**

   A 5v power supply is given to DC motor that is connected to a wheel which is responsible for the movement of the robot.

6. **Power supply**

   A 5v DC power supply is used to drive the Arduino UNO.

7. **Wi-fi Module**

   Wi-fi module is ESP8266. This module is used to transfer the information given by the user in android application.

8. **Android smartphone**

   In Android phone telnet app is installed which is used for controlling the robot

The above schematic diagram of Agricultural robot for automatic ploughing, seeding and sprinkling explains the interfacing section of each component with micro controller, DC motors and drivers. The crystal oscillator is connected to $9^{th}$and 10^{th}pins of micro controller and regulated power supply is connected to $7^{th}$and 20^{th}pin(ie, VCC and AVCC) of micro controller.

- 16*2 LCD display it is used for displaying status of the Robot. Data pins of LCD D4, D5, D6,

D7 are connected to D4, D5, D6, D7 digital pins of arduino UNO respectively.

- Two L293D Motor drivers are used, to which DC motors are connected. One of the Motor driver is connected to A0, A1, A4, A5 analog pins of arduino, and is responsibleformovementofthe Robot.OtherMotordriveriscon nectedtoD8,D9,D10, D11 digital pins of Arduino, and is responsible for operating Ploughing motor and Seeding motor.
- One motor driver IC can control two dc motor in which one dc motor is connected to the output pin 3 and 6 of motor driver IC and another dc motor is connected to pin11 and 14 of motor driverIC.
- Second motor driver IC can also control two dc motor in which one dc motor is connected to the output pins 3 and 6 of motor driver IC for ploughing and another dc motor is connected to pin 11 and 14 of motor driver IC forseeding.
- Arduino Uno Rx pin is connected to the Tx pin of wi-fi module ESP8266 andArduinoTx pin is connected to the Rx pin of wi-fimodule.
- Arduino pins 7 and 20 are VCC/AVCC which are shorted and that is connected to 5V Dc Regulated powersupply.
- Pin 4,5,12,3 of two motor driver IC are ground pins which are shorted and connected to ground pin of ArduinoUno.
- Pin 16 and 8 are VCC pins of two motor driver IC which are connected to +5V/VCC of ArduinoUno.

4. RESULT

In this project we have built a Agricultural robot for automatic ploughing, seeding and watering in which sensors and hardware are successfully interfaces with the microcontroller. The robot is controlled using wi-fi module.

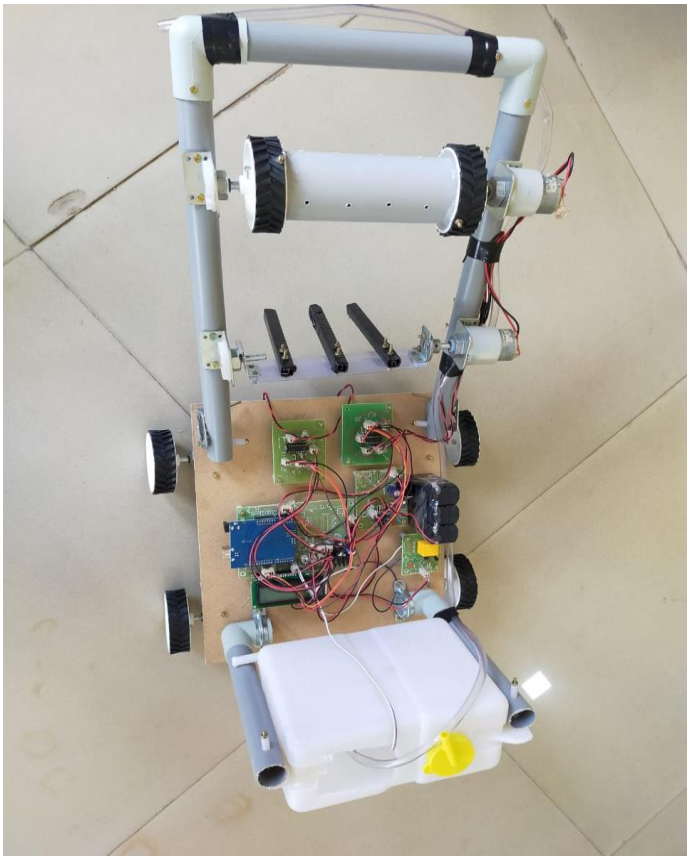


Figure :2 Ploughing Mechanism

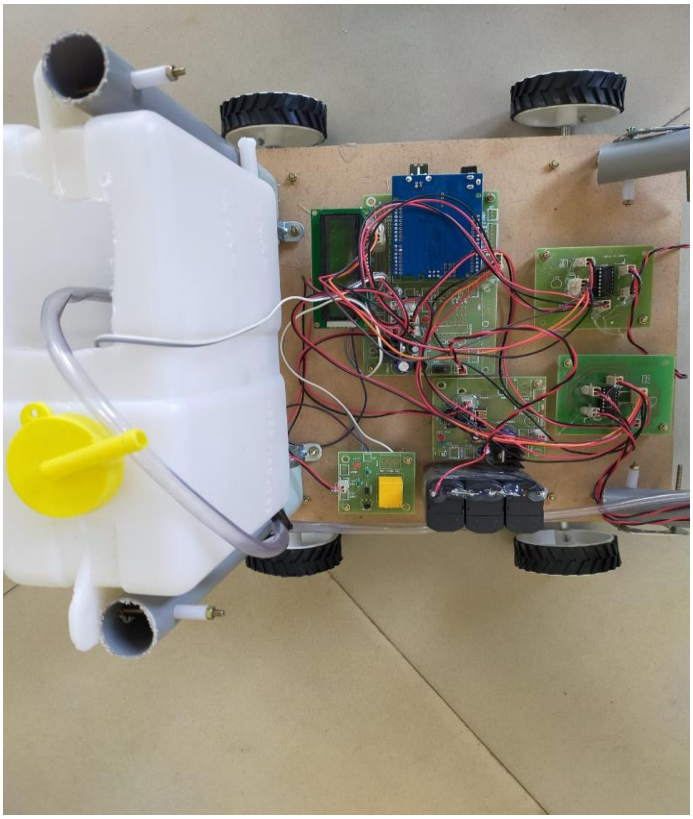
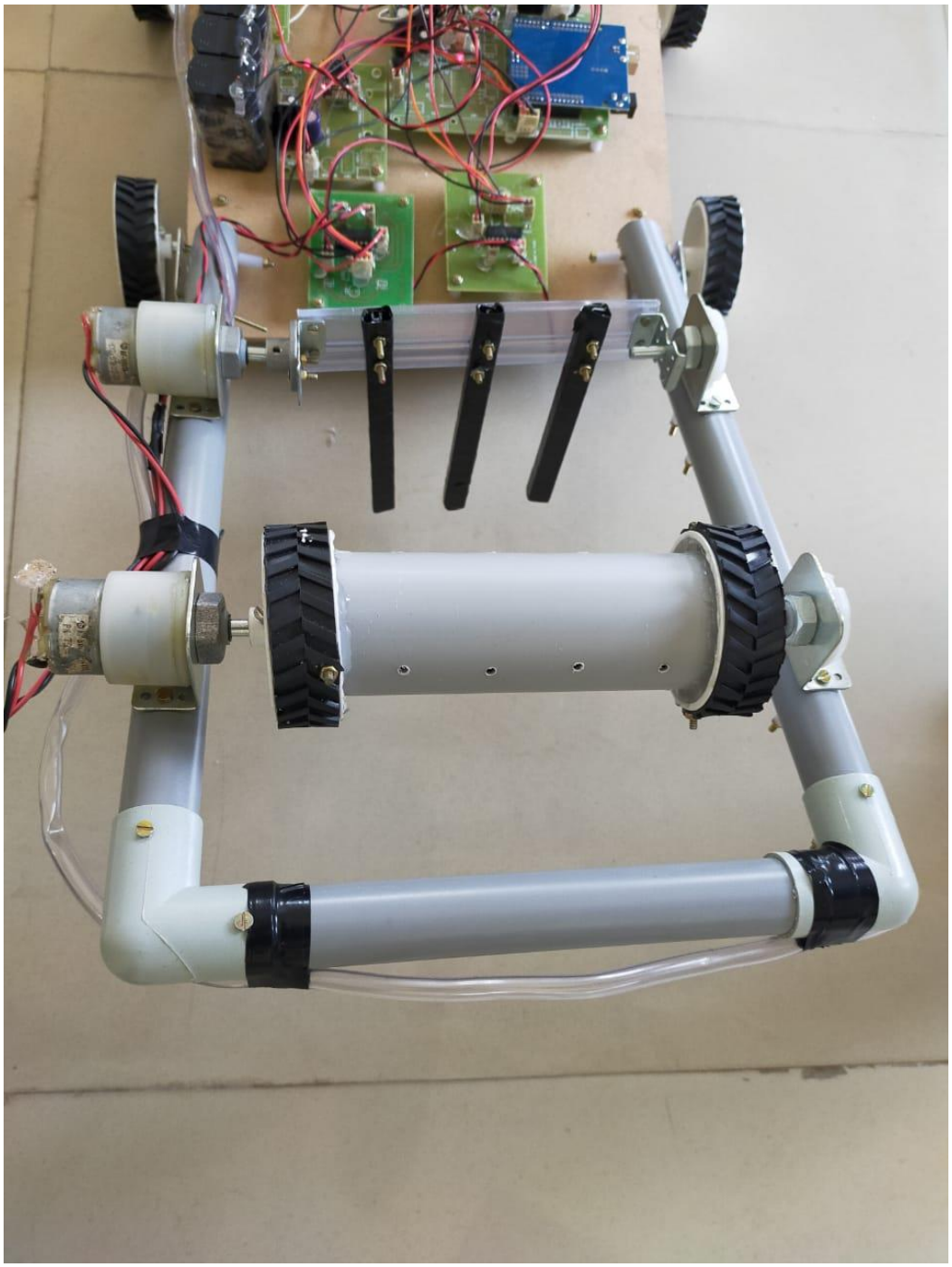


Figure 3 Seeding and watering



5. CONCLUSION

The sensors and hardware are successfully interfaced with the microcontroller. Test results shows that the various field activities like ploughing, sowing seeds and irrigation are performed and controlled with the help of Wi-Fi module.

REFERENCES

[1] S. R. Nandurkar, V. R. Thool, R. C. Thool, "Design and Development of Precision Agriculture System Using Wireless Sensor Network", IEEE International Conference on Automation,Control, Energy and Systems (ACES),2014

[2] JoaquínGutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel ÁngelPortaGándara, "Automated Irrigation System Using a Wireless Sensor Network and GPRS Module", IEEE Transactions on Instrumentation and Measurement,0018-9456,2013.

[3] Dr. V .VidyaDevi,G. MeenaKumari, "RealTime Automation and Monitoring System for Modernized Agriculture" ,International Journal of Review and Research in Applied Sciences and Engineering (IJRRASE) Vol3 No.1. PP7-12,2013

[4] Y. Kim, R. Evans and W. Iversen, "Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network", IEEE Transactions on Instrumentation and Measurement, pp.1379–1387,2008.

[5] Q. Wang, A. Terzis and A. Szalay, "A Novel Soil Measuring Wireless Sensor Network", IEEE Transactions on Instrumentation and Measurement, pp.412–415,2010

[6] Yoo, S.; Kim, J.; Kim, T.; Ahn, S.; Sung, J.; Kim, D. A2S: Automated agriculture system based on WSN. In ISCE 2007. IEEE International Symposium on Consumer Electronics,2007, Irving,TX, USA,2007

[7] Arampatzis, T.; Lygeros, J.; Manesis, S. A survey of applications of wireless sensors and Wireless Sensor Networks. In 2005 IEEE International Symposium on Intelligent Control & 13th Mediterranean Conference on Control and Automation. Limassol, Cyprus, 2005, 1-2,719-724

[8] Orazio Mirabella and Michele Brischetto, 2011. "A Hybrid Wired/Wireless Networking Infrastructure for Greenhouse Management", IEEE transactions on instrumentation and measurement, vol. 60, no. 2,pp398-407.[