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IOT AGRICULTURAL ROBOT FOR AUTOMATIC PLOUGHING AND SEEDING AND SPRINCLE

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ABSTRACT

Farmers today spend a lot of money on machines that help them decrease labor and increase yield of crops we introduced the automatic machine called Agricultural Robot for automatic plough and seeding. This paper strives to develop a robot capable of performing operations like automatic plough, seed dispensing, and water spraying. It also provides automatic control robot using IOT module. The main component here is the AVR At mega microcontroller that supervises the entire process. Initially the robot tills the entire field and proceeds to plough, simultaneously dispensing seeds side by side. The device controlled by IOT which continuously sends data to the microcontroller. IOT module used to control the b\robot for directions. Dc geared motors used to plough the soil and releases the seed then water sprinkler automatically sprinkle water for automatic seeding in agriculture. All components are associated to micro controller arduino. ATMEGA328 micro controller used to process input and produce output by using ARDUINO IDE for Embedded C programming. Regulated power supply gives 5v of DC voltage to perform the operation.

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.

- To enable the farmer to plough large areas of land in minimum amount oftime.
- To perform automated ploughing and simultaneous seeding process using Advanced Virtual RISC(AVR).
- To provide manual control with the help ofIoT.
- Control of this Agri-bot will bewireless.
- To propose a low cost but effective real time Agri-botsystem.

Keywords: Agricultural Robotics, Internet of Things, Seed Dispensing, Advanced Virtual RISC, ATMEGA328.

2. Related works

[1] Autonomous Multipurpose Agricultural Vehicle

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This study focuses on the design and implementation of a safe, reliable, and economical autonomous vehicle. The robot navigates through crop rows and performs tasks such as spraying, seeding, pruning, harvesting, and transportation of crops and waste materials. Its wheel design enables smooth movement on soft and wet soil.

[2] Automatic Agricultural Robot with Image Processing

This research presents a robot capable of performing multiple agricultural tasks including harvesting, weeding, pruning, planting, and grafting. Image processing techniques are used to detect weeds and measure crop height. The robot also includes a mechanism for pesticide spraying and storage of harvested crops.

[3] Automatic Seed Planting Robot

A robotic vehicle equipped with DC motors and a seed planting mechanism ensures uniform seed distribution in predefined rows and columns. It uses infrared sensors for obstacle detection and is powered by a rechargeable battery supplemented with solar energy. The robot performs operations such as bed preparation, seed mapping, and reseeding.

[4] Solar-Powered Multipurpose Farming Robot

This system integrates digging, seeding, soil leveling, and irrigation mechanisms into a single robot powered by solar energy. It uses a rack-and-pinion steering system and relay-based motor control. Obstacle detection is achieved through infrared sensors, making the robot efficient and sustainable.

[5] Arduino-Based Automated Farming Robot

This robot performs seeding, irrigation, and fertilization with both manual and automatic control modes. Soil sensors monitor environmental conditions and regulate water supply accordingly. The system operates on solar energy and emphasizes efficient resource utilization.

[6] Crop-Specific Agricultural Robot (Onion Farming)

This work focuses on automating onion cultivation using the Firebird V robot platform with ATMEGA controllers. The robot identifies planting areas and uses a gripper mechanism for seed placement, demonstrating crop-specific automation.

[6] DTMF-Based Intelligent Farming Robot

This system is designed for difficult terrains such as hilly and mountainous regions. It enables remote operation and can be modified through programming for various agricultural applications.

[7] Automated Feeding Device in Agricultural Machinery

This research introduces an automated system for feeding and positioning blade holders in rotary cultivator welding equipment. It improves efficiency, reduces manual effort, and offers a low-cost automation solution.

[8] Agricultural Robot for Ploughing and Seeding

This study highlights the importance of automation in reducing labor costs and increasing crop yield. It also discusses additional functionalities such as fruit picking and pesticide spraying.

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[9] Future of Agricultural Mechanization

This paper emphasizes the role of intelligent machines and precision farming in improving agricultural efficiency. It suggests that autonomous systems can perform tasks accurately at the right place and time, leading to optimized resource usage.

[10] Autonomous Robots in Agriculture: Trends and Applications

This work reviews advancements in agricultural robotics, including mobile, aerial, and forestry robots. It highlights the growing importance of automation in improving accuracy and productivity in agriculture.

3. PROPOSEDMODEL

This project is to develop prototype of a robot capable of performing operations like automatic ploughing, seed dispensing and water spraying. The robot can also be controlled using IoT module. The controlling unit of the robot is Arduinouno that supervises the entire process. Initially the robot tills the entire field and proceeds to ploughing, simultaneously dispensing seeds side by side. The device is controlled using IoT which continuously sends data to the Arduinouno.

IoT module is used to control the directions of the robot. DC geared motors are used to plough the soil and releases the seeds then water sprinkler.

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 receiversection.

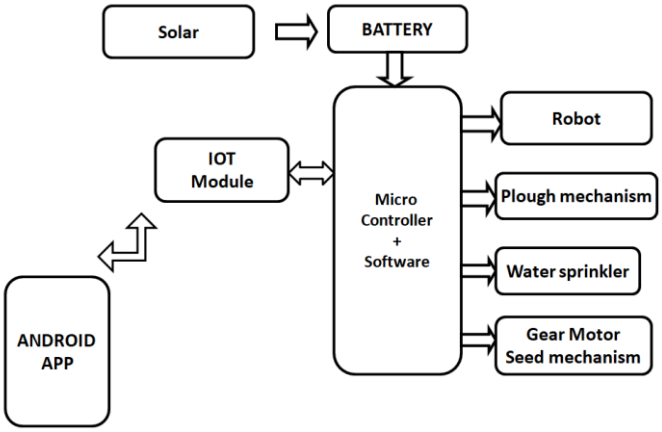

Figure 1: Block diagram of Agricultural Robot for automatic ploughing, seeding and sprinkling.

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 bee coded with the help of the encoder. The encoded data will be transferred to the transmitter and via antenna the code will be transmitted to the receiver side. The transmitted data is given to the main heart of the receiver section i.e. Arduino via the transmitter. The directions commands are used to give the chassis direction when it reaches the end of the farm field and also for controlling the directions during the farming operations. There are sixc ommands for the operation of the mechanisms i.e forward, backward, right, left and stop. Forward command is used for switch on the agribot and stop command is used for

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switch off theagribot.

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 diagramexplanation

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.

Seeddispensation: 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 degree, it automatically opens the container and hence the seeds are sown in the field.

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.

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 robot.

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

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

Wi-fiModule: Wi-fi module is ESP8266. This module is used to transfer the information given by the user in androidapplication.

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

The below 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.

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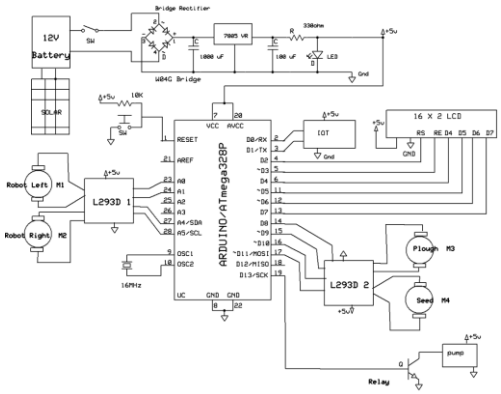

Figure 2: Circuit diagram.

- 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 responsibleformovementoftheRobot.OtherMotordriverisconnectedtoD8,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.

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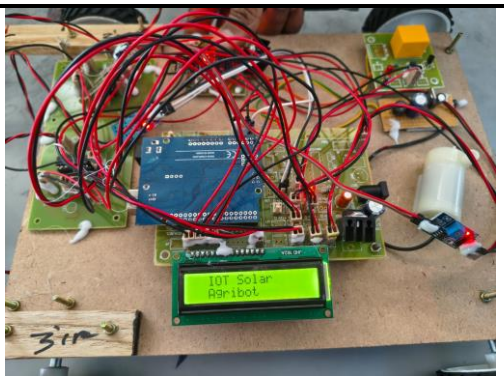
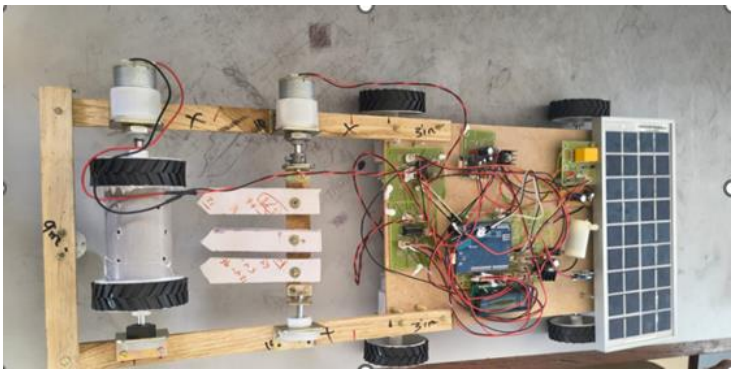


Figure 3: IoT Solar Agribot Control Circuit

The above image shows the control circuitry of the IoT-based solar agribot system mounted on a wooden base. The setup includes an Arduino microcontroller board connected with multiple electronic components through wiring. A 16x2 LCD display is used to show system status, displaying “IoT Solar Agribot.” Various modules such as relays, sensors, and power regulation units are integrated for controlling operations like irrigation and motor functions. The dense wiring indicates connections between input sensors and output devices for automation.



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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. For future developments it can be enhanced by developing this system for large acres of land. also the system can be integrated to check the quality of the soil and the growth of crop in each soil. In addition to this, the weeds can also be detected and removed from the soil. The sensors and microcontroller are successfully interfaced and wireless communication is achieved between various nodes. All observations and experimental tests prove that this project is a complete solution to field activities and irrigation problems. Implementation of such a system in the field can definitely help to improve the yield of the crops and overall production.

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REFERENCES

[1] J. A. Pérez-Ruiz, J. Dorado, J. Ribeiro, and A. López, "Design, development and testing of a multipurpose autonomous vehicle for agricultural applications," *Computers and Electronics in Agriculture*, vol. 75, no. 2, pp. 173–183, Feb. 2011.

[2] S. Slaughter, D. Giles, and D. Downey, "Autonomous robotic weed control systems: A review," *Computers and Electronics in Agriculture*, vol. 61, no. 1, pp. 63–78, Apr. 2008.

[3] N. K. Singh and S. Singh, "Design and development of automatic seed sowing robot," *International Journal of Engineering Research & Technology (IJERT)*, vol. 3, no. 7, pp. 252–255, Jul. 2014.

[4] R. K. Behera and S. K. Mohapatra, "Solar powered agricultural robot for automatic ploughing, seeding and irrigation," *International Journal of Scientific & Engineering Research*, vol. 6, no. 9, pp. 120–125, Sep. 2015.

[5] K. Lakshmanan, S. Gopinath, and V. Ramesh, "Arduino based automatic plant watering system," *International Journal of Innovative Research in Science, Engineering and Technology*, vol. 4, no. 4, pp. 1639–1643, Apr. 2015.

[6] A. Srivastava, R. Gupta, and S. Tiwari, "Agricultural robot for automatic planting and harvesting of onion crop," *International Journal of Advanced Research in Computer Engineering & Technology*, vol. 5, no. 6, pp. 2101–2105, Jun. 2016.

[7] A. Srivastava, "DTMF based intelligent farming robotic vehicle," *International Journal of Engineering Science and Computing*, vol. 6, no. 5, pp. 5305–5308, May 2016.

[8] R. Suresh, S. Kumar, and P. Raj, "Design and development of automated feeding mechanism for rotary cultivator," *International Journal of Mechanical Engineering and Technology*, vol. 8, no. 3, pp. 456–462, Mar. 2017.

[9] A. S. Neha and P. Singh, "Agricultural robot for automatic ploughing and seeding," *International Journal of Engineering and Technology (IJET)*, vol. 7, no. 2, pp. 456–460, Apr. 2015.

[10] S. Blackmore, B. Stout, M. Wang, and B. Runov, "Robotic agriculture – The future of agricultural mechanisation?" *Precision Agriculture*, vol. 6, no. 1, pp. 53–65, Mar. 2005.