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IoT based Agribot for Irrigation and Farm Monitoring

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Abstract: ***Agriculture plays a major role in India's GDP (Gross Domestic Product). The major problems in modern agriculture are water scarcity and high labour costs. This project reduces the working cost, digging, seed sowing operation and also the labour cost. The Agribot is progressed by using an Arduino board. During operation of irrigation the Agribot senses the soil moisture content and it moves along a predetermined path, starts digging and seed sowing operation and covers the ground by closing it. The Proposed system aims at designing multipurpose autonomous agricultural robotic vehicles which can be controlled through IoT for digging the soil & sowing the seed. Agribot transmits data collected from multiple sensors to remote servers using Wi-Fi links. Optical compass Sensor and Digital Compass Sensor are used with the help of Wi-Fi interface operated on Android Application to manoeuvre robots in the field. The paper the complete installation of the agribot***
Keywords: ***Internet of Things (IoT), Wireless Fidelity (Wi-Fi), Agribot***

I. INTRODUCTION

Agriculture is known as the backbone of India. Throughout the world India is second in farming. Some special vehicles play an important role in different fields such as industrial, medical, military applications and agriculture. In Indian agriculture is facing problems such as rising input costs, availability of skilled laborers, lack of water resources and crop monitoring [1]. To overcome these problems some automation technologies are used in agriculture through which farmers are helped by reducing their efforts. The land used for crop cultivation in India is decreasing at an accelerating rate. Outdated irrigation techniques and availability of labour are the primary reasons for incoherent production. Agribot is a vehicle which is driven by electric power to perform certain work such as seed sowing, water spraying, covering seeds and Obstacle detector simultaneously. Every movement is monitored on the web server as well as on Android Application from anywhere. The manual methods for Seed sowing are placing the seeds by hand or by dibbling i.e. making holes and dropping seeds by hand [2]. Another method is a pair of bullocks is used to carry the heavy equipment of levelling and seed dropping. Now it's time to automate the sector to solve this problem [3]. In the agricultural field the chances for robots with increased productivity are enormous and the robots are appearing on farms in various external ways and in increasing numbers. human labours are replaced by android driverless robots, Today the environmental influence of agricultural production is very much in focus and the demands to the industry is increasing. In the present scenario, most of the cities in India do not have sufficient skilled man power in agricultural sector and that affects the progress of developing country [4]. Many such technological solutions have been addressed in the literature that achieve agriculture task automation and help in remote monitoring the farm land [5].

Block diagram

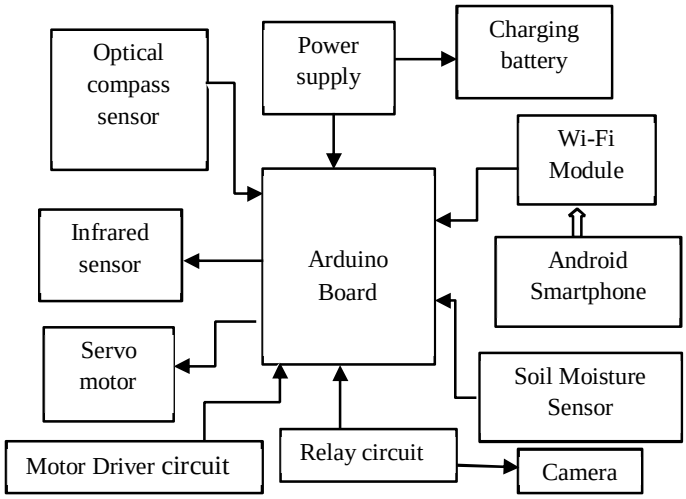

Figure 1- block diagram of IoT Based Agribot for Irrigation and Farm Monitoring

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1) *Power Supply:* An Arduino board can be powered via USB connection or with an external power supply. The power source is selected automatically. The board can operate on an external supply of 6v to 20v. If the supply is less than 7v the board may become unstable. If supply is more than 12v, the voltage regulator may overheat and damage the board. The recommended range is 7v to 12v.
2) *Charging Battery:* The charging battery is used to store the energy. Once the battery gets fully charged, the relay circuit is on.
3) *Wi-Fi Module:* The Wi-Fi module is small which allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-Style commands.
4) *Android:* Wi-Fi technology through smart phones is used to control the entire operation of robots for ploughing, seeding and spraying. It is the heart of the project.
5) *Soil Moisture Sensor:* The sensor consists of two electrodes, which is used to sense the moisture content of soil. When the current is passed to the electrodes, then electrodes to the soil.
6) *Relay Circuit:* The relay is an electrically operated device. Relay is used for electronic to electrical interfacing i.e. it is used to switch on and switch off electrical circuits operating at high AC voltage using a low DC control voltage.
7) *Motor Driver Circuit:* Motor drivers are used to control the movement of the agribot. Motor drivers act as current amplifiers and input is of low-current signal and output is high current signal. Motor Driver which converts the direct current into mechanical energy.
8) *Servo Motor:* Servo Motor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback.
9) *Arduino:* The arduino mega 2560 is a microcontroller board based on the Atmega 2560. It is of 16MHz crystal oscillator, USB connection, a power jack, and reset button. It contains everything needed to a support microcontroller; simply connect it to a computer with a USB cable or power it with a AC to DC adaptor or battery to get started.
10) *Optical Compass Sensor:* Optical compass sensor is a device whose function is to give the directions with respect to magnetic poles of the earth. It also determines the exact rotation of the agribot if we need to rotate in right or left directions.
11) *Obstacle Detector:* The important task of Agribot is Obstacle Detection. Infrared sensors are used to detect the obstacle present in the field.

II. WORKING

When the Microcontroller is powered up, it keeps on checking the signals are arriving at the input port, if there is no signal no function is taken Place. Program stored in the ROM of a Microcontroller starts executing and the microcontroller works as per the program. Agribot is started through the initialization of Wi-Fi module CC3000 and configuration of Adafruit server using Android Application. Then the moisture of the soil is examined by the sensor. If soil is not wet then automatically alarm is activated and the process of spraying water is done. Otherwise the robot starts moving forward and performs various operations like digging and simultaneously seed sowing. Digging operation is performed as the sharp pointed iron blade is fixed in front of agribot and supporter is connected at the back so that removed soil is covered. If any obstacle present it can be sensed by an obstacle sensor, it will stop the dc motor and seed sowing operation till the obstacle is removed and alarm is activated.

We can control the direction of the robot through the android application. There are four buttons to manoeuvre agribot in the field. Start button is for configuring the Wi-Fi module and adafruit server. Forward button is for starting DC motors in the forward direction and Seed sowing button starts the seed sowing operation by making servo motors on. For terminating complete activity, the Stop button can be used.

A. *Algorithm*

1) Start the power supply
2) Connect android application through Wi-Fi module
3) System gets started
4) Checks the moisture content in the soil
5) If soil is not wet then alarm is activated
6) Water spraying operation is activated
7) If soil is in wet condition, then digging, seed sowing and covering the ground operation starts
8) If any obstacle is present in between then the alarm is activated and the obstacle is removed
9) Repeat the above steps
10) Stop the system

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B. Advantages

1) It reduces the number of labours required for agricultural activity.
2) The time required for completing the given task is less, due to its quick action.
3) Agribot has the capacity to do work in any environmental condition.
4) The robots can work without sleep and they can work 24/7/365.
5) It gives protection to the plants from harmful chemicals.
6) This system can detect and classify the cloud condition automatically.
7) This is the modern supplement to replace the traditional manual method.

III. RESULT AND DISCUSSION

The Agribot prototype is tested for its working on a small rectangular area. The proposed system gives a low power and low-cost system with an efficient output. The Table shows the placement of seeds on different contours effectively by controlling agribot in a 15m track to get the expected results.

Figure 2: Prototype of developed Agribot

Placement of seed by Agribot (distance between two seeds)	Farm land	Hard surface	Grassy Land
Soybean seed (expected 4.5-6 cm)	5cm	5.2cm	5cm
Jowar seed (expected 9-12 cm)	10.5cm	10.5cm	10cm
Wheat seed (expected 8-10 cm)	9 cm	8.6cm	8cm
Pulses (expected 6.5-8 cm)	7.7cm	7cm	8cm

Table 1: Results of seed placement

From the table we can observe that Agribot gives 90% accuracy regarding placement of seeds.

IV. CONCLUSION

The seed sowing Agribot has potential to increase productivity.it can handle the weight of battery and the hardware mounted on Agribot it can be operated skilfully and successfully. Seed sowing operation results are observed in different agriculture fields. All the data collected from agribot sends on Adafruit-IO Server and controls using Android Application successfully.

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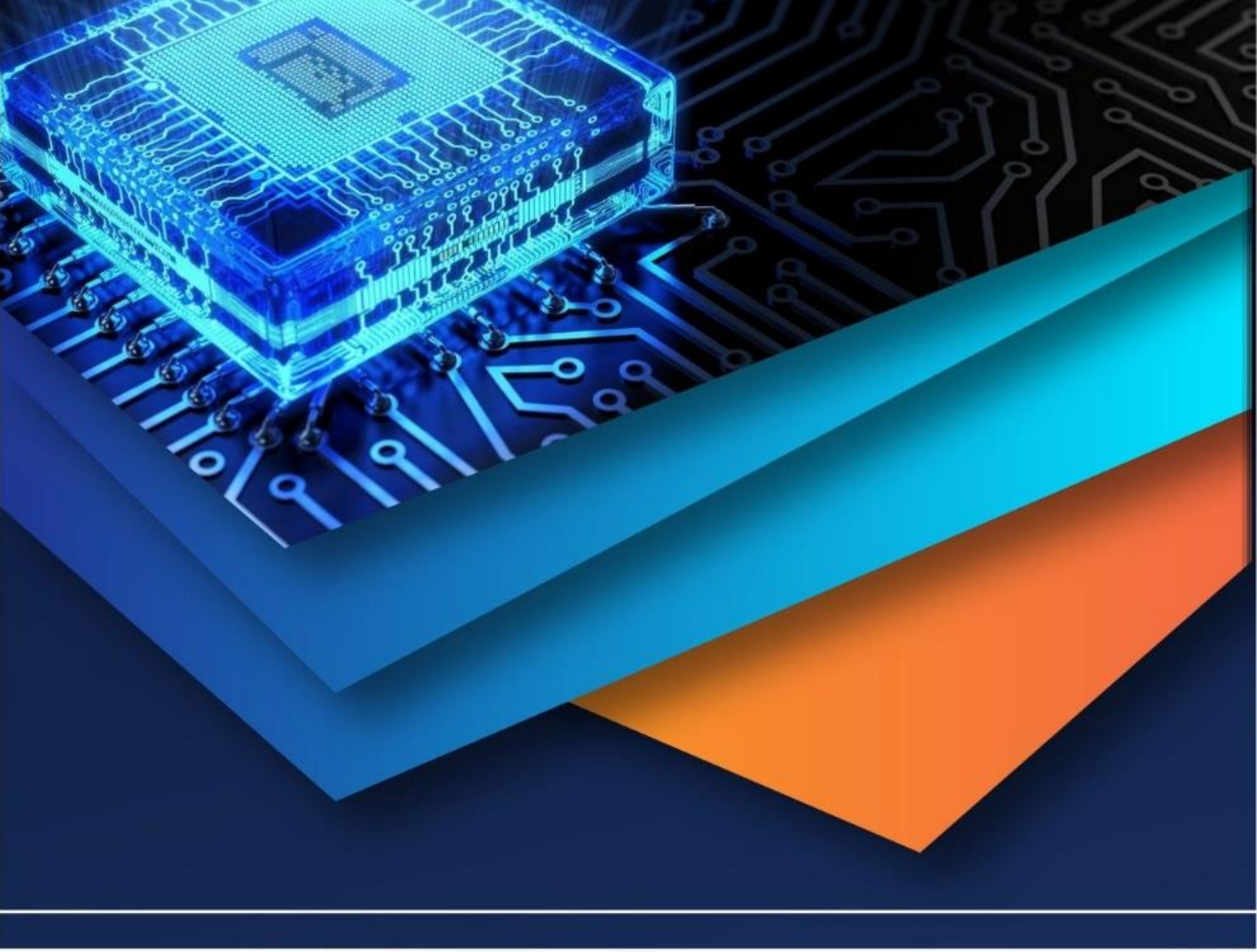

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