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Design of Microcontroller based Agribot and Robotic Hand

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ABSTRACT - *India is a land of agriculture and farmers are called backbone of our country. Agriculture is the main source of livelihood for about 59% of India's population and around more than 40% of the world population. Agriculture takes lots of efforts and hard work and labours, so as to minimize the efforts of farmers and also to reduce the number of labours and to enhance the mode of farm work we go for automation. With huge improvement in Technologies, robot is having the ability to carry out the action without being dependent on humans. Several problems are faced by the farmers during cultivation, for example in cotton cultivation there is lack of labours at hand, high compensation and poor practical Awareness. The solution of these problems lies in automation. Controlling and monitoring are based on IOT through which the farmer can access the actual status of the field using internet from any part of the world. In this project the system is designed for seed sowing purpose. Different sensors are used to check soil moisture, temperature and humidity, fire sensor, seed sensor and also ultrasonic sensor is used to measure the distance to an object(animal or human) in the field to avoid crop stealing. This system is also designed to extinguish fire sensed by the fire sensor in the farm at earlier stage. And it also includes GSM/GPRS technology for tracing the location of the robot for checking the status of the container.*

Key words: Automation, Field control system, Seed Sensor, Microcontroller, sowing mechanism, IoT

1. INTRODUCTION

Nowadays there is tremendous growth in world's population which requires the huge growth in food consumption and it is important to boost the yield by maximizing the potential of every crop**.** About 60 to 70% of Indian population relay on agriculture as their primary source. Agriculture is the main and most important source of our national income. As agriculture grows, our economy also grows automatically and it's a great impact. For a long duration our Indian agriculture was in underdeveloped condition. Earlier we used to import some food grains and vegetables from different countries, because we were unable to produce required amount of food for our people, but there is a drastic change. Now India is able to produce abundant amount of food grains. Some of the human edible are delivered to different countries with this great development has been made in the agricultural field. At present India is producing huge amount of food grains. Earlier almost all the field work was done manually without using any technology. The agricultural task performed by using varieties of small manually operable machines.

By this project small scale farmers will be benefited. There are several heavy and tough field work a farmer need to carry out and it is increasing day by day within short duration of time with accurate result. Because of all these issues a robot is designed to reduce the farmers hard work which gives high Precision and valuable output. A robot can perform the field functions continuously and repeatedly 24X7 without getting tired. .

2. RELATED WORK

Rama Krishna Jha et al.,[1] focused on monitoring soil temperature, humidity and moisture of the field continuously by using IoT devices. Depending on the data that is obtained from agricultural land, the farmer must take appropriate actions towards the field. By using the collected data from the remote agricultural land from different sensors along with ARDUINO board. They have used Zigbee or Bluetooth for sending the data collected by different sensors to farmer's mobile. Once the data is received are analyzed and discussed. This helps in increasing the productivity and loss of crops.

Kyada A.R et al.,[3] explained about small scale cropping where the basic requirements are small farms, technology and design of the system was simple and versatile to be used in different farms. The main focus of the format row planter which is operated manually to increase the productivity of planting and to minimize the hard work done by the labors in planting. Depending upon the size of the seed the processes of seed planting where is the distance between two seeds is directly proportional to the size of the seed. By this method the planting process is improved they assure that small-scale farmers can afford this machine.

Senthilnathan N et al.,[4] proposed a method of designing automated robot in agricultural field.. The procedure in which the implementation of the recent technology where crops yielding efficiency is enhanced is referred as agricultural technology. They focused on sowing the seeds according to the microprocessors instruction. They used microcontroller as their brain of the system and microprocessor is connected to the mobile hotspot for controlling the machine. The control action of field were carried out by the controller commands.

Fermando Alfrado Auat Cheein et al.,[5] has explained the design and execution of task of robotic machine which is a great experience in increased investment and research in the agricultural field. To carry out the agricultural tasks with the help of autonomous robotic machine are operation, guidance and control of field works is known as autonomous farming. The main and important work of such automated machine is the continuous monitoring of the field and the information related to change in environment is obtained automatically.

Thorat Swapnil V et al.,[8] they proposed a manual operating machine. This was a simple machine that an unskilled farmer can operate this machine without the technical knowledge. They used an alarm system which gives the alarm when the container becomes empty then a person. In this paper they explained about manual guidance of the robot for its movement.

Smys, S et al.,[9] This paper explain about the use of robots in automobile industries. The flexible and safety in production added by the system. The robotic arm which is used for pick and place in industries has a transmitter that acts as input. The input data that crossing microcontroller and is encoded and further changed into serial form, then deliver to the radio frequency model.. The received data is converted in parallel bits form by a decoder and this data is transferred to the microcontroller which drives the dc motor and appropriate amount of pressure is applied so that the product is not damaged or dropped while picking it and placing in other place.

3. PROPOSED SYSTEM

3.1 BLOCK DIAGRAM

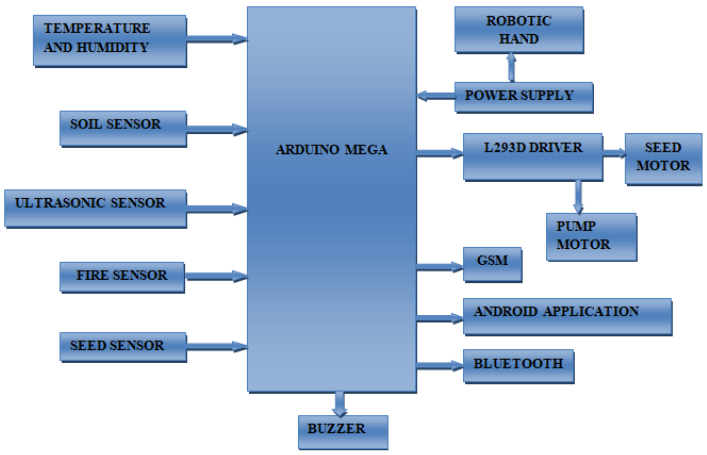


Fig-1: Block diagram of the system

3.2 WORKING OF THE PROPOSED SYSTEM

This multitasking vehicle is controlled by a microcontroller (MCU for microcontroller unit, or CU for µ-controller) that may be a miniature computer on single microcircuit. The central processing unit of this project is the microcontroller that is the ARDUINOATMEGA2560 which controls the entire system. The robot will move in all four directions according to the instructions of the microcontroller board. The DC gear motor connected to the L293D driver helps in dispensing the seeds from the seed container. As the DC gear motor starts rotating the seeds will be dropped into the ground from the seed container. The process of seed sowing is carried out according to the instructions from the Bluetooth controller android app. The sensors connected to the microcontroller are involved in controlling the field automatically. A sensor is a electronics device that takes variation in environment as input and response from sensor is taken as output to the other system. The sensor is used for conversion of real-world environmental circumstances into digital or analog voltage and is further converted in such a manner that human can read the output for to continue further process .Types of sensors used in this project are, Digital Humidity and Temperature sensor, Soil sensor, Fire sensor, Seed sensor, Ultrasonic sensor. The DHT sensor takes the environmental humidity and temperature as the input, the soil sensor takes soil moisture as the input, whenever there is fire or light in the field that will be detected by the fire sensor, the seed sensor helps in checking the status of the container and the ultrasonic sensor helps in detecting the presence of the object in the field by ultrasonic sound waves, the output of all

these sensors are displayed on the android app known as Bluetooth controller. The location of the robot is found by GSM/GPRS module that sends the location of the robot by connecting the android app known as Bluetooth controller to the Bluetooth HC05 module. Based on the location provided by the GSM/GPRS we can examine the status of the container. The robotic arm helps in picking and placing the things, obstacles and objects sensed by PIR sensor for example lifting the plants and placing it.

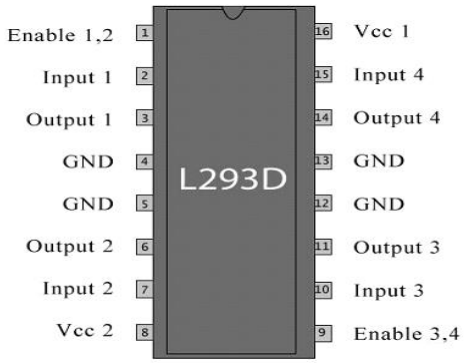
3.3 ARDUINO MEGA2560 REV3

The main purpose of designing Mega 2560 is for more Complex projects like robotic projects. The Mega 2560 has total of hundred pens out of which 54 pins are used as digital input and output pins,16 pins are used for analog inputs. This ARDUINO board has a largest space that can be used for 3D printing and for complicated project like robotic project

The mega 2560 microcontroller chip is used in the ARDUINO. It has total of 54pins are used for digital input output pins among them 15 pins are used as PWM output and 16 analog inputs for UART. It makes use of a crystal oscillator of 16MHz. It provides connection for USB, also for power Jack and ICSP header and it provides facility of resetting the microcontroller with the help of Rs pin. As this ARDUINO board has large enough space that provides the required support to the microcontroller. The Mega 2560 is designed in such a way that it has the ability to compatible with many other boats design for ARDUINO. The ARDUINO Mega is replaced by its latest updated version known as order no Mega 2560.

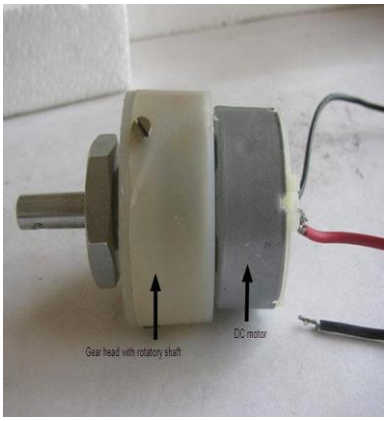
3.4 MOTOR DRIVER (L293D)

L293D has Two H Bridges and is an integrated circuit. It is used as it consume less current controlling signal so they behave as current amplifiers and given signal is of higher current. Here the signal used for driving Motors are of higher current value .In the normal operation they can use two Motors per driver and that is in two directions forward and backward.



3.5 DC GEAR MOTOR

The seed motor used in this system is the DC gear motor which is the extended version of DC motor. Assembly of gears is attached to a motor, in this DC gear motor the counting is done by the rotations of the shaft in a single minute referred as rotation per minute. The Assembly is very useful when it comes to increasing the rotating effect by reducing the quickness of the device. If we combined gear in proper way then it will be very useful in decreasing the quickness to any value which we admire. The procedure where the device reduces the rate of quickness of a car or any vehicle by raising the torque referred as gear reduction. The whole working procedure of the device can be learnt when we go through all the details of the gear that makes the gear head.



3.6 PUMP MOTOR

This pump motor has a minimum of 5V and it pumps 2 liters of water per minute and it is of great use for smaller applications.

3.7 ROBOTIC HAND

This robot hand used in this system is for picking and placing the objects or obstacles in the field. The DC Motors help in operating this robotic arm and it requires the power supply around 9 to 12 volts. The robot hand used in this system is known as the gripper arm which is attached to the robot for functions like pick and place. This Arm is controlled by Android app bluetooth controller which is paired with the Bluetooth module hc-05. The main feature of this arm is that it has a gripper assembly plates of 2x fibre gripper, 1 X DC metal geared motor with 45 rotations per minute worm gear of 1 in size and a spur gear of 2X in size.

3.8 SENSORS

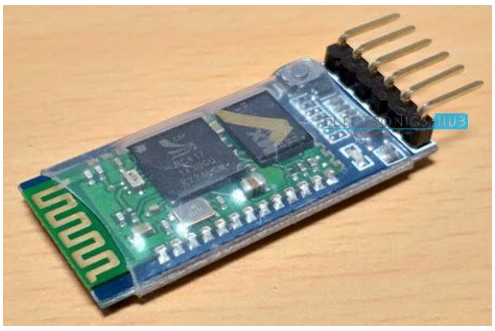
A sensor is an electronic device that takes variation in environment as input and response from sensor is taken as output to the other system. The sensor is used for conversion of real world environmental circumstances into digital or analog voltage and is further converted in such a manner that human can read the output for to continue further process. The types of sensors used in this system are digital humidity and temperature sensor, soil sensor, seed sensor, fire sensor and ultrasonic sensor.

3.9 GSM

Global system for mobile communication easy emerging technology in the world for large number of projects full stop it help in monitoring and controlling of large number of devices remotely without the distance limitation. The main aim of GSM is to send and receive the information in short message form SMS.

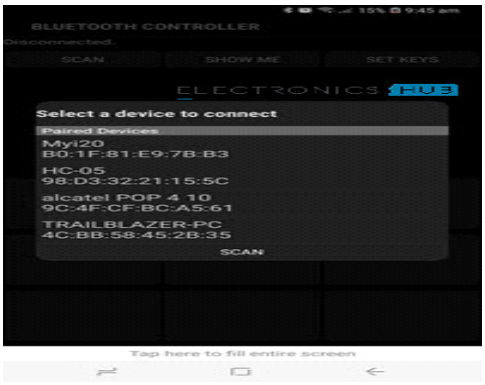
3.10 HC-05 BLUETOOTH MODULE

The communication range of Bluetooth hc-05 is nearly 10m and it requires a frequency of 2.4 GHz it is based on the radio frequency (RF) communication. This is mainly designed for short range of communication that is for transferring the data, in sound systems, in devices that are operated without manual effort in the peripherals of a computer etc. It is a simple wireless communication based device which uses Bluetooth protocol.



APP FOR BLUETOOTH COMMUNICATION:

The Bluetooth HC05 is connected to an android app called Bluetooth controller for transmitting the data between our automated machine and android phone. The pairing of Bluetooth HC05 with android app is as shown in below figure.



4. SCHEMATIC DIAGRAM

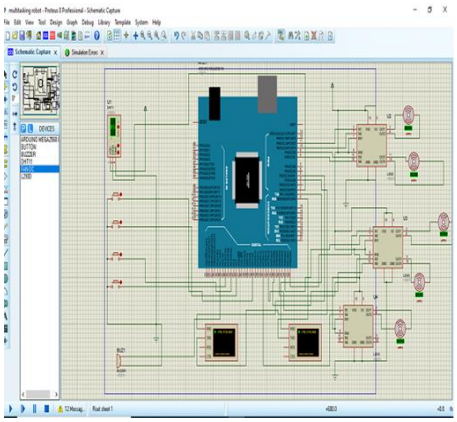


Fig -2: shows schematic diagram of the agribot

5. RESULT

The Bluetooth module is connected to the android app Bluetooth controller for controlling the entire system. The output of the system is displayed on android app are shown below. Figure3 shows the seed sowing process. The status of the container is shown in figure4 and if the container is empty then the GSM module sends the location of the robot as shown in figure5.

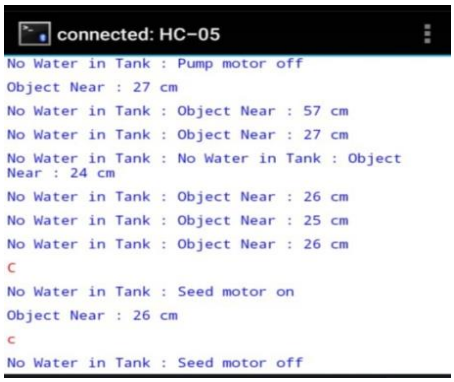


Fig-3: Seed sowing process

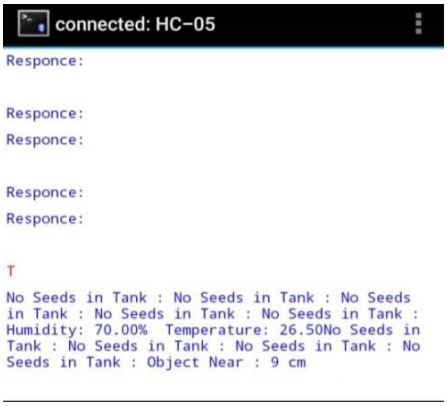


Fig-4: Status of the seed container

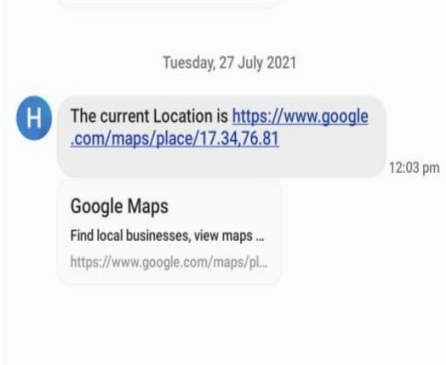


Fig-5: Information from GSM/GPRS

6. CONCLUSION

The prospect of designing this robotic system is to sow seeds in an automatic manner. This robotic machine helps in sowing the seeds in an appropriate manner and in the direction prescribed by the farmer. This leads to the accurate growth in the plants. This method helps the farmer to overcome the problems such as wastage of seed, large requirement labor and long duration of sewing process. The seeds are automatically dropped in the soil according to the rotation of the seed motor. Also the farmer will be updated with the seed containers, whenever it becomes empty full stop the robot hand used in this proposed system helps in picking and placing the objects detected during the seed sowing process.

7. FUTURE SCOPE

- Improvement to robotic arm can be made for other type of field work like cutting grass, filling the container with the seeds.
- Instead of using the wheel chain roller we can robot movement. Different types of crops can also be planted like vegetables, fruits or sugarcane etc.

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