

MULTIPURPOSE ENVIRONMENT AGRICULTURAL SYSTEM USING ROBOTIC TECHNOLOGY

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Abstract—A Multipurpose robot for the field of agriculture has been studied in this research. Precision agriculture by agricultural robots is the newly emerging technology in agriculture sector to save the time and energy that is wasted in repetitive farming. The working of robot is based on field parameters i.e. length and width. Prototype of an agricultural robot is modeled for multipurpose such as seeding, ploughing and harvesting with a separate irrigation system. It is a vehicle which is controlled by ATMEGA328 microcontroller (arduino) as master controller, Humidity and temperature sensors for irrigation, power supply is provided by solar panel which is eco-friendly to the environment. Solar panel will also help in decreasing the use of non-renewable sources of energy and will not pollute the environment. Google voice is provided to convey the messages to robot operated on android application to manoeuvre robot in the field and Bluetooth is to pair the robot with mobile.

Index Terms—precision agriculture, seed sowing, ploughing, harvesting, Arduino.

I. INTRODUCTION

Nearly about 70% people are dependent upon agriculture in India. The main motive for developing Agricultural automation technology is the decreasing labor force, a phenomenon common in the developed world. For designing a robot one has to consider two considerations which are precision requirement in the task and environmental conditions in which robot needs to work for automating the agricultural operation[1,2]. To carry out the process of seeding, robot should move in straightway and also be able to modify the distance between seed dropping. Moisture content in soil can affect the digging process; to complete the process sensors should be chosen according to the environmental conditions of working[3,4]. This robot is a multifunction Robot that performs three major functions in Agriculture field i.e. Ploughing, Seed distribution and Agriculture Harvesting. This Agri-bot consist of a switch to select field measurement in length and breadth in Feet and select the mode of operation and after selecting the size of field, a function key allows you to select mode like Ploughing, Seed distribution or Harvester. A Solar panel is placed on top of the robot and is connected to the battery for charging and providing power to the robot. 15W solar panel has been used in this robot and 4X4V battery

is connected to the power supply circuit. Google voice to give instructions to the robot. A start button will activate the DC geared motors to run the Agri-bot to perform desired function. These things are interfaced with Arduino Atmega328p and programming for the operation of the mode and motor is done on Arduino (IDE) software in c language[5-10].

II. PROPOSED SYSTEM

The agricultural robots were designed only for the ploughing and seeding purposes. They are developed on separate robot for ploughing, seed sowing and separate one for harvesting which can operate automatically. The main factor to be considered for farming is the moisture and humidity content in soil. Hence along with this the irrigation process takes place as it consist of humidity sensors to measure the moisture in the air and soil sensor to measure the moisture content in soil. It gives us the option to choose the mode of its operation. It will be convenient for farmers to operate in their desired mode like moving front, left and right in which command provide through Bluetooth module shown in fig 1.



Fig 1: Hardware of agricultural robot

To attain our proposed system we need to use ARDUINO controller which is used to monitor the field environment. Solar panel is attached with the lead-acid battery for storing energy and it is given to power supply circuitry which is providing +5v for arduino board and +12v for driving DC motors. The key is used additionally to operate manually. The google voice is used to operate the robot direction like forward, backward, left and right. The

robot is fixed to four wheels and the movement of these wheels is controlled using DC motors. Relay is used to control the spiked wheels which dig. A tough metal sheet is attached at the end of the robot to cover the seeds with soil. To enable this function the metal sheet is attached such that its slope touches the ground. Back end of the frame is used for harvesting purpose. Front end of the frame is used for digging process. Metallic sheet like structure is used for digging. A funnel has been used to drop the seed at their location. A funnel is made of plastic material and is connected to vibrating DC motor and the seeds flow through the funnel through the drilled hole on the shaft to the digged soil. This circuit has been designed on PCB board to interface all the components and control the agricultural purpose. The main component is ATMEGA 328 microcontroller which is commonly known as arduino. Key is used for input value and selection of mode of operation. It connects with digital humidity temperature sensors and soil sensor which measures the moisture of the soil. The flame sensor is used to detect fire in the field.

IV.IMPLEMENTATION

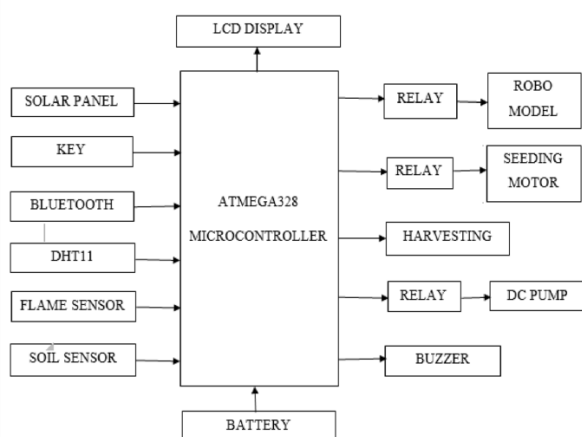


Fig.2:Block diagram of proposed system

A.Mechanism of seed sowing

There are three major distances in seed sowing operation and these are digging or sowing depth for seeds, distance between two crops and two rows. This can be interpreted as row and column distance. Completion of row is detected by IR sensors by detecting the field. After detection of first row the robot will turn to its left by 90° and will cover distance between two crops rows and again turns to its left 90° to continue sowing for second row. Similarly, the end is detected after second row and it will now turn to its right by 90° cover row distance and again turns to right by 90° to cover

third row. So, by alternately turning to its left and right with specific crop row distance, agribot will execute the sowing of each crop row. The block diagram is shown in Fig.2.

B. Mechanism of harvesting

A simple monitored harvester with single DC motor is used to perform the function of cutting the crops this is placed at the front side of the robot. In this harvester tool DC motor is attached with a roller like structure to rotate the roller that cut the crop very fastly. Blades are also attached in this roller.

V.ARCHITECTURE

ATMEGA 328 MICROCONTROLLER: Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again."Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.



Fig.3:Atmega328 microcontroller

RELAY: A relay is an electrical switch that uses an electromagnet to move the switch from the off to on position instead of the person moving the switch it takes the relatively small amount of power to turn on the relay but the relay can

control something that draws much more power. The relay is shown in Fig.4.

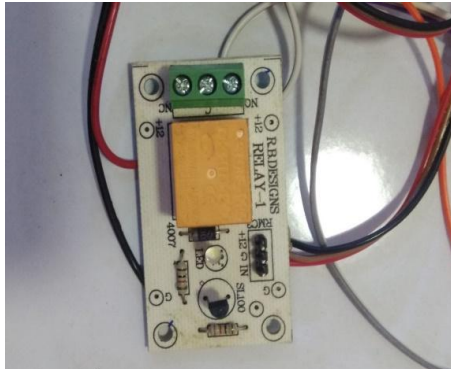


Fig.4.Relay

BLUETOOTH: HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband shown in fig 3. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle shown in fig 5.



Fig.5.Bluetooth

HARDWARE OF BLUETOOTH MODULE

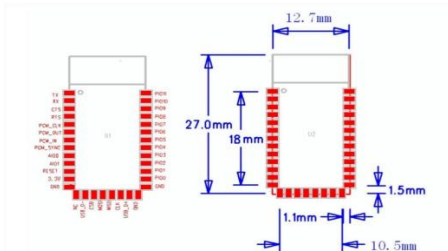


Fig.6: Hardware of Bluetooth module

LCD DISPLAY: LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven-segment and other multi-segment LEDs. The reasons being: LCDs are economical; easily Programmable; have no limitation of displaying special & even custom characters (unlike in seven-segments), animations and so on. A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc shown in fig 7.

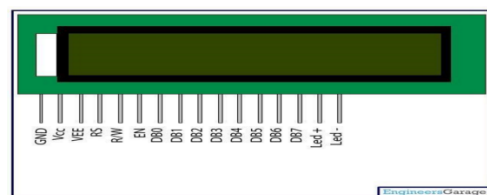


Fig .7: LCD Pin Diagram

DIGITAL HUMIDITY TEMPERATURE SENSOR: Humidity is the measure of water in air. The amount of water vapor in air can affect human comforts as well as many manufacturing processes in industries. Measurement of humidity is important for plantation protection, dew prevention, soil moisture monitoring, etc., Fig.8. Shows the DHT sensor.

When the preset value of humidity and temperature goes high, the sensor will send message to microcontroller and after receiving messages from microcontroller water motor will switch on automatically.



Fig.8:DHT sensor

SOIL MOISTURE SENSOR: When the soil moisture is dry then the sensors sends message from microcontroller water motor will switch on automatically. Soil sensor is shown in Fig.9.

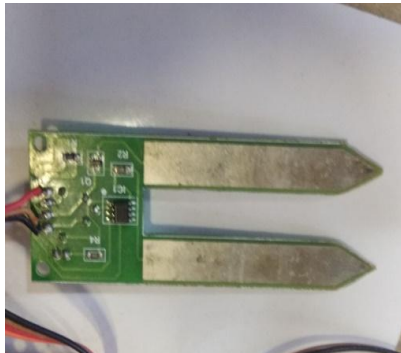


Fig.9:Soil sensor

VI.EXPERIMENTAL RESULT

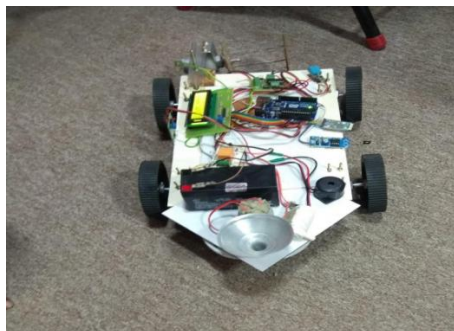


Fig.10:Hardware of agri-bot

Main objective of automating the seeding operation is to make it more efficient and accurate in its working over traditional seed sowing methods. The proposed system gives a compact, low power and low cost system with an efficient output. There are three major distances in seed sowing operation and these are digging or sowing depth for seeds, distance between two crops and two rows. They are interrupted as row and column distance. Experiments are done on the wet soil and distances covered by the robot are compared with predefined optimal distances. Multitasking robot is also able to detect the field end by detecting the compound of the field. Accuracy obtained is satisfactory and can be improved by utilizing more mechatronic design methodology. The hardware is shown in Fig.10.

VII.CONCLUSION

This automated robotic machine which is named as “AgriBot” is specially designed to facilitate the farmers so that the demand of food can be met easily. Agriculture robot serves better result than manual system. It is an automated robot which works on the basis of size of field, size of seed and in which mode it is meant to be operated. This robot can be controlled by using algorithm for the comfort of farmers and interfaced by using arduino board. It is expected that this robot will change the trend of farming in the upcoming days from manual to automate. The implementation of Agro-Bot has significant saving in the term of time, efficiency, man power, wastage of resources and also it works at much cheaper price. This also makes farming easy to learn and implement. By the help of this robot we can create the interest of youth in farming which is very important for our development. These robots can be created in different sizes as per the requirement of farm which will make it more affordable. Robots can come over the difficulties in farming and also it leaves scope of further advancement in it.

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