



AgRo-Bot: An Autonomous Robot

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Abstract: A Multitasking robot for the field of Agriculture has been studied in this research. Now a day, 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 tasks automation in farming processes is quite helpful. To design these sorts of robots there should be certain considerations and particular approach considering the agriculture environment in which it will be working. The working of an autonomous robot is based on field parameters i.e. length and width. Prototype of an agricultural robot "AgRo-Bot" is modeled for multitasking such as seeding, ploughing and harvesting with a separate irrigation system. It is a tri wheeled vehicle which is controlled by ATMEGA328 microcontroller (ardiuono) as master controller, Humidity sensor for irrigation, power supply is provided by solar panel which is eco-friendly to the environment. It will also help in decreasing the use of non-renewable sources of energy and will not pollute the environment. Other accessories are slaves performing specific operations. The approach is now to develop smarter machines that are intelligent enough to work in an unmodified or semi natural environment.

Keywords: AgRo-Bot, Arduino, solar panel, irrigation, seed sowing, ploughing, harvesting.

1. INTRODUCTION

In India, near about 70% people are dependent upon agriculture. As compared to other fields globalization in agriculture system is less. So, it is necessary to make some advancement in this field[1]. The idea of robotic agriculture (agricultural environments maintained by good machines) isn't a replacement one. Several engineers have developed driverless tractors within the past however they need not been flourishing as they didn't have the flexibility to hold the complexity. The main motive for developing Agricultural automation technology is the decreasing labour force, a phenomenon common in the developed world. The reasons are the need for improved food quality[3].

Now a day agricultural operation is automated and also there is commercial availability of automatic machineries and robots[2]. 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. To carry out the process of seeding, robot should move in straightway and also be able to modify the distance between seed dropping[4]. Moisture content in soil can affect the digging process; to complete the process sensors should be chosen according to the environmental conditions of working.

This AgRo-bot is a multifunction Robot that performs three major functions normally required in Agriculture field i.e. Ploughing, Seed distribution and Agriculture Harvesting[5]. This AgRo-bot consist of a switch to select field measurement in length and breadth in Ft 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 start button will activate the DC geared motors to run the AgRo-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.

2. PROPOSED IDEA

After studying the existing model on agriculture techniques and robots we listed many disadvantages that we are overcoming with our proposed idea which is AgRo-Bot programmed on single arduino chip with multiple functions. The block diagram of proposed system consists of a vehicle controlled by ATMEGA328 microcontroller (Arduino) as master controller, humidity sensor for irrigation, indicators such as LCD etc. and other accessories. The proposed system integrates all the functions such as ploughing, seeding, and crop cutting into a single robot and performs the operations automatically. The whole arrangement with arm is used for ploughing, seeding and crop cutting whenever required. AgRo-Bot will automatically move in field provided length and width of field. It gives us the option to choose the mode of its operation. It will be convenient for farmers to operate in their desired mode. Agro-Bot will also be equipped with solar panels which will help in recharging the batteries by natural source of energy. It will also help in decreasing the use of non-renewable sources of energy and will not pollute the environment.

3. METHODOLOGY

The primary aim of our project is to develop a multitasking agricultural robot, which can be used for agricultural processes like digging the soil, seed sowing, crop cutting (harvesting) and irrigation system. keeping in mind

low cost and more efficient. This robot will derive its power from solar panel making it energy efficient and eco-friendly. The whole interfacing is shown in Fig2.

The base frame of the robot is made of DMF board with two wheels and a caster wheel. We are using DMF board instead of metal base to reduce weight and cost. DMF board also adds to the strength of the robot. The wheels are driven by dc geared motor with specification of 12V and 100RPM. DC motor with this specification has been used so as to vary the speed of the robot.

- Front end of the frame is used for harvesting purpose. It is connected to a cutter to serve the harvesting purpose. The cutter is connected to a dc motor which has more rpm (800). The cutter is made of Aluminium sheet and sun board.
- Back end of the frame is used for digging process. Metallic teeth like structure are used for digging. This can be elevated using a robotic arm when not in use or when the robot is performing other process than digging.
- A Funnel has been used to drop the seeds at their location. The 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.
- A circuit has been designed on the PCB Board to interface all the components and control the agricultural processes. The main component which executes the processes is a microcontroller Atmega 328p which is commonly known as Arduino. The circuit contains a dc motor driver L293D which can control two dc motor simultaneously, a LCD to display the ongoing operation and to display the parameter of the field defined, Switches which are used for input value and selection of mode of operation, a power supply circuit which consists a voltage regulator(7812) to regulate the power from 16V TO 12V.
- The circuitry defined above is interfaced and controlled by Arduino uno. Arduino uno is a microcontroller which can be used to operate multiple tasks using logical programming.
- 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.
- We are using four switches for setting the parameter and mode selection and for reset.
- A separate mechatronic sprinkler with water motor is used for irrigation process. It connects with the humidity sensor which sense the moisture of the soil.

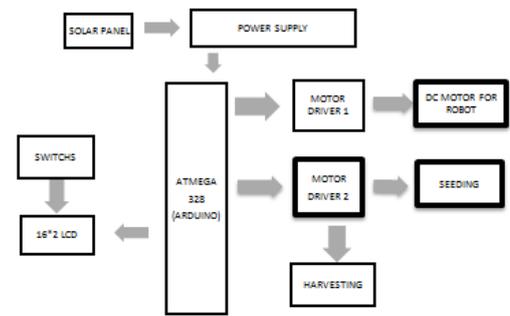


Fig1: Block Diagram of Agro-Bot

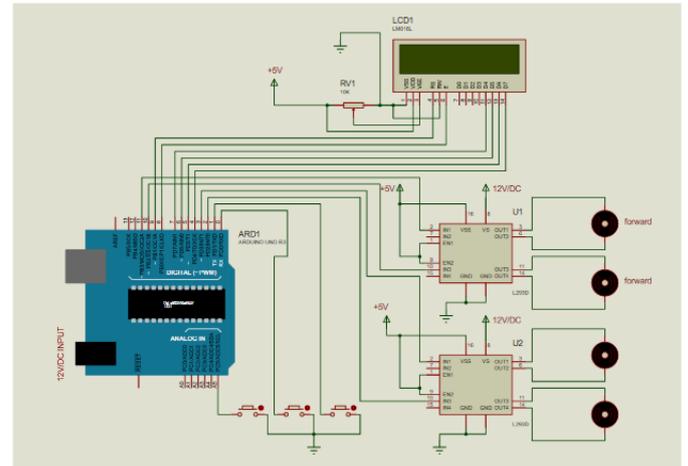


Fig 2:Circuit Diagram

4. ALGORITHM IMPLEMENTATION:

The algorithm of farming system is performed as

1. Start the machine via switch.
2. display the parameters on the lcd screen.
3. Set the parameter (length & width) according to the field by switch1 and switch 2respectively.
4. Now we select the modes of operation for farming according to the process.
 Mode 1 is for the seed distribution which actuates the vibrator motor for dropping the seed.
 Mode 2 is for harvesting process in which a cutter is used to cut the crop with the help of dc motor.
 Mode 3 is for digging purpose. We click ok on mode 3 it simply start the digging in forward direction according to straight line.
5. when this process is continue in work it will go in forward direction according to the length and after the delay which has already been defined in it will rotate itself by 180⁰ and after this it will do same process in that direction.

These processes can be implemented according to the requirement of user.

4. RESULTS

AgRo-Bot is performing three main operation. These all operations are executed and control by the Arduino. The processes are following as:

1.Ploughing:This application is very easily achieved by attaching the metal like structure at the back side of the robot. For this application we require to give good

mechanical strength to the robot, because it is quit heavy and when it is place on soil forploughing purpose, it required extra force to move forward.This is the initial operation in the farm. This application has no delay time. Once it place on the farm Itcontinuously plough the soilthrough the ploughing tool which operate on 12V DC.

2. Seed Distribution:The dropping of seed is done using the dc motor vibrator mechanism. For that we are using the special mechanical head at the shaft of dc motor. This DC motor is attached with a funnel at the back side of the robot.The point on the farm where we want to dropping the seed is comes,the dc motor has large rpm vibrates so due to his vibration seeds are dropping from the funnel and a thin Al sheet is fixed below the hole of the funnel to control the quantity and density of the seeds. In this way the controlling action of motor takes place at equaldistance of farm, and also it dropped quantities seed's on the farm.

3. Harvesting:In AgRo-bot, a simple motorized harvester (cutter) with single dc motor is used to perform the function of cutting the crop. 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. A further modification with advance features can be implemented with hardware changes.

4. Irrigation: A separate irrigator in the form of a mechatronic sprinkler was developed to apply variable rates of water when soil is dry. The trajectory and sector angles of the jet were controlled by dc motor. A humidity sensor is attached with this sprinkler which will sense the moisture of the soil and give command to the water pump+for supplying the water. We can adjust the range of moisture of soil in humidity sensor according to the weather and the desired pattern with accordance of the circuit.

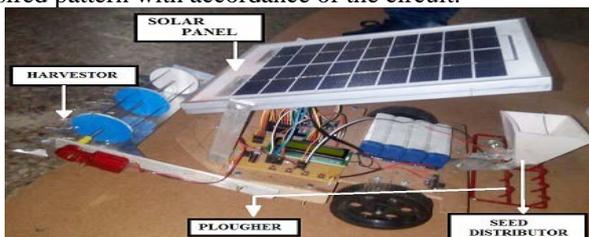


Fig3:AgRo-Bot

CONCLUSION

This automated robotic machine which is named as “Agro-Bot” 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 arduinoboard. 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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