Fabrication of Agricultural Robot for Ploughing, Seeding and Grass Cutting

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ABSTRACT: In India, nearly about 70% people are dependent upon agriculture. So the agriculture system in India should be advanced to reduce the efforts of farmers. Various number of operations are performed in the agriculture field like seeding, weeding, waste planet cutting, plowing etc. Very basic and significant operation is seeding plowing, plant cutting. But the present methods of seeding, plowing and plant cutting are problematic. The equipments used for seed sowing are very difficult and inconvenient to handle. So there is a need to develop equipment which will reduce the efforts of farmers. This system introduces a control mechanism which aims to drop seeds at particular position with specified distance between two seeds and lines while sowing. The drawbacks of the existing system will be removed successfully in this automatic machine.

INDEX TERMS:- Robot, Ploughing, Seeding and Grass Cutting.

1 INTRODUCTION

In olden days technology was not developed that much. So they were seeding plowing and plant cutting by hand. But nowadays technology is developed. So now it's not necessary to do seeding in sunlight. By using robot technology one can sit in a cool place and can do seeding by monitoring the robot motion. Today's agricultural field demands to find new ways of agricultural operation to improve performance efficiency. In the field of agriculture various problems are faced by the farmers in the operations like seed sowing, plowing, and waste planet cutting, weeding. Also the equipment's used to perform the operations are very heavy. Due to migration of human's in the cities the labor problem occurs. Now day's robotics technology plays a paramount role in all sections like medical field, industries and various organizations. In other countries robots are used to perform different operations in the agricultural field. We can make the use of available technologies and the robotics technology in the farming system to reduce the efforts of farmers and also to reduce time, energy and required cost.

This project is about moving a solar panel along with the direction of sunlight; it uses a stepper motor to control the position of the solar panel, which obtains its data from a microcontroller. The automated solar tracking system is design in order to optimize the efficiency of overall solar energy output. Light dependent resistor (LDR) is used for each degree of freedom. LDRs are basically photocells that are sensitive to light. Several applications of solar energy ranging from simple solar water heating to complex megawatt power generation systems are under extensive investigation. The function of the solar collector is to collect the radiation incident from the sun. To get maximum energy from the Sun, solar panel needs to rotate according to movement of the sun with the help of LDR.

S.D. Sambare and S.S.Belsare [1] worked on Seed Sowing Using Robotics Technology. In India, near about 70% people are dependent upon agriculture. So the agricultural system in India should be advanced to reduce the efforts of farmers. Various number of operations are performed in the agriculture field like seed sowing, weeding, cutting, pesticide spraying etc. Very basic and significant operation is seed sowing. But the present methods of seed sowing are problematic. Swetha and G.H. Shreeharsha [2] investigate on Solar Operated Automatic Seed Sowing Machine. The real power required for machine equipment depends on the resistance to the movement of it. Even now, in our country 98% of the contemporary machines use the power by burning of fossil fuels to run IC engines or external combustion engines. This evident has led to widespread air, water and noise pollution and most importantly has led to a realistic energy crisis in the near future. Now the approach of this project is to develop the machine to minimize the working cost and also to reduce the time for digging and seed sowing operation by utilizing solar energy to run the robotic machine. In this machine solar panel is used to capture solar energy and then it is converted into electrical energy which in turn is used to charge 12V battery, which then gives the necessary power to a shunt wound DC motor. This power is then transmitted to the DC motor to drive the wheels. And to further reduction of labor dependency, IR sensors are used to maneuver robot in the field. Here 4 post sensors are used to define the territory and robot senses the track length and pitch for movement from line to line. Seed sowing and digging robot will move on different ground contours and performs digging, sow the seed and water the ground after

closing. P. G. Salunkhe [3] worked on Automatic Seed Plantation Robot. Automatic Seed Plantation Robot which is based on electronic and mechanical platform that performs advance agriculture process. We have developed an electromechanical vehicle which is steered by DC motors to drive wheels. The farm is cultivated by the automated system, depending on the crop considering particular rows & specific columns. The spacing between two seeds in a column has to be entered manually. Proximity sensor is used to measure the rotation of wheels. To detect the obstacle in the path of the vehicle IR LED with TSOP receiver is used and turning position is also depend on this sensor. To check whether seed container is empty or not LDR sensor is used. All the operations are monitored and control by PIC microcontroller using sensors. The programming of this microcontroller is done in assembly language. LCD display is used to show seed count. K. P. Deekshitha, and P. Prasanna [4] worked on "Automated Agribusiness Seeding and Grass Cutting Utilizing Android Smartphone. Aims on the design, development & the fabrication of the robot which can put the seeds, dig the soil, plough the land, cutting the waste plant these whole systems of robot works with battery. In India near about 70% people dependent on agriculture. So the agriculture system in India should be advanced to reduce the efforts of farmers. Various operations are performed in the agriculture field like seeding, weeding, waste plant cutting, plowing etc. Very basic operation is seeding, plowing & plant cutting. But the present method of seeding, plowing & plant cutting are problematic. The equipment's used for seed sowing are very difficult and inconvenient to handle. So there is a need to develop equipment which will reduce the man power. The machine can be advanced for sowing seeds in farm with particular distance between seed is adjusted. In this paper robot direction is provided by using Software programming. By using that proper direction is given to the robot. The farm is not the straight line and smooth. If any obstacle is occurred like stone, electric light pole, trees etc. the automatically robot get stop. Agriculture is the main occupation. So this system in India should be advanced to reduce the efforts of farmers. Nayana V. Chavan and Monika B. Patil [5] worked on Automated Solar Grass Cutter. According to the author a daily purpose robot which is able to cut the grass in the lawn. The system will have some automation work for guidance and other obstacle detection and the power source that is battery and a solar panel will be attached on the top of the robot because of this reduces the power problem. Automated solar grass cutter are increasingly sophisticated, are self – docking and some contain rain sensors if necessary, nearly eliminating human interaction. The system is switched to automatic modern which the robot's infrared sensors make a comparison between cut and uncut the grass. The mower continues this process until it completes the job. The system uses 12v batteries to power the vehicle movement motors as well as the grass cutter motor. They also use a solar panel to charge the battery so that there is no need of charging it externally. The grass cutter and vehicle motors are interfaced to an 8051 family microcontroller that controls the working of all the motors. It is also interfaced to an ultrasonic sensor for object detection. The microcontroller moves the vehicle motors in the forward direction in case no obstacle is detected. If incase obstacle is detected by the sensor then the microcontroller stops the grass cutter motor so as to avoid any damage to the object/human/animal coming. Bhagyashri R. Patil and Sagar S. Patil [6] worked on Solar Based Grass Cutting. According to the author, human enlargement in many countries there are studies and trials going on the solar energy and the wind energy, so they made their new concept solar power grass cutting machine. In this concept they cut the grass on the agricultural land or small plants in lawns and gardens. The design of solar powered agricultural equipment will include direct current (DC) motor, a rechargeable battery, solar panel, a stainless steel blade and control switch. The automatic grass cutting machine is going to perform the grass cutting operation by its own which means no manpower is essential. The purpose of the project here is to design and build a remote controlled grass cutter. The device consist of linear blades and it does not affected by climatic conditions. Amritansh srivasatava [7] worked on DTMF Based intelligent farming robotic vehicle. These worked on DTMF Based Intelligent Farming Robotic Vehicle. The main objective of machine can also be used to reach the places where farmers make harder efforts for farming such as hill areas, mountains etc. where land is not plane. This is how we can use this robot in different fields as well as for research purpose by further manipulation in programming it can be modified accordingly. R.suresh [8] worked on GSM based Automated Irrigation Control using Rain gun Irrigation System. This extensive work on automatic feeding device in rotary cultivator blade shaft welding equipment. It can achieve automation of grab, feeding and placement of all blade holders and assures that the blade holder feeding device and other devices in welding equipment work coordinate automatically. It can replace a universal robot to realize welding automation of the shaft weldment. Moreover the biggest advantage of it is easy to operate and low cost. Amrota sneja [9] worked on Agricultural robot for

automatic ploughing and seeding. In this research paper agricultural robot for automatic ploughing and seeding. The concept of fruit picking and pesticide spraying is described under the process domain. Farmers today spend a lot of money on machines that help them decrease labor and increase yield of crops but the profit and efficiency are very less. Hence automation is the ideal solution to overcome all the shortcomings by creating machines that perform one operations and automating it to increase yield on a large scale. Simon Balckmore [10] on national conference "Robotic agriculture the future of agricultural mechanization. In this paper robotic agriculture the future of agricultural mechanization. Developed agriculture needs to find new ways to improve efficiency. One approach is to utilize available information technologies in the form of more intelligent machines to reduce and target energy inputs in more effective ways than in the past. Precision Farming has shown benefits of this approach but we can now move towards a new generation of equipment. The advent of autonomous system architectures gives us the opportunity to develop a complete new range of agricultural equipment based on small smart machines that can do the right thing, in the right place, at the right time in the right way. Sajjad yaghoubi [11] worked on Autonomous robots for agricultural tasks and farm assignment and future trends in agro robots. Autonomous robots for agricultural tasks and farm assignment and future trends in agro robots. This article is the logical proliferation of automation technology into bio systems such as agriculture, forestry, green house, horticulture etc. Presently a number of researches are being done to increase their applications. Some of the scientist contributions are mobile robot, flying robot, forester robot, Demeter which are exclusively used for agriculture. A brief discussion is being done about the types of robots which increase the accuracy and precision of the agriculture. Mahesh R. Pundkar[12] investigated on "Seed sowing Machine. Author stated that the seed sowing machine is key component of agriculture field. High precision pneumatic planters have been developed for many varieties of crops, for a wide range of seed sizes, resulting to uniform seeds distribution along the travel path, in seed spacing. S. Chavan and A. Dongare [13] worked on Agriculture Based Robot. Now a day's most of the countries do not have sufficient human factor in agricultural sector and it affects the growth of developing countries. So it's time to automate the sector to overcome this problem. In India, 70% people depends on agriculture. So we need to study the agriculture. Innovative idea of our Project is to automate the process of sowing crops such as groundnut, baby corn, sunflower and so on .The farming system like plugging, cultivating, weeding, harvesting, etc. is the different process. All the processes are advance to modifying the mechanism in farming which works automatically without the man power requirement. Manually seed plantation method suffers from various problems. The tendency of manual work is going on reducing. The man power shortage is one of the biggest problems faced continuously to all farmers. Due to labor shortage the plantation cost should be increased. So it is not economically beneficial for all farmers. Now a day's instrumentation and control system plays an important role. So we develop a system for "seed plantation robot" using microcontroller which is very economical and beneficial. Due to automation the work become easiest, errorless and it saves money also. Our system is nothing but the four tyre vehicle which is driven by geared DC motor. According to microcontroller program, after some distance or some time instant the seed should be dropped through the nozzle, which is operated by relay. Nozzle size is depends on the diameter of the seed. Same operation is repeated after some time delay. Shivprasad B S and Ravishankara M N [14] worked on 'Design and Implementation of Seeding and Fertilizing Agriculture Robot. The aim of the designed system is to seeding, fertilizing and soil ph. temperature, moisture, humidity checking. The robot is controlled by remote. The designed system involves navigation of robot to the destination successfully and does the above functions. The direction of the robot is controlled via remote. The robot and the remote system are connected through internet system.

2 EXPERIMENTAL WORK

2.1 Block diagram of Agricultural Robot

The robotic systems play an immense role in all sections of societies, organization and industrial units. The basic idea in this study is to develop a mechanized devise that helps in on-farm operations like seeding/seed sowing at pre-designated distances and depths with all applicable sensors for controlling humidity, temperature. But many problems are faced by farmer during seed sowing operation, like proper adjustment of distance between two crops, distance between two rows. Seed sowing's very basic and paramount operation in the agricultural field. Nowadays seed sowing is done either manually or by tractors. Manual method includes broadcasting the seeds by hand. Sometimes method of dibbling i.e. making holes and dropping seeds by hand is used. Also a pair of bullocks is used to carry the heavy equipment of leveling and seed dropping. Another method of seed sowing is to use tractor in farms. The heavy equipments of seed storage and

dropping mechanism are attached to the tractor to drop the seeds. A ground wheel is attached at the base of the seed sowing machine. The power transmission system is used to transmit the motion of the rotation to the metering mechanism. The metering mechanism contains number of scoops to drop out the seeds from the hopper. The seeds are then transmitted in the seed distributor pipes. Flexible and compatible pipes can be used to distribute seeds. With the help of tiller we can make the land smooth for sowing the seeds as shown in fig.1. This system has three main sections like seeding, plowing and waste plant cutting, which are inter-communicated using communication technologies. The control station as well as robotic station possess the amenities viz., temperature sensor, humidity sensor, seed dispenser, seed storage, robotic system with motors, microcontroller.

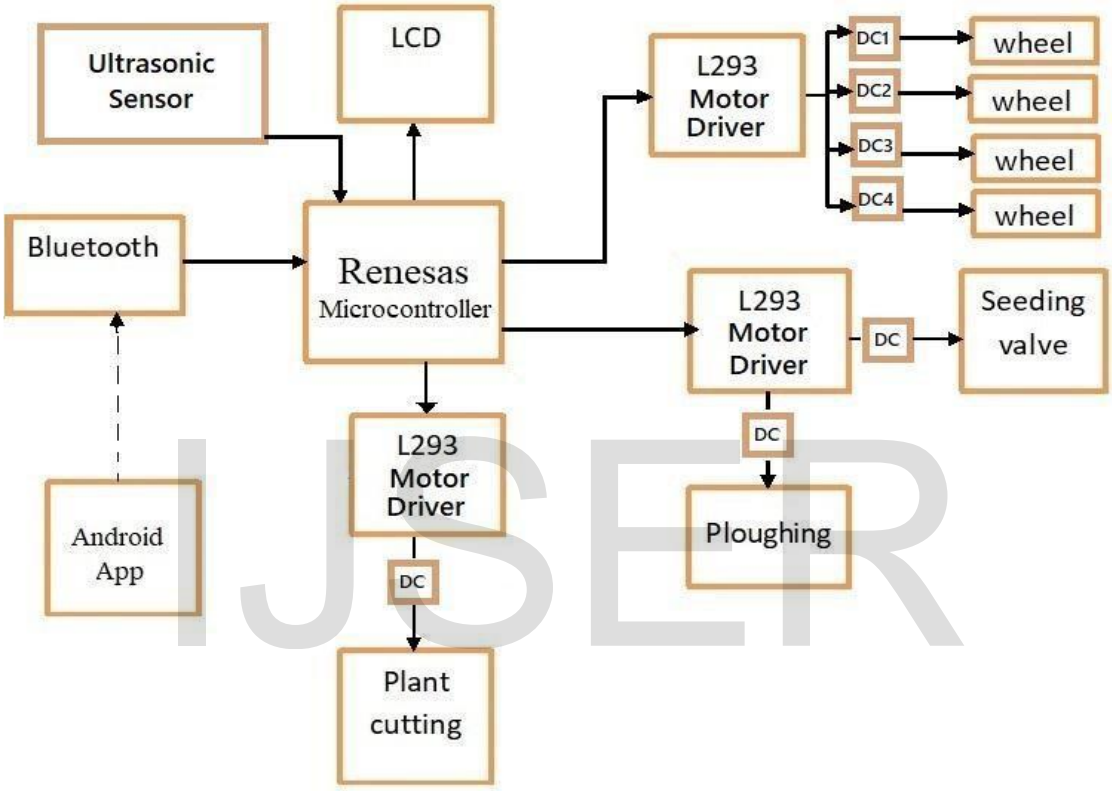

Fig.1 Block diagram of Agricultural Robot

2.2 Hardware components

- Renesas 64 pin Microcontroller
- LCD
- GSM
- Relay
- L293 Board
- Four wheeled robot
- Plant cutting & Ploughing arrangement
- Solar panel

2.2.1 Renesas 64 pin Microcontroller

The microcontroller is brain of this system, which can dedicates the order of suggestions received to all the networks, and sensible factors processed by their corresponding embedded programs. We can use GSM module information sending to Robot machine using solar energy. An GSM module will be given to communicate with the robot. User can select any of the 3 options i.e. seeding, plowing and cutting. Here the robot keep moving in a one direction, the 2 ultrasonic sensors will detect the plants on both left n right side and plant cut automatically. The grass cutting is done by using DC Motor. The complete project process will be displayed on LCD screen and solar energy produce the power to robot unit through sun light In GSM application we need to set the number of columns and number of steps movement for the robot. Complete agriculture land will be divided into columns and number of steps.

2.2.2 LCD

A liquid crystal display (LCD) is a flat panel display electronic visual display based on on Liquid Crystal Technology. A liquid crystal display consists of an array of tiny segments (called pixels) that can be manipulated to present information. Liquid crystals do not emit light

directly instead they use light modulating techniques.It is an electronically modulated optical device made up of any number of segments filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome. LCDs are preferred to cathode ray tube (CRT) displays in most applications because of

- The size of LCDs comes in wider varieties
- They do not use Phosphor; hence images are not burnt-in
- Safer disposal
- Energy Efficient
- Low Power Consumption

2.2.3 GSM

The GSM standard initially was used originally to describe switched circuit network for full duplex voice telephony to replace first generation analog cellular networks. The standard was expanded over time to include first circuit switched data transport, then packet data transport via GPRS (General packet radio service). Packet data transmission speeds were later increased via EDGE. The GSM standard is succeeded by the third generation (or "3G") UMTS standard developed by the 3GPP. GSM networks will evolve further as they begin to incorporate fourth generation (or "4G") LTE Advanced standards. "GSM" is a trademark owned by the GSM Association. GSM networks operate in a number of different carrier frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G), with most 2G GSM networks operating in the 900 MHz or 1800 MHz bands. Where these bands were already allocated, the 850 MHz and 1900 MHz bands were used instead (for example in Canada and the United States). In rare cases the 400 and 450 MHz frequency bands are assigned in some countries because they were previously used for first-generation systems.

SIM900 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. SIM900 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. You can use AT Command to get information in SIM card. The SIM interface supports the functionality of the GSM Phase 1 specification and also supports the functionality of the new GSM Phase 2+ specification for FAST 64 kbps SIM (intended for use with a SIM application Tool-kit).Both 1.8V and 3.0V SIM Cards are supported. The SIM interface is powered from an internal regulator in the module having nominal voltage 2.8V. All pins reset as outputs driving low.

2.2.4 L293 Board

The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays, solenoids, DC and Stepper motor) and switching power transistors. To simplify use as two bridges each pair of channels is equipped with an enabled input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included. The L293D is assembled in a 16 lead plastic package which has 4 center pins connected together. L293D is an H-bridge IC used to drive the DC motor. This driver is also used to vary the speed of the DC motor, CPU fan and to control the brightness of the led light. L293 requires +12V, and +5V power supply. It has a dual channel i.e. we can control 2 motors with single IC. For every channel there is a 1 enable pin (connected to +5V) and 2 input pins are connected to microcontroller port. The second channel 2 input pins are connected to microcontroller port. To control the speed of the DC motor, CPU fan or to control the brightness of the led light, the enable pin will be connected to the PWM pin of the microcontroller.

3 RESULTS AND DISCUSSION

Agricultural robot accepts the input given from the App, these inputs are received using Bluetooth module (range 100 m) and it performs all the activities selected by the user.

3. 1 Grass Cutting

The Blades attached to DC motor in front of the robot effectively cut the grass. A grass cutter is a machine utilizing one or more revolving blades to cut a grass surface to an even height. The height of the cut grass may be fixed by the design of the mower, but generally is adjustable by the operator, typically by a single master lever, or by a lever or nut and bolt on each of the machine's wheels. The blades may be powered by muscle, with wheels mechanically connected to the cutting blades so that when the mower is pushed forward, the blades spin, or the machine may have a battery-powered or plug-in DC motor as shown in fig.2.

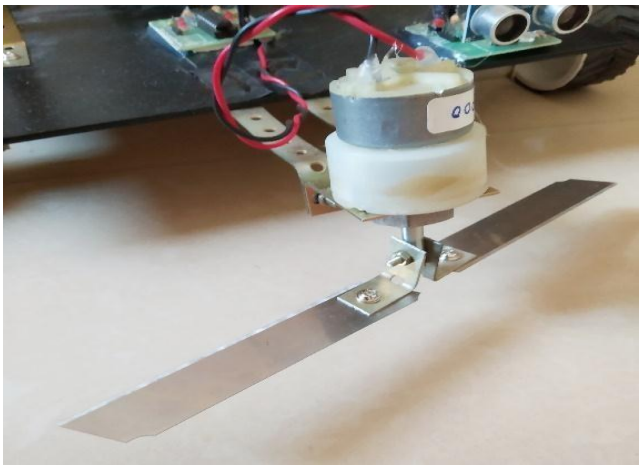

Fig.2 Grass Cutting Mechanism

3.2 Ploughing

The Plough arm made of screws moves down and plows the soil and is lifted up after completion of ploughing. The first and foremost step in the farming is Ploughing. The assembly is attached to the off road bot used for drilling and seeding. This process is done in order to loosen the soil and create a path or tracks on the farm land in order to sow the seeds uniformly. The structure and the design of the plough tool depends on the various constraints such as the type of soil to be ploughed and the depth required based on the type of crop that has to be grown and so on. There are many types of Ploughing mechanisms that has been adopted which can be broadly classified into two categories; one is the manually driven Ploughing tool and the other being machine driven. We have designed the plough tool using Solid Works software. The design and dimensions of the plough tool are in accordance with the size of the bots. The angle of inclination and length of the tool are calibrated by considering the depth required for ploughing the soil and it varies with the type of crops and soil. The tool is operated by using a 12V dc motor having 10 rpm. The initial and final positions of the plough tool are controlled by coding it in a required manner.

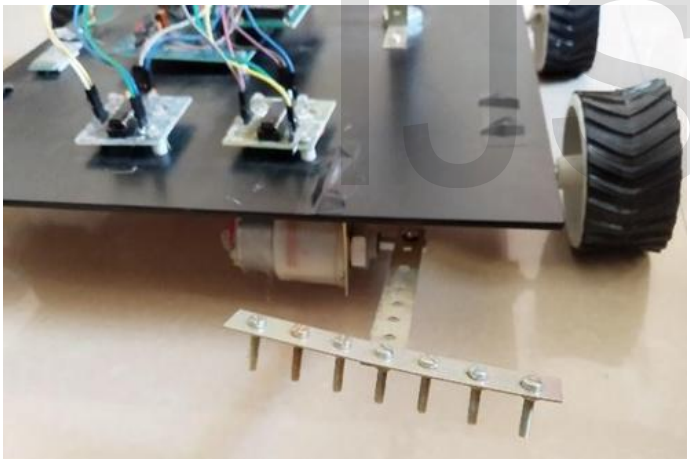

Fig.3 Ploughing Mechanism

3.3 Seeding

Seeds are dropped from the funnel using the open-close movement of values at equal intervals. The assembly is attached to the off road bot used for drilling and seeding. The next major step in the process of farming is seeding. Seeding usually depends on the type of crops being grown and the type of seeding varies over a variety of crops. In case of robots, utmost care has to be taken to ensure uniform spacing and controlled flow of the seeds from the bot; where in the seeds required for sowing is stored in a container and is mounted on the bot at the suitable position as shown in fig.4. The robots take wheat seeds from a station and sow them as even as possible on the area.

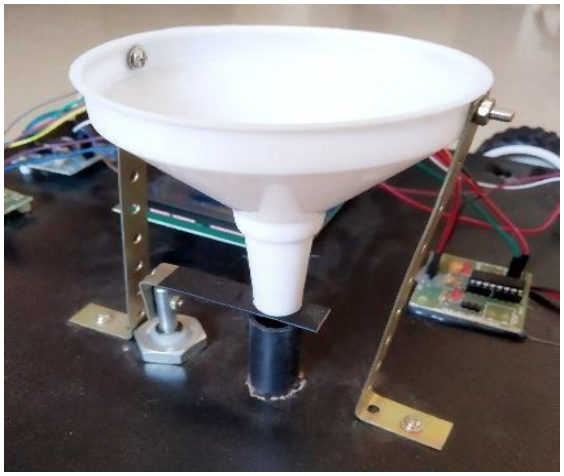

Fig.4 Seeding Mechanism

3.4 Obstacle Detection

On detection of any obstacle the robot stops its movement and waits for the user to remove the obstacle and to reset the robot.

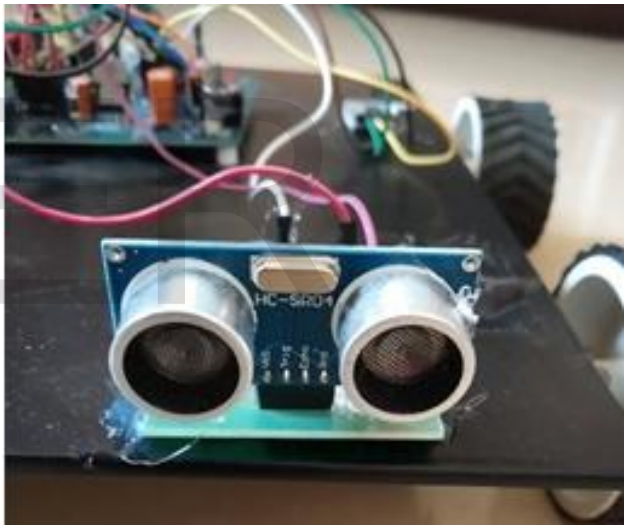

Fig.5 Obstacle Detection System

3.5 Final outlook of the Agricultural Robot

In this project we are using Renesas 64 pin microcontroller. According to the instructions given by the user the robot move in forward, reverse, left and right direction to drop the seeds at a particular position. Four wheels are connected at the base for the flexible movement of robot. DC motors are used to drive the wheels connected to the robot. L293D is used to drive the DC motors. GSM are used for send information to robot machine and solar energy is used for protect the power to robot unit. LCD are used display for entire our process.

Fig.6 Final Agri Robot

4 CONCLUSIONS

The project is designed using structured modelling and is able to provide the desired results. It can be successfully implemented as a Real Time system with certain modifications. Science is discovering or creating major breakthrough in various fields, and hence technology keeps changing from time to time. Going further, most of the units can be fabricated on a single along with microcontroller thus making the system compact thereby making the existing system more effective. To make the system applicable for real time purposes components with greater range needs to be implemented. The mode of operation of this machine is very simple even to the lay man; this design is made for multipurpose use for the farmers in a single machine like plowing, seeding and grass cutting .the wastage of seed will be reduced by using these machines and the depth of plowing will be fixed .It can operated both manually and automatic. By using this mechanism, the loading and the unloading time get reduced.

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