

## 5 in 1 Multipurpose Agricultural Robot

A. Vasanth Kumar<sup>1</sup>, C.Pragathi<sup>2</sup>, M. Preethi Reddy<sup>3</sup>, R. Bharath Simha Reddy<sup>4</sup>, S. Madhava Reddy<sup>5</sup>

<sup>1,2,3,4</sup>U.G Students, Department of Mechanical Engineering, Mahatma Gandhi Institute of Technology(MGIT), Hyderabad, Telangana, India.

<sup>5</sup>Professor, Dept. of Mechanical Engineering, MGIT, Hyderabad, Telangana, India.

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**Abstract** - The purpose of this project work is to perform five major activities in the field of agriculture land and they are : Automation of Seed planting mechanism, construction of weed plucking mechanism, Ploughing, Providing water where seed is planted, Soil leveling. All these mechanisms are attached to the single moving mechanism and all above said activities will be performed one after another in a sequence. Entire mechanism is designed as automatic and it will be controlled through remote.

**Key Words:** Automation, Multipurpose, Seed planting, Weed Plucking, Water delivering, Ploughing, Soil Levelling

### 1. INTRODUCTION

The development of any nation in the world depends upon the agriculture production. If proper machinery is used in this field, accuracy in the farming and quality in the production can be achieved. Traditional methods of farming consume lot of time and also it may not be accurate because of human errors. Therefore here this 5-in-one machine is designed for doing above jobs automatically. With the help of a remote controlled unit, entire machine movements can be controlled. The person who is operating this machine need not get down in to the field, simply with the help of a handy remote control unit, entire machine that performs various functions can be controlled from certain distance.

Maintaining uniformity in seed planting can increase the sowing efficiency, thereby it is essential to adapt latest agricultural machines for various applications, in this regard to overcome manual problems, and to save time, in addition to maintain accuracy, human involvement must be reduced and all these activities must left-over to the machines. The main purpose of developing this machine is to enhance the technology in the field of agriculture, to prove the theme practically this prototype module is constructed for demo purpose.

The machine designed here is quite useful for the large cultivated areas, since it is a prototype module, the machine is designed to plant seeds one after another in one row, but when it is converted in to engineering module, the machine can plant multiple seeds in multiple locations simultaneously. Similarly other activities also implemented simultaneously, there by many acres can be planted with seeds within less time.

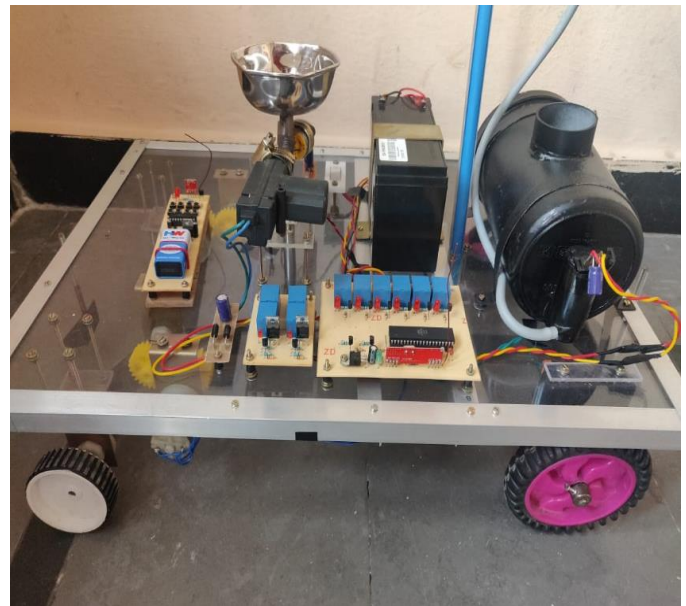


Fig. 1 5 in 1 Multipurpose agricultural robot

### 2. LITERATURE REVIEW

Nowadays, many modern techniques are introduced in agriculture; these modern techniques included the use of tractors for ploughing the field, production of pesticides, Invention of tube wells etc. These techniques enhanced the living standards of farmers.

#### 2.1 EXISTING TECHNOLOGY

Today's agriculture routinely uses advanced technologies such as robots. Some of the most common robots in agriculture are used for Harvesting and picking ,Weed control etc., Like this there exists different kinds of robots for various operations in agriculture. But all these robots can perform only one operation ex: fruit picking robot only picks fruits, weed removing robot only removes weeds. There also exists 3 in 1 multipurpose robot which can perform activities like ploughing, sowing and watering.

#### 2.2 PROPOSED SYSTEM

The proposed system here is a 5 in 1 multipurpose agricultural robot, where we can perform various operations in farmland using single robot and it can be operated using rechargeable batteries and solar energy.

### 3.1 BLOCK DIAGRAM OF ROBOT

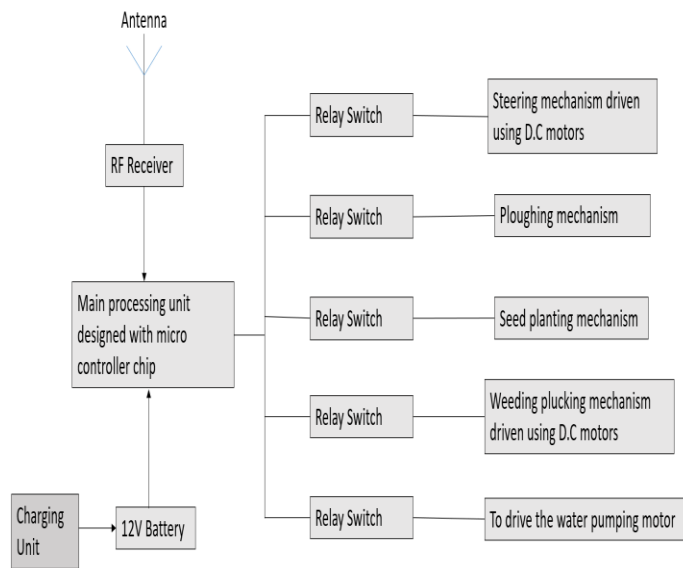


Fig.2 Block Diagram of Robot

1. Steering mechanism constructed using DC motors to move the robot in desired direction.
2. Ploughing mechanism to plough the land.
3. Seed planting mechanism to plant the seeds and cover up the mud.
4. Water pumping motor.
5. The power supply for operating the robot is taken from batteries and provided with charging unit.

### 3.2 BLOCK DIAGRAM OF REMOTE CONTROLLER:

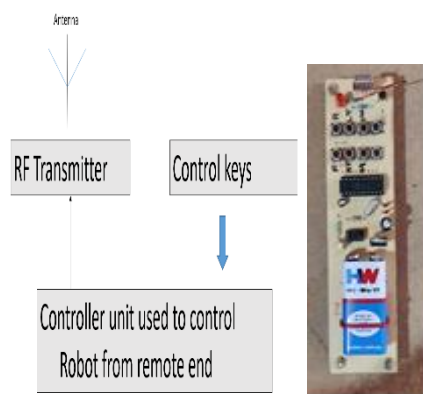


Fig. 3 Block Diagram of Remote Controller

It consists of 89C2051 microcontroller unit to drive the robot from remote end with the help of 6 control keys.

## 4. METHODOLOGY

### 4.1 MAIN PROCESSING UNIT

It consists of three main components:

1. 89C52 Micro controller chip
2. RF Receiver
3. Relay Switches

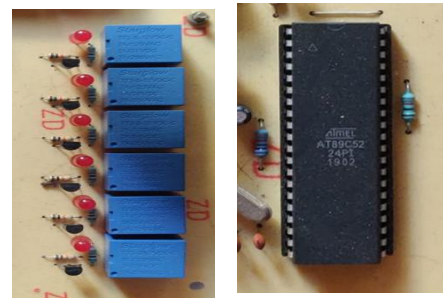


Fig. 4 Relay Switches and Microcontroller

### 4.2 Working of RF communication system

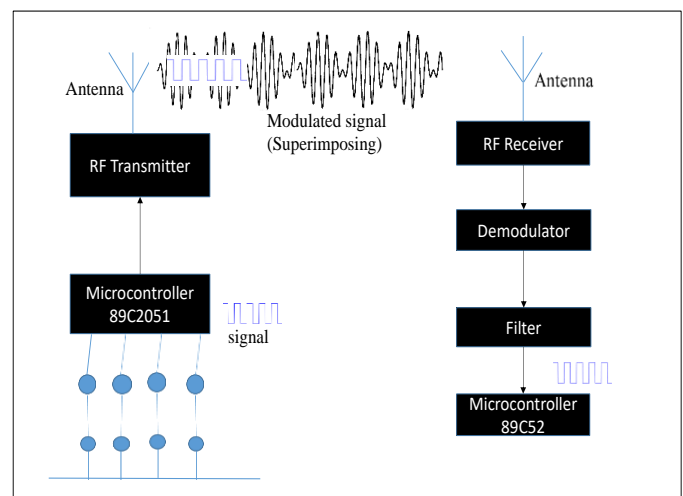


Fig. 5 Line Diagram of RF Communication

Initially, based on the key activated on Remote Controller unit, microcontroller input lines take that data and produces corresponding signal through output lines. The information is carried to RF receiver through the transmitter and antenna's. This information is carried in the form of either radio or electromagnetic waves. This frequency waves themselves cannot travel long distances. So here, frequency wave gets superimposed with the carrier frequency wave. This modulated signal can reach long distances and that is transmitted to RF receiver and gets demodulated. Thus, like this the actual signal generated by 89C2051 microcontroller is received by 89C52 microcontroller chip and according to the data received, it performs various functions with the help of relay switches.

### 4.3 MOVING MECHANISM

The moving mechanism is driven using DC motors and 4 relay switches. These motors are controlled independently to drive in ,

- Forward direction
- Reverse direction
- Left Turn
- Right Turn

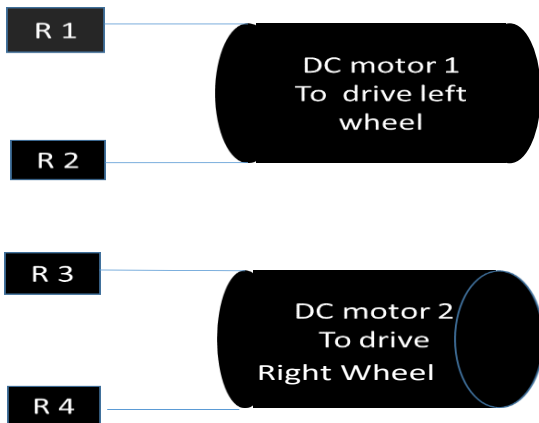


Fig. 6 Block diagram of Moving Mechanism

Relay's will be activated depending upon the desired motion. If an R1 relay is activated D.C motor 1 will rotate clockwise direction and when R2 relay is activated, the D.C motor 1 will rotate in anticlockwise direction. Similarly, If R3 relays is activated D.C motor 2 will rotate clockwise direction and when R4 relay is activated, the D.C motor 2 will rotate in anticlockwise direction.

**4.4 SEED PLANTING MECHANISM**

The seed planting mechanism is designed using Solenoid coil and Vibrating Motor. The seed planting pipe is divided in to two sections, and is arranged as see-through manner. Here to make obstacle between two pipes solenoid coil is employed, this obstacle is supposed to be removed during the seed planting time. A small metallic flat piece is used here as barrier and it is arranged between the two pipes. This metallic piece is welded with solenoid coil rod.

Solenoid coil is used to control the flow of seeds. Supply to this coil is provided through relay contact, for this purpose normally open contact relay is used. In order to plant a seed the relay is energized by controller and is supplied to solenoid coil.



Fig. 7 Seed Planting Mechanism

**4.5 WEED PLOUGHING MECHANISM**

This mechanism is used to pluck the grass or weeds in the field. The weed plucking mechanism is divided in to two sections and each section contains 2 spur gears. Both mechanisms are designed to drive through 2 DC motors and are arranged at left and right sides of the moving mechanism at front side. Each mechanism is constructed with 2 spur gears and both are equal to each other in dimensions and having similar teeth's. One spur wheel is directly coupled to the motor shaft and therefore the motor used here operates at 12V DC. The other spur wheel is meshed with motorized spur gear by which both gears are going to be rotated in clockwise.

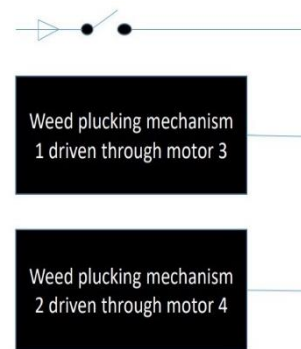


Fig. 8 Weed plucking Mechanism

**4.6 PLOUGHING MECHANISM**

The seed planting mechanism designed here is equipped with one small plough, it is a stand still component and its position can be adjusted manually



Fig. 9 Ploughing Mechanism



**4.7 WATER DELEVERING MECHANISM**

Another important function is to sprinkle the water over the planted seed at specific location, DC motor is attached to the small water tank, it is used to deliver water and therefore it is called as water pumping motor. This small water pumping motor attached to the body of mini water tanker will be activated automatically through relay switches when required and delivers the water over the soil where the seed is planted. This mechanism is activated momentarily by two relay switches connected in series.



Fig. 10 Water Delivering Mechanism

**4.8 SOIL LEVELLING MECHANISM:**

The soil leveling mechanism is arranged at the rear side of moving mechanism, here simple soil level plates are used. Here, levelers are used to close the seed with soil and level it.

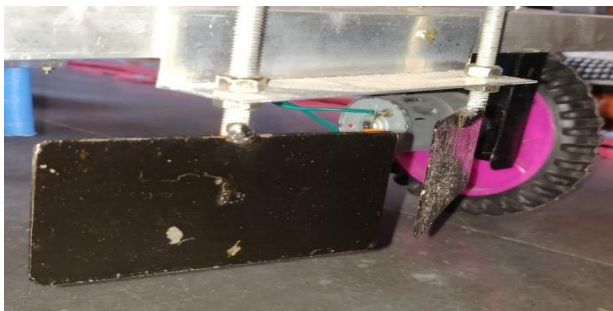


Fig.11 Soil Levelling Mechanism

**5. WORKING OF ROBOT**

Initially this mechanism must be placed in a position from a starting point of the row from where seeds are to be planted one after another with a fixed span. After positioning the mechanism, start button must be activated by which the mechanism will perform the activities in a row.

First, it ploughs the soil, then the mechanism will be moved little distance in forward direction, there it will be stopped for a while to drop the seeds, after performing this activity the mechanism will be moved further to deliver the water, water will be delivered for a moment & automatically. While delivering the water again the

mechanism will be stopped for a while. When the start button is activated, simultaneously weed plucking mechanisms also will be activated automatically and plucks all the weeds on the way and will be stopped when stop button is activated. The soil leveling mechanism is arranged at the rear side of moving mechanism. Likewise, the mechanism continuous to perform its function of dropping seeds and delivering water, weed plucking etc. until stop button is activated.

**6. POWER SOURCE DESCRIPTION**

It utilizes battery back-up power, for this purpose 12V, 7Ah rechargeable lead acid battery is used.



Fig.12 Rechargeable Battery

When the battery is discharged it can be charged using

- i) Solar panel
- ii) Mains supply



Fig.13 Charging Methods

**6.1 Battery Charging Time:**

**i) With main power supply**

$$\begin{aligned} \text{Battery Charging Time} &= \text{Battery rating} / \text{Charging current} \\ &= 7\text{Ah} / 1.5\text{A} \\ &= 4.6 \text{ hours} \end{aligned}$$

When the battery is charged with 15v and 1.5A charging unit it takes about 4.6hours.

**ii) With solar power**

$$\begin{aligned} \text{Battery Charging Time} &= \text{Battery rating} / \text{Charging current} \\ &= 7\text{Ah} / 2\text{A} \\ &= 3.5 \text{ hours} \end{aligned}$$

The ideal solar power source will be a panel of 2A imp which will take about 3.5 hours to charge the battery.

## 6.2 BATTERY BACKUP TIME:

Back-up time = battery rating / power consumption  
= 7.5Ah/1A  
= 7.5 hours

## 7. RESULTS AND CONCLUSION

- A prototype of 5 in 1 multipurpose agricultural robot is developed and its working is demonstrated, which will be
  - ❖ useful for the farmers
    - ❖ Reduces human effort in the farm land
    - ❖ Purely non – conventional
    - ❖ Easy to operate
    - ❖ Safe to handle
- The proposed system is battery and solar operated.
- Using this robot, farmers can carry out various activities along with operating the robot simultaneously.
- Thus, by carrying out various activities at the same time, farmer can save his Time, effort and increase his income which in turn results in the enhancement of country's economy.

## 8. FUTURE SCOPE AND RECOMMENDATIONS

- This Robot can be further enhanced to make it a completely autonomous and Intelligent Robot by installing other sensors like cameras, IR sensors etc, so that it can take its own decisions based on the localized environment conditions and it can make its own map to move in field.
- Instead of conventional RF Modules we can make use of micro miniature RF connector technology that combines excellent electrical performance with the smallest mechanical dimensions which offers users feature of simplified system assembly and it reduces the size of board by 75%.

In near future this robot can be induced with some more additional features and also to take required decisions even in the absence of the farmers. It can also be induced with human interconnections and also learning from events.

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