

Robotic Agriculture Machine

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Abstract: This paper presents a system with high speed of operation for an advanced agriculture process which includes cultivation based on robotic platform. The robotic system is an electromechanical (conveys a sense that it has agency of its own) and artificial agent which is steered by DC motor which has four wheels. The farm is cultivated by the machine, depending on the crop considering particular rows & specific columns. The infrared sensor detects the obstacles in the path and it also senses turning position of vehicle at end of land. The seed block can be detected and solved using water pressure. The machine can be controlled remotely and solar panel is used to charge DC battery. Assembly language is used in programming the microcontrollers. The microcontroller is used to control and monitor the process of system motion of vehicle with the help of DC motor. The result of implemented unit is also presented.

Keywords: Agriculture Robots, Seed block mechanism, Solar panel, DC motor and Microcontroller.

I. INTRODUCTION

In the current generation most of the countries do not have sufficient skilled man power specifically in agricultural sector and it affects the growth of developing countries[1] [2]. So it's a time to automate the sector to overcome this problem. In India there are 70% people dependent on agriculture. So we need to study agriculture. Innovative idea of our project is to automate the process of sowing crops such as sunflower, baby corn, groundnut and vegetables like beans, lady's finger, pumpkin and pulses like black gram, green gram etc [1] & to reduce the human effort and increase the yield. The plantation of seeds is automatically done by using DC motor. The distance between the two seeds are controlled and varied by using Microcontroller. It is also possible to cultivate different kinds of seeds with different distance. When the Robot reaches the end of the field we can change the direction with the help of remote switches. The whole process is controlled by Microcontroller. Seed plantation is our day to day life is done by tractor in farms. The conventional method for seeding is the manual one. But it requires more time & the man power shortage is faced continuously.

TABLE I
Comparisons Between Seed Sowing Method

SR.NO	Parameter	Manual	Tractor	Seed Plantation Machine
1	Man power	More	Moderate	Less
2	Time required	More	Less	Less
3	Sowing technique	Manually	Manually	Automatically
4	Distance between seed	Not Fixed	Not Fixed	Fixed
5	Wastage of seed	Moderate	More	Less
6	Required	High	Very high	Less

	Energy			
7	Pollution	NO	More	NO
8	Alarm and Display	No	No	Yes

Need:

The main requirement of Automation is to reduce man power in our country; the buzzword in all industrial firms generally involves electrical, electronic component as well as mechanical part. Automation saves a lot of tedious manual work and speeds up the production processes [2]. Now a day we have lack of man power. Energy required for this machine is less as compared with tractors or any agricultural instrument Pollution is also a big problem which is eliminated by using solar plate. A manual farm consumes more time & leads to more pollution. So it is a time to automate the process of sowing. Another is also need is to increase high speed of operation.

II. METHODOLOGY

The advanced seed plantation machine consists of three storage hoppers in which the seeds to be planted are stored. Below the hoppers rotary drums are provided. It is having hole throughout. In which four sensors are used like IR sensor, block sensor, Empty sensor & Proximity sensor. IR sensor used for detecting the obstacle, Seed block sensor consist two LDR type sensor which detect the blockage in cultivation pipe by using nand gate, Proximity sensor i.e. Metal detector detect one complete rotation of tire wheel.

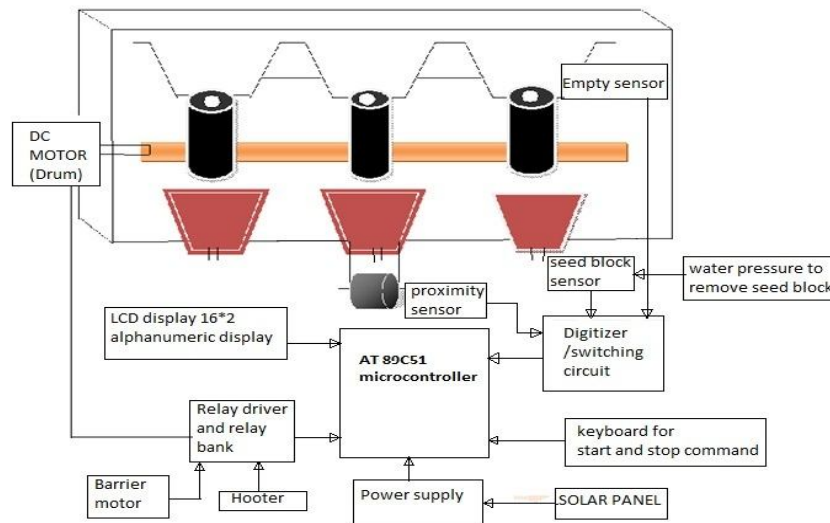


Fig. 1 Block Diagram of Seed Plantation Machine

Block diagram contains

- A. *Digitizer:* The output of the sensor may or may not be compatible with the controller. Hence it becomes necessary to convert the pulse in the form which controller can accept.
- B. *Microcontroller:* It is the heart of our system. It is the main control block and all other blocks are interfaced to the controller [6]. The software fed into the controller is the main logic of our system. The completion and implementation of our system wholly depends on this logic and finally worked by the controller. We have selected 89C51 micro controller. Relay driver and display are interfaced to the various ports of 89C51.
- C. *Relay Driver:* IC ULN 2003 is relay diver is used for to drive relay.

- D. Relay:** Relay is used as a switch to control the final process & also to set the alarms. We are using a sugar cube type relay, which is easily available.
- E. Display:** Here we are using LCD type display; LCD display is display of welcome message of project and seeding counter.
- F. Sensor:** It is the most important elements of this system. We are using proximity sensor (metal detect) that sense complete rotation of wheel. And second and third sensor is used LDR type. That sense is seed storage and when seed drop pipe is block. After detecting the object, the sensor sends a pulse to the micro controller.

The microcontroller acts as central processing unit of the system. When it receives the start command from the keyboard, then barrier motor starts, the machine starts moving in the forward direction. Near to the tire wheel a proximity sensor is provided. During one complete rotation of the tire, the sensor provides one logic pulse. This logic pulse goes to the switching circuit, then to the microcontroller. It is expected that the rotor will rotate once after receiving one pulse. One seed is dropped that directly goes to ground. Then the soil is spread over the seed so that the seed properly goes below the soil.

Before the seed is dropped proper digging line is also formed with the help of a projection provided. It is a self driven barrier with geared DC motors. The DC voltage is provided to motors. Out of four wheels the two wheels are provided with motor drive and two wheels is driven automatically one more dc motor is provided to rotate the rotary drum. If the front tire complete one cycle, then the drum rotate and plant seed. The operation will be repeated. The number of seeds planted will be shown on LCD display.

III. MISSION PLANNING OPERATION

Bottom Panel of Robot

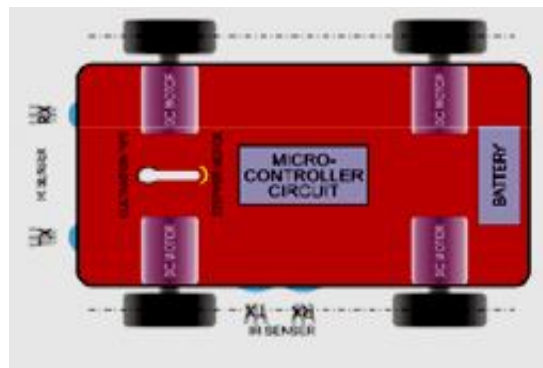


Fig. 2 Bottom Panel of Robot

In above figure shows there are total four wheels in which front wheel motor energized by DC supply through microcontroller IC. Front two wheels are used for rotation of +45 and -45 around bearing [4]. Two DC motor are connected to the wheel of robot. Power supply is connected at last; power is coming from solar panel. DC motor has 100 rpm and it operates on the 12Volt supply. At the middle of panel shows microcontroller [1].

Path Controlling

In this project direction is provided by using remote control. By using remote proper direction is given to the robot. The farm is not the straight line and smooth. Figure shows how obstacle problem is solved [1]. If any obstacle is occurred like stone, electric light pole, trees, etc such new path is establish by remote control [4].

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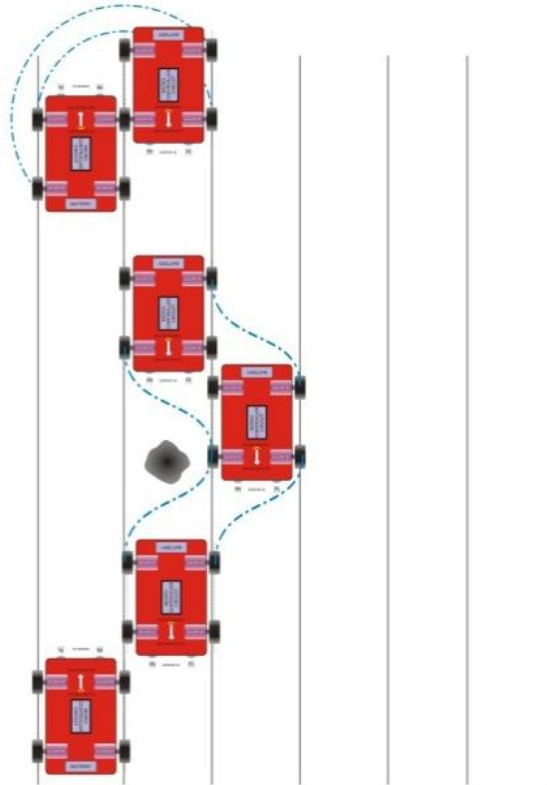


Fig. 3 Path Control of Vehicle

Solar Panel

The working principle of all today solar cells is essentially the same. It is based on the photovoltaic effect. In general, the photovoltaic effect means the generation of a potential difference at the junction of two different materials in response to visible or other radiation.

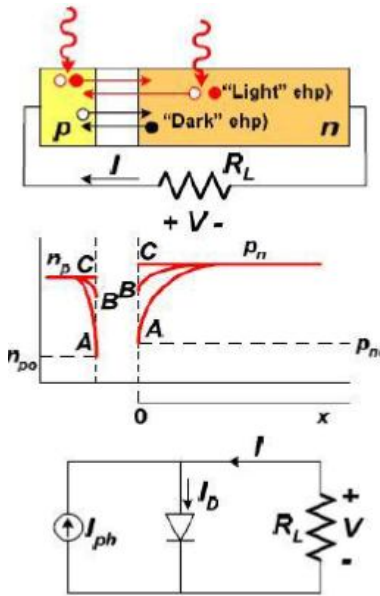


Fig. 4 A Basic Solar principle

A solar cell is a solid-state electrical device (p-n junction) that converts the energy of light directly into electricity (DC) using the photovoltaic effect. The process of conversion first requires a material which absorbs the solar energy (photon), and then raises an electron to a higher energy state, leading flow of this high-energy electron to an external circuit. Silicon is one such material that uses such process.

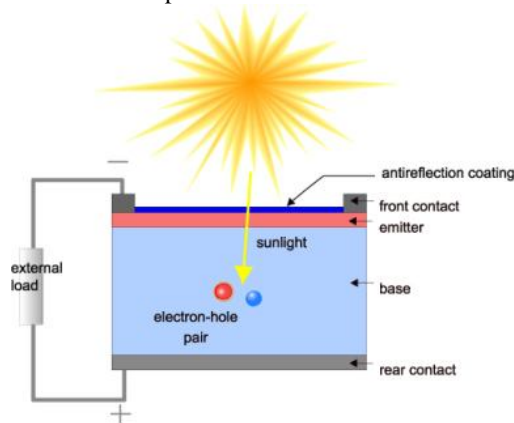


Fig. 5 A Solar Cell Structure

Photovoltaic effect: The collection of light-generated carriers does not by itself give rise to power generation. In order to generate power, a voltage must be generated as well as a current. Voltage is generated in a solar cell by a process known as the “photovoltaic effect.” The collection of light-generated carriers by the p-n junction causes a movement of electrons to the n-type side and holes to the p-type side of the junction. Under short circuit conditions, the carriers exit the device as light-generated current.

IV. EXPERIMENTAL RESULTS

A. Speed of seed plantation machine depending upon moisture

The speed of advanced seed plantation machine depends on certain moisture level of soil. As shown in figure 4 we have taken various results to the advanced seed plantation machine. The standard level of moisture for those seeds is shown in red column. It shows the characteristics with good performance as explained below.

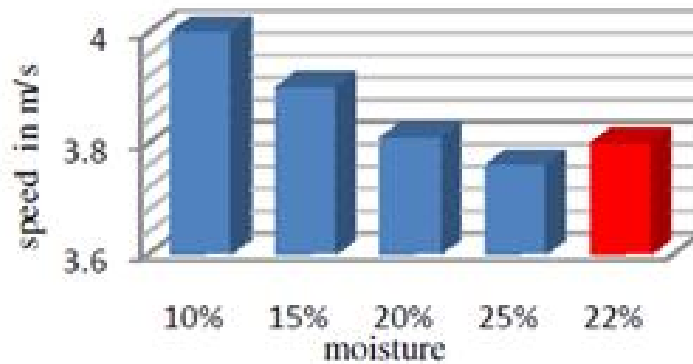


Fig. 6 Graph shows speed depends on moisture

B. DC Motor

The D.C. motor is operated on 12V with 100 rpm. The graph shows torque speed characteristics of D.C. motor to full load. It is obtained by increasing armature voltage from 1V to 12V linearly. Current of DC motor is 100mA. It is plotted in below figure. As speed is increases then torque is also decreasing [4].

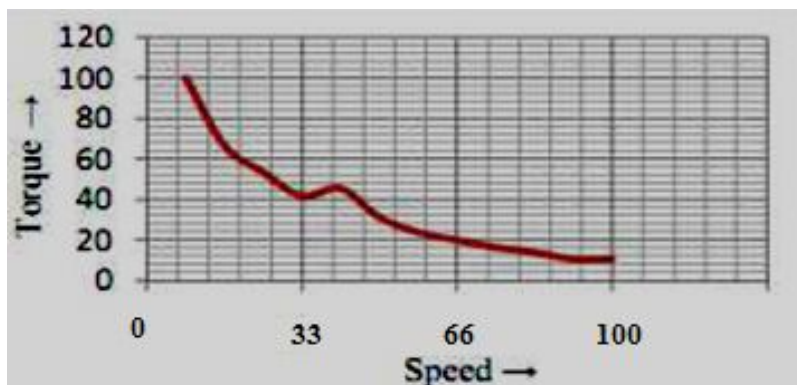


Fig. 7 Speed Torque characteristics

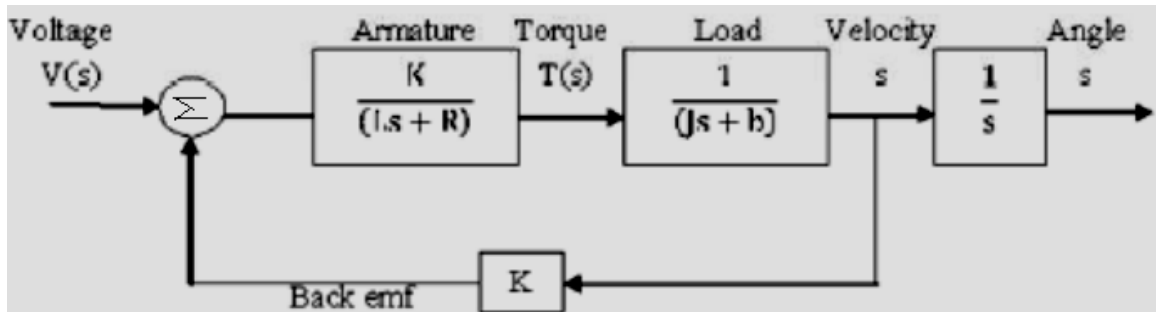


Fig. 8 Block Diagram of DC motor.

Closed loop equation.

Where $G_v(s)$ =Closed loop gain.

K =constant.

$w(s)$ =angular velocity.

$v(s)$ =input voltage.

C. Seed Blockage Detector

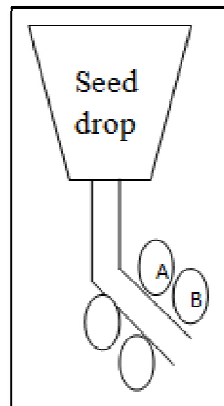


Fig. 9 Seed Blockage Detector

When seed is dropped in the dropper pipe in front of LDR then use variable resistor and LDR for voltage divider circuit and set the voltage divider when normal condition 100mv- 500mv, set threw the variable resistor means we give 0 (low) logic pulse. When seed drop that time LDR front side is darkness create that time LDR resistance is high and voltage is 1v-4.5v give means we have logic pulse is 1 (high). Use 2 LDR A and B. Seed plant robot seeding this time seed block pipe is block that time A and B is 1. A and B is 1(high) nand gate output is 0(low). Write in microcontroller program logic 0 inputs. Logic 0 is receiving microcontroller. Microcontroller decides next action relay is on.

V. ALGORITHMIMPLEMENTATION

1. Start the machine.
2. Select the distance between two columns
3. Display"Wel-come"message on LCD display.
4. Check the whether seed is block or not, if seed is block then water pressure is become ON.

5. If seed box is empty, buzzer ON

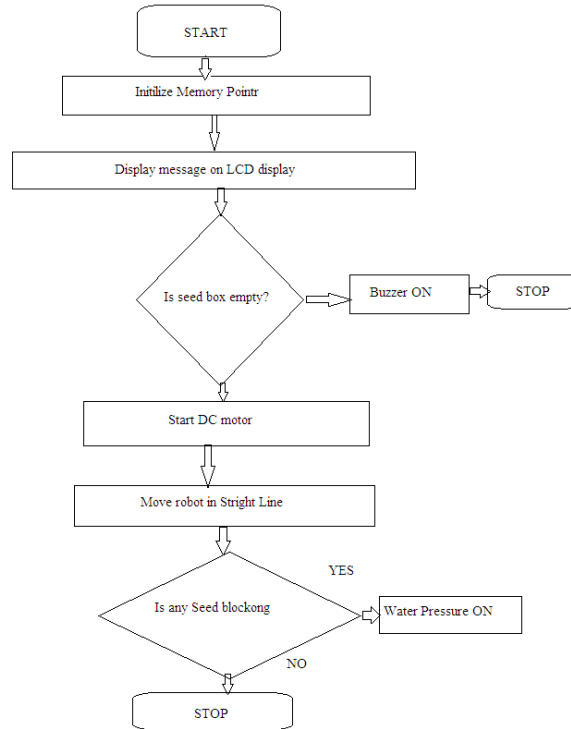


Fig. 10 Flow chart of operation

At first initialize memory pointer in microcontroller memory then display Welcome message on the LCD display. The distance between seed depends on cultivation pipe & the three columns. After that, check seed box if is to empty. If after some time seed box is empty then buzzer will be ON. Incase if seed is blocked in cultivation pipe then automatically water pressure will be ON and removes the blockages seeds immediately.

VI. FUTURE IMPLEMENTATION

The system can be advanced for sowing seeds in farm with particular distance between seed is adjusted. It cans automatically sowing seed in land, when providing water supply to this system. It can be also used fertilizer sawing instead of seed. The system can further be modified by one or many systems can be monitored through GSM system. so at time implementation of PCB then separate port is assign to RS-232 for serial communication.

VII. CONCLUSION

This paper has presented the requirements and progress made towards achieving a future precision autonomous farming system. The assembly is developed for cultivating ploughed land automatically i.e. less power is required. The blocking of seed problem is eliminated with the help of water pressure. So this project increases the efficiency and accuracy. The project consists of two different mechanisms. The first mechanism contains making an assembly of vehicle and its motion, whereas second mechanism is preparing a seed bed on ploughed land. The microcontroller is used to control and monitor the process of system motion of vehicle. It is controlled with help of DC motor and servo motor.

This system also detect obstacle present in the path of the vehicle by infrared sensor. It is also used for sensing turning position of vehicle at the end of the land. Because of no man power requirement and high speed of operation, it has scope for further expansion. The aim of solving of today's seed sowing problem is solved by this machine.

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