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ENHANCED AGRICULTURE ROBOTIC SYSTEM

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ABSTRACT

This article addresses improvement in agriculture processes like automatic planting of seeds on ploughed land by using robot. We have developed a robotic vehicle having four wheels and steered by DC motors. The seed planting mechanism is fitted on the vehicle to plant the seeds in uniform manner. The enhanced agriculture robotic system architecture gives us the opportunity to develop a complete new range of agricultural equipment based on small smart machines. The machine will cultivate the farm by considering particular rows and specific column at fixed distance depending on different seeds. The obstacle detection problem will also be considered, sensed by infrared sensor.Forward movement of the vehicle can be defined by defining delay to microcontroller. Turning of the vehicle can be obtained by position encoder circuit which is fixed to one of the wheel. The complete assembly can be powered by using 12V rechargable battery. The battery can be charged by using solar panel which is also mounted on robot. Assembly language is used in programming the microcontrollers. The whole algorithm, processing, monitoring are designed with dc motors, sensor and encoder circuit. The result obtained through activation unit is also presented.

KEYWORDS: Autonomous vehicle, cultivation processes, seed planting mechanism, obstacle detection.

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. A man with pair of bullocks can be replaced by manned tractors.Because of this the man power can be reduced.To improve the accuracy man-less tractors can be introduced.But they failed to embrace the complexity of real world. To overcome this difficulty automated compact robot can be made to obtain specific results.

This paper presents advancement in agro-robotic system by considering a compact robot which will work automatically by using ATMEGA 89C51 microconroller. It consist of IR sensor to detect any obstacle in front of vehicle. It has encoder IC which is placd at rear wheel to get exact 90 degree turning. By defininggdelay, we can findout specified distance travelled by robot. Seed planting mechanism can be done by fifth DC motor which is placed on the top of the vehicle. Rotating mechanism is used to have uniform distance between two seeds. Feedback mechanism is used to drive the fifth motor. It works when the vehicle is going straight line& it will not work while turning the vehicle and changing the row.

The whole assembly is operated on +12V rechargeable battery. The battery can be recharged by placing solar panels on the vehicle.

CULTIVATION PROCESSES

There are so many different processes in the farming system like ploughing, seeding,fertilizing, weeding, harvesting, spraying etc. which require large amount man power. So, toreduce this problem from rural area, the advanced implementation in farming should benecessary. The various processes in farming are explained as below.

1.Seed bed preparation

The process of preparing a bed for cultivating a seed in ground is called as “ploughing”. It isprimary farming process in which effectively mixing of top soil to prepare a seed bed is
processed.

2.Seed mapping

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The process of recording the geospatial position of each seed passively as it goes in to groundis called as "seed mapping".

3.Seed placement

The process of placing seed at a particular seed position is called as "seed placement". Rather thanonly record the position of each seed it would be better to be able to control the seedposition.

4.Reseeding

This is the concept of being able to identify where the seed was not placed and can
automatically place another seed in same position.

METHODOLOGY

In this project, seed planting system for different crop is represented. As we aware that, the distance between two seeds is different for each seed. The technique of seed planting inploughed land is based on row per column with fixed standard distance. The distance between two seeds can be set by using different wheels depending upon number of teeth. As we change number of teeths of rotating wheel placed on robot for seed planting, we can get different readings for seed placement. The distance travelled by robot and distance between two rows can be set by defining delays to the microcontroller using software implementation.

The hardware implementation of project is shown in Figure 1. The system includes four 100rpm dc motors to drive the vehicle. It includes one 10rpm dc motor for seed planting mechanism, IR sensor, Position encoder, Buzzer, 12V rechargeable battery and a solar panel. This whole assembly is controlled by ATMEGA 89C51 microconroller.

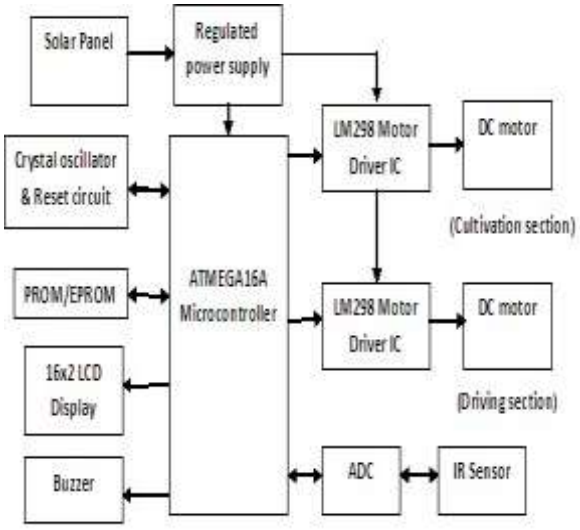

Fig.1 Hardware implementation of Robotic system

The dc motors of the vehicle are designed to move the vehicle in forward direction. These dc motors willrotate clockwise for defined delay.While moving the vehicle in forward direction if there is any obstacle present in front of vehicle, it can be detected by IR sensor which is placed at front side. When any obstacle is detected IR sensor will send the signal to microcontroller. At this time, vehicle will stop and buzzer will be ON until the obstacle is removed.

After defined delay, the robot can automatically turn left/right with 90^0 angle. Exact 90^0 angle can be obtained by position encoder. The distance between two row is fixed. According to this robot will travel that distance and it will turn again 90^0 in left/right direction. So the robot will take 180^0 turn to go into second row. During second row, the turning direction is different i.e. right/left. Such process is repeated. In this way the working of this system takes place.

ROBOTIC SYSTEM

A robot is a combination of hardware and software on the basis of which it will do the particular work effectively. When considering this project following points can be considered.

1Mechanical view

In this project, the design of robot plays a vital role. Because, we are using this robot in ploughed land where surface of the land is not uniform.

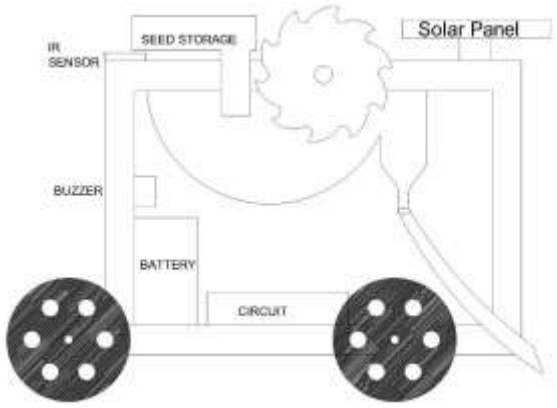

Fig.2 Design of Robotic system

As shown in fig.2, the robot consist of four vehicles which can be run by dc motors. The design of the system is compact, self operated and can work in small land for applications of cultivation in agri-culture system. The system is designed such that it will go in a straight line without any mechanical errors. It consist of rotating gear type mechanism which consist of teeth. It can be rotated with the help

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of dc motor. If the distance between two seeds is more then we have to use less number of teeth and if we want the distance between two seeds is less then we can use more number of teeth to this driving mechanism.

2 Solar Panel

Now a days, everyone is aware of natural resources available in life. The best natural resource for generation of electricity is from sun. This can be done by using solar panel.

Solar panel cab be work on photo-voltaic effect.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 externalcircuit. A solar panel is used to charge the battery. Because of this the efficiency of the system is increased.

ALGORITHM IMPLEMENTATION

The algorithm of farm cultivation system is implemented as

1 Start the machine.
2 Initialise memory pointer.
3Display the distance on LCD display board.
4Check the whether the seed box is empty or full.
6 If it is empty, Buzzer will be ON and dcmotor will OFF. If it is not empty, start dc motor.
7 Vehicle startto move in forward direction in straight line.
8 If any obstacle is detected, Buzzer will be ON and the all dc motors will Stop.
9 If no, perform the current instruction.
10 After defined delay, Rotate vehicle 90^0 towardsRight.
11 For defined delay, vehicle will go forward for short distance.
12 Again it will rotate 90^0 towards Right.
13 During second row after defined delay vehicle will rotate 180^0 in left direction. This process is repeated.

RESULTS AND DISCUSSION

The result of this project can be experiemented on different seeds such as jawar, soya, wheat by considering different number of teeth to the wheel. When we are placing different seeds, the distance between two seeds will vary according to the requirement of user. So this system is flexible. While taking result, the performance of vehicle in ploughed land with and without load can be considered.

Here are some advantages of Enhanced agriculture robotic system over other systems.

Sr No	Parameter	Manual	Tractor	Seed planting robot
1	Distance between seeds	Not fixed	Not fixed	Fixed
2	Sowing Technique	Manual	Manual	Automated
3	Seed wastage	More	Moderate	Less
4	Required energy	More	Moderate	Less
5	Accuracy	Less	Moderate	More
6	Man power	More	Moderate	Less

Table 1. Comparison of Seed planting systems

1 Distance between two seeds in row:

In ploughed land, we have taken different readings in a row for 6, 8 and 10 teeth. From these readings, we found that seeds are planted at defined distance. Table 1 shows different experiemental readings.

Sr No	Number of Teeth to the rotatingwheel	Required distance between two seeds in mm	Actual distance between two seeds in mm
1	10	45	42-44
2	8	75	68-72
3	6	150	143-145

Table 2. Distance between two seeds

2 Speed of vehicle depending upon moisture:

The speed of vehicle is only depends upon moisture level of soil. We have taken differentresults to the speed of vehicle as shown in Fig 3. The red column shows standard level of moisture for those seeds. The red column defines the good performance with characteristics as explained bellow.

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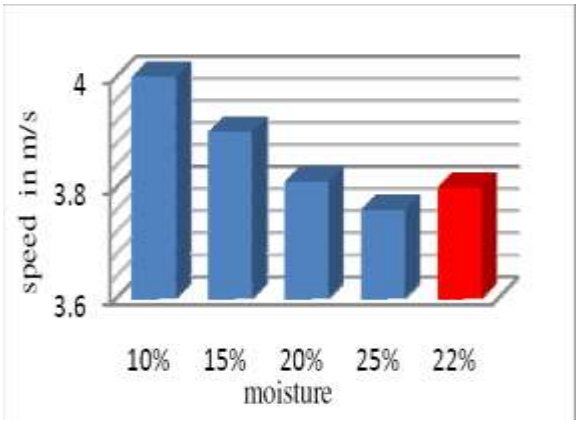

Fig.3 Graph of speed v/s moisture

CONCLUSION

This paper has presented progress towards achieving a future precision autonomous farming system. This system is designed to plant the seeds effectively. With this compact design of robot, it is possible to plant the seeds in ploughed land. The system can be automised by using IR sensor, solar panel, dc motor, position encoder. IR sensor will help to detect any obstacle present in front of vehicle.

This system can be operated on +12V rechargeable battery. The accuracy of seed planting can be obtained. This system will reduce labour problem in future. So this system will be the best replacement for currently used systems.

ACKNOWLEDGEMENTS

We are pleased to publish a paper on 'Enhanced agriculture robotic system'. As it will help to improve the technical aspects in agriculture field. We are jointly made every possible efforts to elliminate all the errors in this paper.

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