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Autonomous System for Cultivation Process

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Abstract:-*This paper presents the advanced system which improves agricultural process like cultivation on ploughed land, based on robotic platform. We have developed a robotic vehicle having two wheels and steered by DC motor. The machine cultivates the farm by considering particular rows and specific column at fixed distance depending on crops. This distance has to be entered manually. The obstacle detection problem will also be considered, sensed by infrared sensor. When DC motor would be started, vehicle moves along the particular columns of ploughed land for boring the seeds. The infrared sensor is connected to the front edge of the robot. The whole algorithm for processing and monitoring were designed and motors and sensors are interfaced with microcontroller to realize it. The result obtained through prototype developed is also presented.*

Keywords:-*Agriculture Robot, DC Motor, Microcontroller, Stepper Motor.*

1. INTRODUCTION

Agriculture is mankinds oldest and still it is the most important economic activity, providing the food, feed, fiber, and fuel necessary for our survival. With limited land, water and labour resources, it is estimated that the efficiency of agricultural productivity must increase by 25% to meet that goal, while limiting the growing pressure that agriculture puts on the environment. Many technologists have developed driverless tractors but they did not have ability to embrace the complexity of real world. The progressive invention in agriculture system is becoming an important task especially because of rising demand on quality of agriculture products and declining labour availability in rural farming areas. There are different processes in the system of agriculture like ploughing, cultivating, weeding, harvesting etc. All these processes are advanced by modifying the mechanism in farming which works automatically without man power requirement. Also by studying social aspects which shows that public are ready to use the small intelligent machine food production [1]. Because of small autonomous machine, its liability and insurance will be lot easier.

2. DESIGNING OF ROBOT

A robot is a mechanical and artificial agent. It is usually an electromechanical system, conveys a sense that it has agency of its own. This paper presents the farm cultivation process in advanced agriculture system which is controlled by microcontroller assembly. The technique of seed boring in ploughed land is in the form of row per column with fixed standard distance depending upon type of crop or type of cultivation. The block diagram for this system is shown in figure 1. The other main part of this technique is sensor part. The sensor perform the well job of identifying obstacles as well as turning of robotic vehicle to next row per column and follow remaining part of the farm[1]. The system includes an infrared sensor, two DC motors, one stepper motor and whole parts are controlled by microcontroller assembly. The operation of DC motor is based on simple electromagnetism. It is used to give energy to the wheels of vehicle. Depending upon the revolution per minute of DC motor axel, it drives vehicle at particular distance, the cultivation motor i.e. stepper motor will be worked and controlled. When DC motor would be started, vehicle moves along the particular columns of ploughed land for boring the seed. In agriculture, before the process of cultivation it is necessary that the land is ploughed.

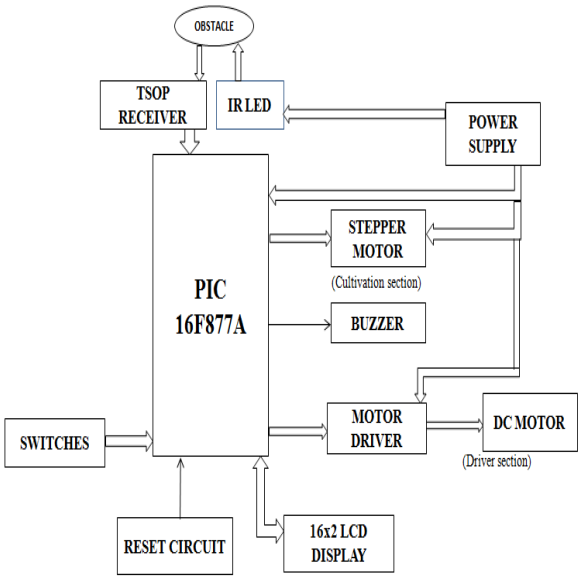

Figure 1: Block diagram of the robotic system

Infrared sensor is set at the front edge of vehicle for sensing obstacle, and provides instruction to microcontroller for controlling motion of wheels. At cultivation section, a stepper motor and an infrared sensor is used for boring seeds in the ground [2], [5]. If any error is detected in this process like seed box is empty, battery backup problem etc., then it stars buzzer and shows the fault on display board.

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3. PATH CONTROL MECHANISM

Case I: Obstacle is present: If any obstacle is present like hard rock in the way of vehicle, the infrared sensor along with the TSOP receiver gets automatically triggered. So microcontroller understand that and is ready to turn the vehicle in 270 degree in forward direction and come back against same row per column and process it further. Figure 2 shows the trajectory of the robot when an obstacle is present.

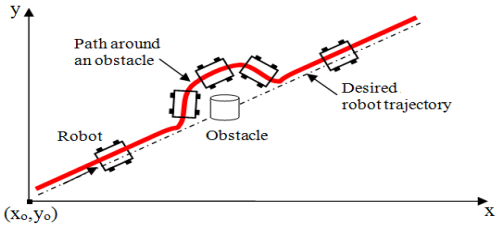

Figure 2: Trajectory of robotic vehicle

Case II: Completion of ploughed land: If there is no obstacle present in the way of the vehicle, it will moves up to last end of the column. At that position, it tries to move 270 degree but cannot succeed and microcontroller understand to move next columns and in reverse direction. Now it again check for case (I) and move away further. And it repeatedly follows these two cases [2]. When vehicle moves towards row per column, the stepper motor gets ON or OFF at a particular distance and seed get bored, which obeys the instruction of stepper motor [3-4]. Different distance is required for different seed cultivation, which is provided by push button switches.

4. ROBOTIC SYSTEM

Figure 3 shows the robotic vehicle. In agriculture environment, heavy or loaded vehicle can't move easily on the bumpy road, so small vehicle is designed, which operates on dc motor. In this paper, for developing the structure of robotic agriculture machine, simple technique is used.

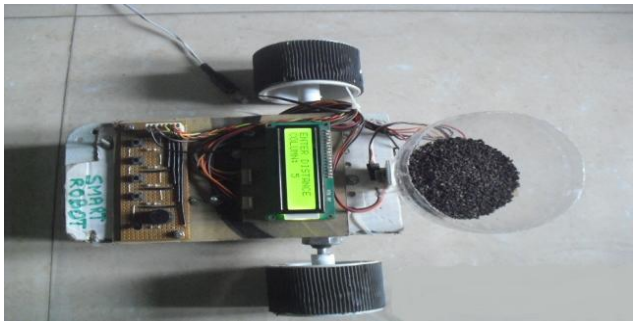

Figure 3: Robotic vehicle

It has two wheels which are individually driven and steered. These wheels drive respectively with two dc motors. All dc motors are energized by dc supply through microcontroller circuit. For controlling path of vehicle, it should be predefined as shown in Figure 4.

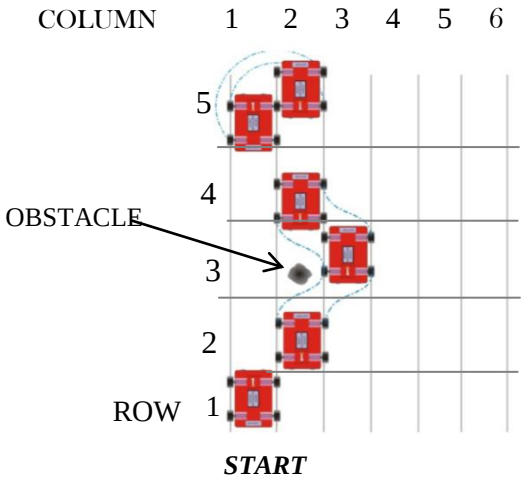

Figure 4: Path change when an obstacle is present

Previously the vehicle drives in straight line to first column and after end of ploughed land, the vehicle rotate 180 degree and select second column and proceed further. When obstacle is detected, the vehicle turns by 90 degree first and sense for another obstacle and turns by 90 degree towards right or left, depending upon condition as explained in section 3.

5. RESULT AND CONCLUSION

This paper has presented the requirements and progress made towards achieving a future precision autonomous farming system. An initial outcome from this study indicates that most of these autonomous systems are more flexible than conventional systems and may reduce labour costs and restrictions on the number of working hours significantly [2].

It works automatically with less human interference. Self-operating and controlling assembly. It is more flexible than conventional systems and may reduce labour cost and restrictions on the number of daily working hours significantly. These vehicles should be able to carry out useful tasks all year round, unattended and able to behave sensibly in a semi-natural environment over long periods of time. The small vehicles may also have less environmental impact replacing the over-application of chemicals and fertilizers, requiring lower usage of energy with better control matched to requirements, as well as causing less soil compaction due to lighter weight.

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