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RESEARCH ARTICLE

CONSTRUCTION OF PLOUGHING BOT PROTOTYPE WITHOUT USING ARDUINO

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ABSTRACT

Ploughing bot is mixture of mechanical and electrical fields. This bot is made for small agriculture lands which will replace need of tractors and animals in the field. It is a new idea where, a simple bot is attached with a ploughing sledge, and with renewable battery-operated system it is moved across a field to plough the field and the field and make the field even. The renewable system, helps not only to conserve energy but, it also introduces a new method of using bots for agricultural purposes making it cost effective. Due to no use of microcontrollers like Arduino boards, the working of this bot becomes very simple and can easily be understood by the farmers. Its main purpose is to replace cattle in small farms and reduce the manual labour for ploughing.

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INTRODUCTION

There are five parts in the ploughing machine. First part includes the transmission, second part is suspension, third part is steering the fourth part is the electronics and the final part is the plough. The first thing is to select a suitable platform on which the bot components are mounted which is known as the chassis of the bot.

- For transmission and torque generation, dc brushed motor is used with gears of appropriate gear ratio and this transmission is attached on the rear axle so that it will provide the required torque to the rear wheels.
- For suspensions, shock absorbers (small size) are used and these are attached to the front wheels to minimize the jerks.
- For steering, the front wheels are attached to the servo motor with the combination of different size metal pipes.
- The plough is the main part of our bot. it is a simple structure of 3 pipes bended for both ends where the sharp and more bended end plays the role of teeth and the less bended plays the role of hook to the chassis.

Hardware Components

Servo Motor: This servo motor plays an important role in the bot. The whole steering system lies on it.

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This bot has a link which connects servo head to steering arms and these steering arms are connected to the wheels via bended pipe, a coupling and a bearing. When the servo moves, the entire system moves with it.

DC motor: It is what we call the drivetrain of this bot. It takes power supply from the battery and transmits the torque to the gears which in turn rotate the rear wheels.

Lithuim Polymer battery (1000 mah): It is acting as the power train of this bot. It supplies power to the servo motor, the dc motor and the receiver.

Transmitter and Receiver: The transmitter used here gives high and low output to the receiver channels to which other electronics are attached. The high output means max value and low output means least value may that be torque or degrees of rotation in case of servo motor. First of all, this transmitter had to be bind with receiver so that both are in sync. The transmitter is by default bind with the receiver if they are bought together. The receiver takes in signals from the transmitter and then gives it to the electronics attached to its channels. We have used 6 channels receiver and transmitter. Each channel of transmitter gives a signal to the corresponding receiver channel and an extra BAT channel given for power supply.

Shock absorbers: The work as the suspension system of the bot along with the clamps on which they are hooked. They take in the bumps and try to minimize the jerk on the chassis.

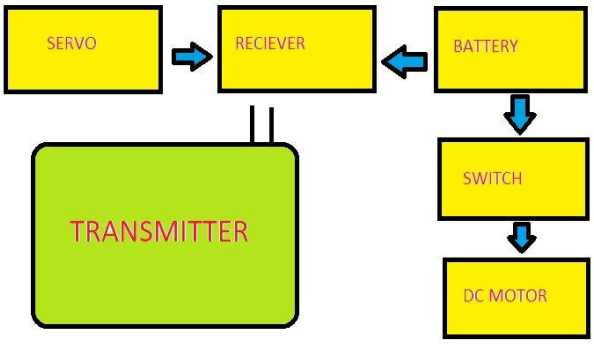


Fig. 1. It is the block diagram of the electronic circuit of the bot

GEARS: Two spur gears are used in this bot. One is smaller and has lesser teeth than the other. Since we require more torque, the shorter gear is attached to dc motor shaft and the bigger gear is attached to the rear axle.

Working of Bot: Working of this bot project is simple. As we already explained that the project has four parts first is the transmission which when the voltage is provide to the motor transfers the generated torque to the rear wheels through gears. Second is the suspension which to connected to the front wheels to provide support and rigidity. Third is the steering system in which servo is used along a steering mechanism to turn the front wheels.

The final part contains the electronics or the electronic circuit in which the receiver is first bind with the transmitter then to its BAT channel the battery is connected. Servo is connected to the first channel. Motor is then connected to a switch which is then connected to battery Hence the circuit gets completed. Now when we move the channel one of the transmitter the servo starts working and it steers the vehicle whereas the switch starts the bot which drags the plough (the bended rods) behind it. Due to the drag created by the soil, the soil starts to line up near the plough tooth (the sharp, less bended end of rod) and ploughing starts

This bot is just a small prototype of the bigger machine for which we have designed a plough with much better ploughing capacity.

Design of plough: The plough we have used for the prototype is just a combination of rods bended like a hook at one end and used as a plough from the other end. We have also designed a plough for the bigger machine just to give an idea for the plough to be used. This plough has 3 teeth with metal plate to give a better surface area. It has a cage like structure, bended towards the ground at ploughing end and contains a L-shaped hook at front end which is attached to the machine from behind.

Project Photograph

RESULTS

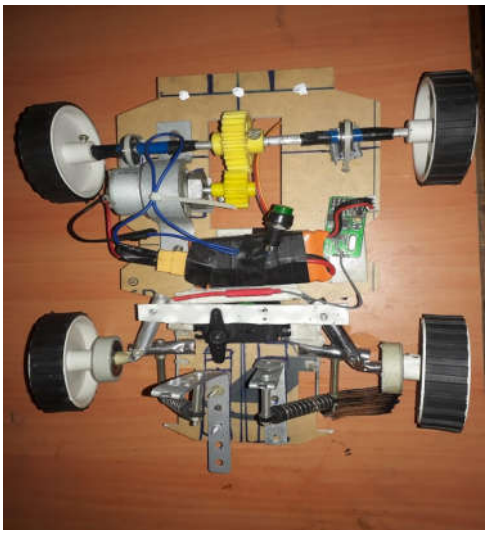
Thus, we can use such a system in bigger bots to decrease the programming and complexity of the circuit created. These bots can move to distances within receiver range and can be used to plough, till or do many different agriculture-related jobs as just a proper combination of motor and battery is required to complete the job.

(2a)

Fig. (2A). It is the picture of the actual plough from the front.

(2b)

Fig. (2B). It is the picture of the actual plough from the top

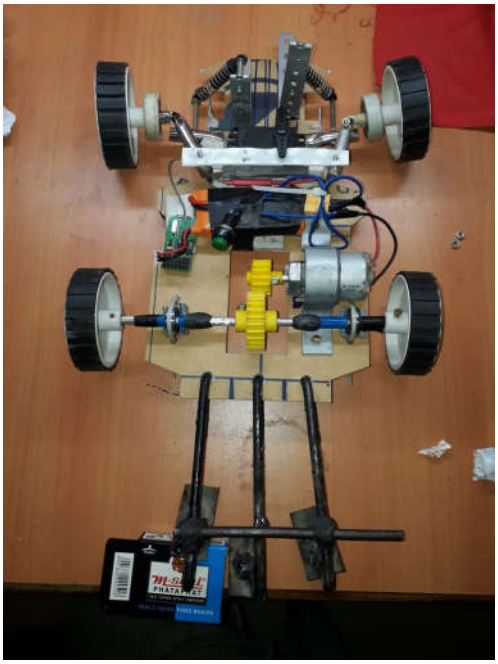


(3a)

Fig (3A). It is the picture of the top view of the bot (separately)

(3b)

Fig (3B): It is the plough connectors used in the prototype.



(3c)

Fig (3C). It is the picture of the whole bot

Advantages

- The ploughing bot can be used to till, plough the field at long distances.
- This type of bot will have a lesser complex electronic system.
- This model is derived from the working mechanisms of motor charged cars and can be used to understand the complex systems used in a car as well as a tractor.
- Easily available and replaceable hardware is used so it has an easy maintenance.
- Effortless ploughing.
- Higher lifetime than programmed bots as it has mainly mechanical components and only some simple electronic components.

Limitations

- It is expensive and requires proper calculations and precision as compared to programmed bots.
- The chassis used cannot handle torsional strain well and the other chassis models are more complicated.
- Since it is a battery charged vehicle, its battery life always be a problem.
- Switch is used so we cannot control the speed of the vehicle and the direction change also becomes difficult.
- This bot is just a prototype to understand the basic working of a bigger and more powerful model and so does not have enough torque to work in a proper farm but it work on flatter grounds containing similar type of soil.

Future scope

- The future scope of this project is to increase the battery life of the bot and it can be done by using a solar panel with the battery in parallel such that the car will run on solar power when the battery dies.
- Adding of electronic speed controller (brushed) will easily solve the direction and speed control problems
- We can also upgrade this bot to four-wheel drive, as it is just the rear wheel drive, to improve the grip and stability of the bot.
- This is just a prototype. The main future scope of this project will be to make this prototype a working machine and at a less cost (lesser cost than that given by a poor farmer for a cattle).

Conclusion

The conclusion of our paper is that using purely electronic devices with less or no programming a cost-effective ploughing bot can be made. We conclude that this paper can be used in making of ploughing bot without using Arduino. We can also conclude that this bot can be easily maintained and handled by a farmer as it has very similar systems than that of a tractor.

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