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MACHINE CONTROLLED SEEDING ROVER

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***Abstract*—** Agriculture is the spine of the Indian economy and most of the population in the country is dependent on agriculture for its livelihood. The objective of this 'Remote-controlled Rover' is to provide farmers an alternative choice in the place of tractors and support various farm practices. A majority of small-scale farmers use animals like bulls and bullocks to plough and do other agricultural work. This rover is designed to replace the long-established and conventional farm machinery. This rover runs by an electric motor supplied with a suitable battery source. It is equipped to perform nearly all of the major farm practices such as seeding, drilling etc.

The rover is an electro-mechanical vehicle designed to encourage farmers with advanced machinery and eco-friendly farms for higher yield. With help of this rover, we can reduce manual labour and increase the farmer's efficiency crop yield. The problem of evenly spaced sowing of seeds and digging of equally spaced furrows that arose due to the animals as they move of their wish can be overcome by the use of this rover. The seeder of the agricultural rover has the capability of delivering the seeds precisely with uniform depth in the furrow, and also with uniform spacing between the seeds.

***Keywords*—**Agriculture, rover, remote controlled rover, farmer,eco-friendly farms.

I. INTRODUCTION

Agriculture has played a major role in the development of human civilization. The agriculture sector has brought out a fundamental and vibrant change in the world's socio-economic situation. The traditional methods and equipment of agriculture are being used in many parts of the country for small-scale farming. In India, 82% of farmers come under the category of small and marginal farmers. They carry out their crop cultivation on an average of 2–3-hectare lands. They are mainly dependent on manual labour or draught animals. They have been using traditional equipment such as wooden ploughs, yoke, leveler, harrow, spade, big sickle, etc; for farming for a long time.

The traditional cultivation in India was based on the use of animal power for 97.6% of the farms. The horsepower obtained from one bullock is equivalent to 0.75HP, which is very low and not sufficient for sustainable farming practices. These traditional methods and equipment used by the small-scale farmers lead to their huge losses of labour, crop, and revenue. They are also a hindrance to increased farm productivity and better income for the farmers. Sustainable agriculture requires the successful management of resources to satisfy human needs in current times, without endangering the ability of future generations. There has to be an emphasis to consider the agriculture sector at par with the industrial sector to ensure substantial income from small-scale farming. Technological advancement has to be provided to farmers with tools and resources to make farming handier and more sustainable. The need of the hour is to provide farmers with new and sustainable technology to heighten their income and crop production.

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II. DESIGN AND CONSTRUCTION OF ROVER

Remote-controlled rovers have claimed a lot of success in recent years. Taking that example as a result we design a four-wheel electric rover which is used to help for the agricultural purpose the frame of this rover is made up of iron. The four wheels are attached to the rover with the shaft of the motor and welded with four vertical legs. The rover is controlled by using four PMDC motors to convert electrical energy to mechanical power. Each of the two PMDC motors is connected in parallel using a cable in order to get good output. Each wheel of the rover is connected to the PMDC motor. PMDC motors are geared coupled motors. Motors are connected relay module and relay module connected to battery for electrical supply. We used two batteries of lead-acid type. This remote rover is useful for small cultivating lands. Our rover is quite easy to operate in any particular sector. The major objective of the rover is an effective mechanism for removing faults of modern days rover. The tools used to design a rectangular shape chassis are drilling, cut-off machines, and welding.

Design of Rover

Fig 1: Rover metal frame

To Design the rover, we used aluminum rods to form a rectangular type of frame**.** The aluminum is used to construct the rectangular frames. The dimensions of the rectangular frame are length 30inches and a breadth is of 14 inches is cut through the cut-off machine. For a rectangular frame, we connected four vertical legs attached at the edges. We attached four PMDC motors which are gear motors are attached to four vertical legs of the rectangular frame through the welding process. Welding is the fusion of two pieces of metal by an electric arc between the pieces being joined. Four motors are connected to four wheels, each wheel is fixed with the shaft of the motor. The each of two motors is connected in parallel through the wire.

For the rectangular frame, we attached cardboard using drilling. On cardboard, components are attached to run properly.

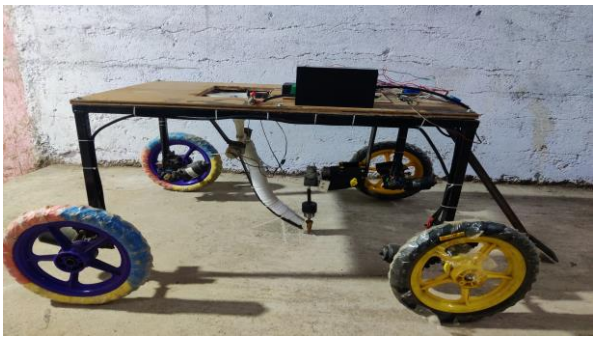

Fig 2: Rover side view

The final design incorpates enough space which satisfies the components and provides necessary strength for the rover. The entire body of the rover is connected to each other by welding the rods with each other which provides strong support to the rover.

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On cardboard, we made a rectangular box shape. In that box shape, we inserted a funnel and below the funnel, we attached a PVC pipe which is used for seed drops in the ground and it is consists of one hole to that pipe we attached a geared motor for rotating. To that geared motor we attached a step-up driller. Using welding we placed a greenhouse pipe earlier we made a whole to PVC pipe in that whole area down side greenhouse is placed with the support of metal. the metal is attached to a metal Frame. The final design incorporates enough space which satisfies the components and provides the necessary strength for the rover. The entire body of the rover is connected to each other by welding the rods with each other which provides strong support to the rover.

Constructional Details of Rover

The major components we used to work the rover:

- Geared Motor
- Four-channel Relay module
- Two channel Relay module
- L293Driver
- PMDC motor
- Batteries
- Connecting wires
- Cable wires
- Arduino UNO
- ESP8266 WIFI Module
- LCD

Fig 3: Rover front view

All the components are placed on the top of the wooden frame. From the 12v and 1.5A battery source the supply is given to the Data board. The data board consists adaptor female terminal that gives an input power supply to the capacitor. This capacitor used frequency and gives a constant power supply. In the data board voltage regulator, IC is also present which converts 12v to 5v and gives the output power supply to another capacitor and gives input to the regulation section. The regulator power supply section output is divided into two parts one is coming from after the capacitor other is after the regulated IC. After the regulated IC output is going towards the Arduino board, L293 Driver ESP 8266 WIFI Module,4 channel relay board. Another 2-channel Relay module consists of 5v and 12v where 5v gives an input power supply to the relay IC whereas 12v is coming from the capacitor. LCD requires 5v which comes from the data board only. this is the way the power supply is disturbed to all the components on the cardboard. The inputs and outputs are we have a single input module i.e, the WIFI Module. This WIFI Module gives input to the Arduino board using Tx and Rx terminals. The output is an LCD display,2 and 4-channel relay, and L293 Driver. According to the data given by the android application we can use functions working.2 channel relay module is used to run the drilling and 4-channel relay module is used to run the chassis and an L293 driver is used to run the up-and-down motion of the motor.

III. DEVELOPMENT OF WI-FI-BASED REMOTE CONTROL

Nowadays the usage of remotes to control the devices like fans, lights, and other electronic devices has increased a lot, due to this manual work has been reduced and the comfort increased. Normal or traditional remotes which are used to operate TVs, Radios and Ac's use IR radiation to control the corresponding device, for this kind of remote controlling the operating distance is less and we have to keep the remote in a particular direction for better operation of it. To avoid the above problem these traditional remotes are replaced by Wi-Fi network-based remotes which are connected through signals and the range of operation is also high. This kind of remote control can also be done by using the Android mobile Wi-Fi with the help of an application. These days smartphones are manufactured with the above-mentioned specifications as inbuilt applications.

So, for this rover controlling we are using Wi-Fi-based remote control, to operate the rover by mobile application. We used ESP8266 Wi-Fi module for the rover and mobile application. We used Android mobile as a remote to control the rover.The communication technology used to control the rover is Wi-Fi.

DEVELOPMENT COMMUNICATION TECHNOLOGIES USED TO CONTROL THE ROVER:

The Mobile application **"WiFi Controller"** is used to develop to control the rover.In this android application different options are available to move the rover.In this app there are several options to interface that allows therover to move ,forward ,backward, right, left, step up drill,step down drill,Seed ON,Clockwise,Anti clock wise,STOP.

INTEGRATION OF ROVER WITH MOBILE APP:

The IP address of the Wi-Fi module(192.168.4.1) is entered in the IP address block of the app.When the address is added to the app,the connection is formed between the rover and the application.Now rover moves in the direction according to the commands given in the mobile like forwaed,seed on,stop etc.

Case1 : Rover forward operation

When we press Forward(stores ASCII value of *1#) in the App, as shown above then WiFi module sends to 4 relay module. Then all the motors will rotate in clockwise, due to this rover moves forward direction.

Case2 : Rover backward operation

When we press backward(stores ASCII value of *2#) in the App, as shown above then WiFi module sends to 4 relay module. Then all the motors will rotate in anti-clockwise, due to this rover moves backward direction.

Case3 : Rover movement in the right side

When we press RIGHT (stores ASCII value of *3#) in the App, as shown above then WiFi module sends to 4 relay module. Then the right-side motors rotate anticlockwise and the left-side motors rotate clockwise, due to this rover moves on the right side.

Case4: Rover movement in the left side

When we press LEFT (stores ASCII value of *4#) in the App, as shown above then Wi-Fi module sends to 4 relay module. Then the right side motors rotate clockwise and the left-side motors rotate anti-clockwise, due to this rover moves on the left side.

Case5 : Rover STOP R

When we press STOP (stores ASCII value of *5#) in the App, as shown above then WiFi module sends to 4 relay module. Then all the motors stop rotating.

Case6 : Clock

When we press clock(stores ASCII value of *A#) in the app,as shown.Then the driller moves in clockwise direction .

Case7 : ATC

When we press ATC(stores ASCII value of *B#) in the app as shown.Then the driller moves in anticlockwise direction.

Case8 : STOP

When we press STOP(stores ASCII value of *C#) in the app as shown. Then the driller stops rotating clock and anticlockwise.

Case9 : Seed ON

When we press seed ON (stores ASCII value of *D#) in the app,as shown above then WiFi module sends to relay module. Then motor drops seed through PVC pipe.

Case10 : Seed D

When we seed D(stores ASCII value of *E#) in the app as shown above then WiFi module sends signal to relay module.Then motor stop seed droping which is coming from the PVC pipe.

IV. TESTING AND ROVER PERFORMANCE

The machine controlled seeding rover that we created have a promising outcome on the paper, however, the final conclusion cannot be decided just by taking some calculations, so the testing of the rover in the field gives a complete result about the performance of the rover, the prototype testing is a major consideration when making a machine for a complete knowledge of the capability of the machine, so the testing of the rover is being in process, the testing contains a series of tasks which will check the rover chassis strength, battery capability, ruggedness of the rover and the wear and tear of the components used. The performance of the rover is also checked when testing because the performance of the rover tells us the capability of the rover in a field when the load is applied

First, we give the supply from three 4v batteries which are connected in series to the regulated power supply, that is given to LCD and Arduino UNO.And then connect the rover to the mobile by turning on the wifi in the mobile.According to the code dumped in the Arduino UNO, the commands are stored in the respective keys in the mobile app.To control the rover front and back give respective commands in the mobile app such that through the wifi module the i/p is given to the Arduino and that is given to relay, and finally the wheels of the rover will be operated.Similarly, when we give a drill on command using a mobile the driller will operate and it will dig a hole with help of a worm gear mechanism. Worm gear helps to move the drill bit to move up and down.After this we on the seed on command in the mobile, this time from the funnel the seed travels through the pipe attached to it and falls into the dug hole. The drilling and the seed-dropping mechanism are controlled using the L293d motor driver.Finally, the rod attached at the end of the rover covers the seed with soil.The performance of the rover is moving at a constant speed for a constant time. On even surfaces, the rover is moving smoothly and on uneven surfaces too. Due to PMDC motors, there are no disturbances in movement. The wheels are moving well and all wheels are rotating in time. At uphill, the rover will reach some distance only. Due to the wi-fi module, we can control the rover from 3040m (approx). Due to this module, we can control and is easy to control the rover. The supply to the motor is given through a 4-channel relay so we can control the short circuit in the rover through rps(regulator). Overall the performance of the rover is good in the field it moves constantly and working is better and controllable through the wi-fi module.

Observation:

SNO.	Weight on rover (in kgs)	Speed and time taken (in kmph)
1	10kgs	7.0kmph
2	32kgs	6.3kmph
3	38kgs	5.9kmph
4	40-50kgs	5.1to4.6kmph
5	50kgs and above	Rover may move very slowly.

The rover will move at the same speed with time up to 30kgs weight on that. When we increase the weight the speed of the rover will gradually decrease. So, this rover is designed for some suitable weights only. The maximum weight on this rover is 50kgs(approx.). There is a disturbance in motors when we keep heavyweights sometimes there is a chance of not working of rover so we have to take care on suitable weights on the rover.

Result:

The machine controlled seeding rover is concluded and the observed following results are:

- The amount of depth that the machine can drill is approximately “3mm-5mm”.
- The time taken by the machine to sow a seed in the ground is approximately “2sec”.
- The time in between one sow to another sow is approximately “3sec-4sec”.

- The total amount of time that the rover can work in single charge is approximately "30min-45min".

- The total area that can be covered by the rover in a single charge is approximately "half of an acre".

V. CONCLUSION

The agricultural rover is an electric vehicle to which farm tools are attached to solve the purpose of a farm tractor. The machine is thoughtfully designed keeping in mind the literacy rates of small-scale farmers and their financial conditions. The agricultural rover is divided into two parts; the locomotive part is called the rover and to this rover, the farm tools or equipment are attached. The rover is an electric vehicle designed for sustainable agriculture and for pollution-free farms. Based on the overall performance of the machine we can definitely say that the project will satisfy the need of small-scale farmers because they are not able to purchase costly agricultural equipment. The machine requires less manpower and less time compared to traditional methods, so if we manufacture it on a large scale its cost gets significantly reduced and we hope this will satisfy the partial thrust of Indian agriculture.

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