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Review on Multipurpose Agriculture Robot

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Abstract: *The paper aims at the overall review of planning, development and thus fabrication of the multipurpose agriculture robot which is able to dig the soil, leveler to shut the mud, sprayer to spray water and fertilizer separately, these whole systems of the robot works with the battery, and therefore, the alternative energy. Quite 40% of the population within the planet chooses agriculture due to the first occupation, in recent year the autonomous vehicles within the agriculture has experienced increased interest. The vehicle consist of Relay switch and Bluetooth. This language input allows a user to interact with the robot which is familiar to most of the people. The agriculture robot works on solar energy. The advantages of these robots are hands-free, and fast data input operations. In the sector of agricultural autonomous vehicle, a concept is being developed to investigate if multiple light compact autonomous machine may be more efficient than traditional large tractors and human forces. Hence, the device is to be designed which helps farmers to beat the stated problem. It's geared toward increasing the productivity and reducing the labour involved, the robot is intended to execute the essential functions required to be administered within the farms.*

Keywords: Multipurpose; Agriculture; Robot; Farming; Bluetooth; Plough; Sowing; Irrigation; Fertilizer; Solar; Mechatronics

I. INTRODUCTION

The growth or development of any nation within the world is solely depends up on the agriculture production. If proper machinery is employed during this field, accuracy within the forming and quality within the production will be achieved. Traditional methods of sowing seeds manually and other activities like ploughing, water pouring, pesticide spraying, etc are done manually that consume lot of your time and it should not be accurate due to human errors. Therefore here a 4 in-one machine is intended for doing above jobs automatically. With the assistance of a distant controlled unit designed with android mobile entire machine movements will be controlled through its Bluetooth interface and therefore the one who is working this machine needn't to urge in to the sector.

Maintaining uniformity in seed planting can increase the sowing efficiency, thereby it's essential to adapt latest agricultural machines for various applications, during this relation to overcome manual problems, and to save lots of time, additionally to take care of accuracy, human involvement must be reduced and every one of these activities must be left-over to the machines. The most purpose of developing this machine is to reinforce the technology within the field of agriculture, to prove the theme practically a prototype module are constructed for demo purpose.

The machine designed here is kind of useful for the massive cultivated areas, since it's a prototype module, the machine is intended to plant seeds one after another in one row, but when it's converted into an engineering module, the machine can plant multiple seeds in multiple locations simultaneously. Similarly other activities also can be implemented simultaneously, there by many acres will be planted with seeds within less time. The applications of instrumental robotics are spreading on a daily basis to hide further domains, because the opportunity of replacing human operators provides effective solutions with return on investment. This is often especially important when the duties, that require be performed, are potentially harmful for the protection or the health of the workers, or when more conservative issues are granted by robotics. Heavy chemicals or drugs dispensers, manure or fertilizers spreaders, are activities more and more concerned by the deployment of unmanned options.

A. Problem Statement

In agriculture a number of the foremost problems within the Indian agricultural are rising of input costs, availability of skilled labours, lack of water resources and crop monitoring. To beat these problems, the automation technologies are utilized in agriculture. The automation within the agriculture could help farmers to cut back their efforts. These robots are being developed for the operations of ploughing, levelling, water spraying. All of those functions haven't yet performed employing a single vehicle. Due to this the robots are developed to concentrate in an efficient manner and also it's expected to perform the operations autonomously.

The idea implements the robot to perform the operations like ploughing, seed sowing, mud levelling, water and fertilizer spraying all at once on command. The possibility for robot enhanced productivity are immense and therefore the robots are appearing on farms in various technologies and in rising numbers. We will expect the robots performing agricultural operations autonomously like ploughing, seed sowing, mud closing, water spraying and solar charging. Watching the farms day & night for an efficient report, allowing farmers to cut back the environmental impact, increase precision and efficiency, and manage individual plants in novel ways.

B. Objective

Multipurpose Farm Robot aims at performing all the elementary functions of farming automatically in a very sequence without human intervention with affordable cost. It acts as an aid to farmers. This robot will help in reducing the efforts, increasing accuracy and decrease the idle time. The elementary functions of the farming include

- 1) Digging the bottom to the desired depth.
- 2) Sowing adequate amount of seeds within the dug hole.
- 3) Back filling the soil after sowing.

The major objectives are the attributes which the device must meet. They are:

- a) It should dig the bottom to the desired depth.
- b) It should sow adequate amount of seeds within the dug hole.
- c) It should perform all operations automatically in a very sequence.
- d) It should be safe and simple to control.
- e) It should be reliable.
- f) It should be durable and economical.
- g) To reduce human effort within the agricultural field with the employment of small robot.
- h) To perform all the operations at single time, hence increases production and decrease idle time.
- i) To complete great amount of labour in less time.
- j) Farmer can control the robot through remote by sitting at one side and operate easily.
- k) The usage of solar may be utilized for Battery charging. because the Robot works within the field, the rays of the sun may be used for solar energy generation.
- l) To increase the efficiency, the solar energy is employed and therefore the Power output may be increased.

C. Methodology

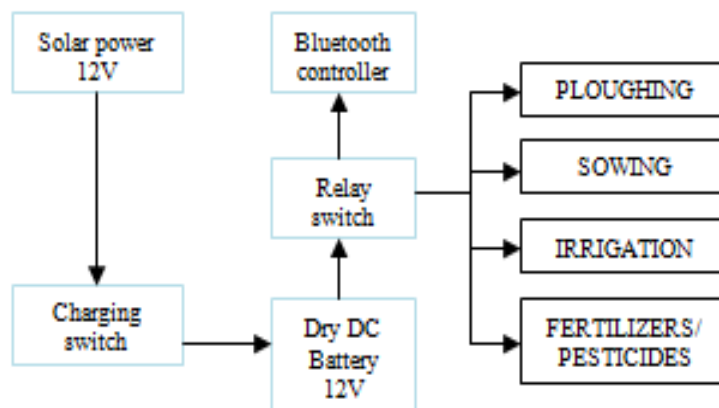


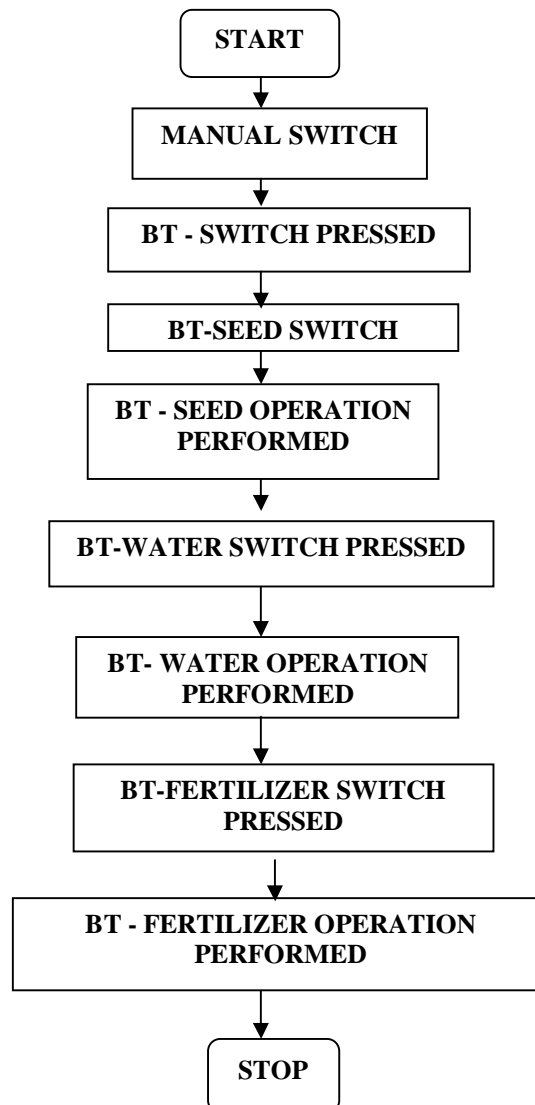
Fig1. Block Diagram of System

Methodology is a systematic analysis of methods to be carried out to design the final product. The well implemented project needs a plan of action and specified steps for its completion. The work of this project started with the need analysis to collect the information about the existing problems and find the problem statement for the project. Based on the morphological chart the different design alternatives were found. The best alternative was chosen based on the evaluation matrix.

- 1) The body / frame of the robot is made of Mild Steel.
- 2) The two wheels at the back is connected with high powered geared DC motor respectively.
- 3) The front of the chassis body is connected to two free wheels on either side.
- 4) In front of the free wheels are attached three digger tools connected to a 100 rpm DC motor which can be adjusted according to the ground level and depth.
- 5) In between the funnel which is used to store the seeds has three joint tube path ways connect linearly to the digger, into the metal tube seeds flow down with the help of slow speed rotating vibrator.
- 6) Behind the seed sowing mechanism, we have the flapper which will cover the sowed seeds with mud.
- 7) Now coming to the water and fertilizer, both the nozzles are separate and have small motor pumps connected to the end of the pipe sitting in separate containers of 1ltr to 4ltr.
- 8) Coming to it's main energy efficiency property that is the solar panel, it sits above the whole set in an inclined position. The Multipurpose agriculture robot is controlled via Bluetooth signals connected with robot and android phone.

The works are carried out simultaneously. The source of the power is the battery which can be charged through solar power.

II. OPERATIONS



A. Ploughing Operation

A plough may be a large farming tool with sharp blades which is dragged across the soil to shove it over, usually before seeds are planted. Ploughs were traditionally drawn by oxen and horses, but in our set up its drawn by the robot and motorised to always plough at ground level.

B. Seed Sowing Operation

The sowing operation is to put the seed in desired depth and seed to seed spacing, when the machine is pushed in given direction. It is stored in the funnel and travels through a single tube. This tube is converged to three seed holes.

C. Irrigation And Fertilizer Sprinkler

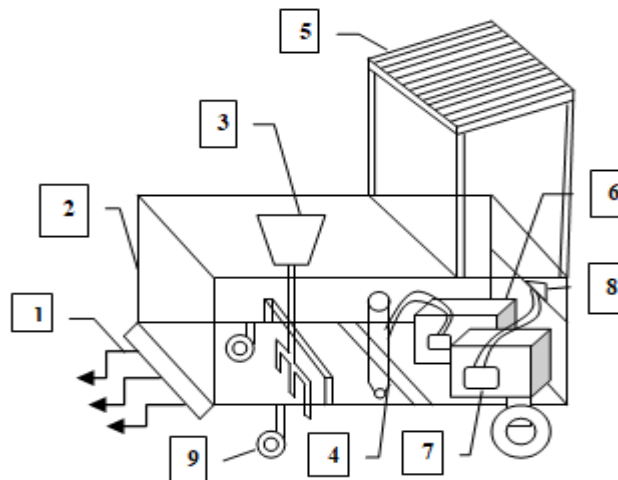
Irrigation is the controlled amounts of water to plants at needed periodic intervals. Irrigation helps to grow agricultural crops, maintain lands of dry areas through seasons of minimum than average rainfall.

Fertilizer sprinkler is any material of natural or synthetic that's applied to soil or to plant leaves to provide one or more plant nutrients essential to the expansion of plants. Many sources of fertilizer are available in natural and industrial produced.

D. Solar Charging Power

The solar energy coming from the solar panel converts the heat energy to photo voltaic energy. This is used as clean energy to power the multipurpose agriculture robot, increasing the efficiency of work at all times.

III. WORKING



This project aims to do work on 4 in one mechanism output to complete the given agriculture task within the idle time and with more efficiency, so

- A. This entire mechanism is controlled by the remote-controlled android device through Bluetooth interface.
- B. The vehicle that is equipped with all the supporting hardware and can be controlled through Bluetooth based remote control technology.
- C. The vehicle can be controlled in all directions through Bluetooth app from the android mobile.
- D. The ploughing motor is controlled to move the plough up or down using two push buttons placed on the vehicle to the required level manually.
- E. And the rest of the operations like vehicle movement, water spraying and pesticide spraying are all controlled through the user mobile using Bluetooth app.
- F. Switching on the robot and getting it connected is constructed using a Bluetooth module with supporting mechanical components, which receives the transmitted data from the android device and gives to the Arduino microcontroller ATMEGA 328 in the receiver.

- G. Depending on the data received, the Arduino controller operates the DC motors using H – bridge and relays to perform the desired operation is the first step.
- H. By sending Bluetooth commands from the android mobile through the app, the vehicle can be controlled in all the directions.
- I. So second step is to press the forward button and then press the seed sowing button, the seeds will fall down from the funnel every 3 sec.
- J. Now when required in the same way we can press the irrigation and fertilizer button respectively. The irrigation takes place drop by drop by water being pumped by a small motor.
- K. The fertilizer is sprayed from a nozzle with high pressure and this has a separate button.
- L. Finally while the robot is in the field working this will be out in the sun, so as to use this to an advantage we are using the solar panel to recharge the 12v battery.
- M. The robot is equipped with the two DC motors with reduction gearbox mechanism of 30 RPM for the movement in all directions arranged at rear end of the robot.
- N. The required power supply for the entire machine is derived using a heavy-duty sealed lead acid rechargeable battery of 12v, 2Ah for long back up time.

IV. PARTS OF THE MULTIPURPOSE AGRICULTURE ROBOT

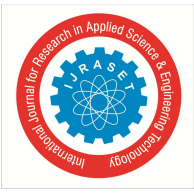
- A. Ploughing mechanism.
- B. MS metal body frame.
- C. Seed holder and sowing mechanism.
- D. Irrigation dripper.
- E. Solar panel .
- F. Water container with pump.
- G. Fertilizer container with pump.
- H. Nozzle for fertilizer.
- I. Rollers.
- J. Wheels.

V. ADVANTAGES

- A. Scientific farming methods.
- B. Precision farming.
- C. Acceptance for modular equipments.
- D. Fool proofing.
- E. Our equipment is completely easy to assembly and disassembly.
- F. Low cost.
- G. Clean energy is used as well as reuse of solar energy charging is equipped.
- H. The overall time taken for each operations have been decreased to a minimal idle time.

VI. FUTURE SCOPE

Mechatronics is playing an enormous role in agricultural production and management. There is a desire for autonomous and time saving technology in agriculture to possess efficient farm management. The researchers are now aiming towards different types of farming parameters to style autonomous multipurpose agricultural robots because of traditional farm machineries and topological dependent. Till date the multipurpose agricultural robots have been researched and developed mainly for harvesting, fertilizer spraying, picking fruits, sowing, solar energy and monitoring of crops. Robots like these are brilliant replacements for manpower to a better extent as they deploy unmanned sensors and machinery systems. The agricultural benefits of development of these autonomous and intelligent robots are to improve repetitive precision, efficiency, reliability and minimization of soil compaction and chemical utilization. The robots have the potential of multitasking, sensory measures, idle operation as well working in odd operating conditions. The study on multipurpose agricultural robot system had been done using model structure design along with various precision farming machineries. With fully automated farms in the future, robots can perform all the tasks like ploughing, seed sowing, pesticides spraying, monitoring of pests and diseases, harvesting, etc. This allows the farmers to just supervise the robots without the need of manual operation. In the future robots may also run on PLC and SCADA with automatic systems. In this paper, overview of mechatronics approach of our multipurpose agriculture robot for precision Agriculture in India and worldwide development is reviewed.



VII. CONCLUSION

In agriculture, by using the solar operated multi-purpose agriculture robot. We can easily reduce the man power, farming tools and time. The machine required less farmers and less time compared to the old working methods. Keeping all this valuable limitation and benefits in mind our multipurpose agriculture robot works on 4 in one operation and given commands. Achieving all the five application of ploughing, sowing, irrigation, fertilization and solar power in one robot has drastically reduced the negative aspects in viewing agricultural efforts. We hope this will satisfy the needs of Indian agriculture and hard working farmers. In this way we can overcome the labour problem that is required of today's farming in India.

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