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Solar Powered Multifunctional Agricultural Robot

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Abstract - *More than 40 percent of the population in the world chooses agriculture as the primary occupation. Advancement of agricultural tools is the basic trend of agricultural improvement. The proposed system shows the design, development and the fabrication of the robot which can dig the soil, sow seeds, level the land after sowing and spray fertilizers or insecticides, this whole systems works on battery charged with help of solar panel. This robotic vehicle is controlled through Bluetooth interfacing on android application and minimizes the labor of farmers increasing the speed and accuracy of the work.*

Key Words: **Solar panel, Ardunio Uno R3, Digging, Sowing, Levelling, Spraying.**

1. INTRODUCTION

The main motive for developing Agricultural Automation Technology is decreasing labor force and increasing the processes of digging and seed sowing of crops and covering the land so that human efforts will get reduce up to 90 percent. Especially when the duties, that needs to be performed, are potentially harmful for the safety or the health of the workers or when more conservative issues the applications of instrumental robotics cover further domains, as the opportunity of replacing human operators. The proposed model uses basic components like DC motors, relay, relay driver ULN2003, Bluetooth module and Arduino Uno R3 as the main controller. The mechanical design of the robot is also simple. It is programmed to carry out the above functions simultaneously. To perform the function of ploughing it is equipped with rotor wheel which is fixed in the anterior end of the robot, to sow seeds it has a container with seeds, funnel and its bottom contains a perforation to sow the seeds and finally the posterior end of the robot has a sloping metal sheet touching the ground to cover the sown seeds with soil and level as it moves forward. It is also mounted with sprinklers and dc spraying motor with a water bag to spray fertilizers and insecticides.

2. PURVIEW OF PROJECT

The aspiration of our proposed project is designing a multifunctional robot remotely controlled through Bluetooth by android application. The preeminent intention of our project is to advance a solar operated agricultural robot which performs digging, sowing, levelling and spraying at a single time. Solar panel is used in our agribot to convert solar energy into electrical energy captured by it. The electrical energy generated is used to charge 12V battery. This electrical power is transmitted to wheel DC motors and other motors used for digging rotor, seed container through relay driver. In this proposed plan electrical and mechanical system is collaborated in an efficient way. We are in attempt to integrate and assimilate digging, seed sowing, levelling and spraying features in our solar powered multifunctional agricultural robot.

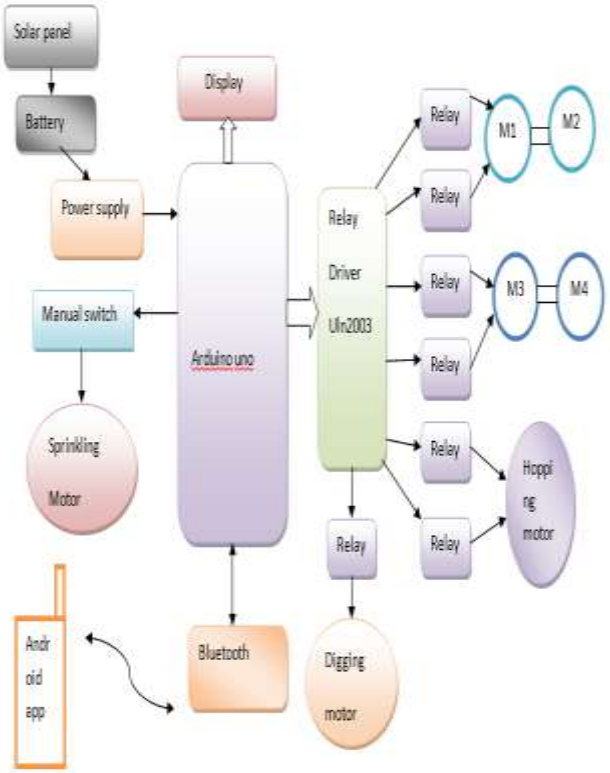
3. OBJECTIVES

Our intention is to concoct a prototype solar powered multifunctional agricultural robot which must execute the below features-

- The first objective to design this agribot is to make work the whole system on solar energy.
- The robot must perform digging, seed sowing, levelling the mud and spraying operation at a time and complete the entire work in minimum time.
- Our aim is to curtail human effort and escalate yield by introducing this designed robot.
- The motive to operate robot from distance to keep farmers away from the hazardous effects of pesticides and insecticides averting their exposure to farmers while spraying.
- Cynosure will be on potential labour cost savings, farm structure connotation and sizes for operation, daily working hours, probable natural brunt, energy costs and safety concerns.

4. METHODOLOGY

The basic aim of this project is to develop a multifunctional agricultural robot which is used for ploughing, sowing, leveling and spraying with minimum cost. The robot is to be powered with solar energy which is stored in battery in form of electrical energy. This agricultural robot may be called 'Agribot'.



- The chassis of robot is made of iron square pipes mounted on four wheels driven by DC motors.
- The ploughing mechanism is fabricated on the anterior part of the chassis of robot.
- A seed cultivating arrangement is assembled in the middle of the chassis.
- On posterior side of chassis soil levelling mechanism is fitted on chassis.
- Insecticides spraying feature is also mounted on the robot.

The 12V battery is used which is charged by solar panel. Then supply is given to Arduino Uno R3 board which is interfaced with relay driver ULN2003. Seven relays for seven DC motors are used in the robot. The operation of these relays is controlled through programming in Arduino by relay driver. Four DC motors are used for four wheels to perform forward, reverse, left and right operation of the robot. Two DC motors are coupled in parallel and two relays are used for the operation of forward, stop and reverse operation as a single relay performs only two actions of motor run and stop. One DC motor is used with two relays for canister in seed sowing operation for performing forward reverse operation of motor. The ploughing rotor is operated by two DC motors with relays, performing only forward and stop action of rotor. A manual operation of DC spraying motor is contrived on the robot. All the operations are programmed in the Arduino and are operated through the Bluetooth module (HC-05) by android application.

5. Operations

The operation performed by the agribot are described as below

5.1 Ploughing Operation

The elementary purpose of ploughing is to turn over the top layer of the soil, taking fresh nutrients outward to surface, while embalming weeds and the remnants of earlier crops. In the prototype model designed, two DC motor are used for ploughing the farm. The rotor is lowered down manually and the soil is dug up to 1 inch. The operation of the rotor blades can be controlled by the Bluetooth app in the smart phone.

5.2 Sowing Operation

A plastic canister is used for seed storage. We have provided a hole to canister. The canister is placed above the funnel. The canister is powered by DC motor which is monitored by two relays and is controlled by mobile application remotely via Bluetooth. As the motor is switched on, the canister tends to rotate and rotation makes the seeds fall in the funnel. The speed of the motor can be controlled in programming developed in Arduino. An iron nozzle is provided which trench the seeds in ploughed land. The nozzle can be adjusted up and down manually as required.

5.3 Leveling Operation

A metal sheet Plate is used as mud leveller. The movement of leveller is made manually. As the levelling plate is moved downward to the ground level, the seed is closed by the soil and the uneven soil in levelled.

5.4 Spraying Operation

A water container is placed on robot for water storage. A DC water pump is used for pumping water to the water sprayer. The water flows to the aerosol through hose. The power for pump is coordinated by a toggle switch.

Circuit Board of Robot with battery assembly

Android Application On Cell Phone Screen

6. CONCLUSION

In agricultural filed, the contingency for robots, augmented yield is colossal. Hence robots are emerging on farms in various guises and are increasing in numbers. The alternative dilemmas combined with autonomous farm

equipments can apparently be overcome with automation. This project is mainly based on curtailing human power as well as expenditure on equipments. The robot can be with accessible source system rather than a normal robotic car. Affability of automation system is high than traditional system. The advantage of this system is it diminish the labor cost, and time. In this design a robot is assembled to entrench automatic digging, seeding, leveling and fertilization in a field. The working of the robot is executed by renewable energy as solar energy. It is presumed that robot will support farmers in bettering the efficiency of operations in their farms. It can aid the farmers in initial stage of farming. One of the advantages of the smaller machines is that they are more acceptable to the non-farm community. The jobs in agriculture field are a drag and require intelligence and speed hence robots can be rightly substituted with human operator. Robots can improve the quality of our lives but there are downsides. At present in our country all agricultural machines are working manually or by petrol engine or tractor. Humans can't work for long time manually. To avert this condition, we need some kind of power source system to operate the digging, sowing, leveling and sprinkling at a time. This can be achieved by our solar powered multifunctional agricultural robot.

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