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Solar Powered Multi-Function Agri-Robot

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Abstract - *In excess of 40 percent of the population on the planet picks agribusiness as the essential occupation. Lately, expanded interest has been developed for the development of the self-ruling vehicles like robots in the agribusiness. In traditional strategy for farming works, the types of equipment used to perform various activities are costly and badly designed to deal with. In this way, farmers need advanced equipment to perform farming procedures. The proposed work aims to build up the robot which can perform activities like ploughing, seed sowing, grass cutting and water sprinkling. The proposed robot gets power supply from solar photovoltaic (pv) panels, so it needn't bother with any outer power supply. The entire framework is constrained by android application utilizing Bluetooth interfacing with PIC18F4520 which imparts the signs to the robot for required operations. The ploughing of firm and sowing of seeds is consequently done by utilizing dc motors. Steady separation is kept up for planting of seed. Sprinkler with rotating nozzles is utilized to sprinkle the water on crop. The grass cutting instrument comprises of rotating blades having a sharpened knife edge on both sides to cut the waste grass effectively. This mechanical vehicle will limit the work cost, speed up and increase the exactness of the work. It incorporates various tasks, so it is financially savvy. Vitality required for this machine is less as contrasted to tractors or other farming instruments like electric pumps.*

Key Words: **agriculture, robot, ploughing, seed sowing, grass cutting, water sprinkling.**

1. INTRODUCTION

In India there are 70 percentage of population chooses agriculture as a primary occupation [1]. In the current generation we do not have sufficient skilled man power specifically in agricultural sector. A manual farming consumes more time & leads to more pollution. The main purpose for developing Automation in Agricultural field is decreasing labor and decreasing time required to perform the processes on crops so that human efforts will get reduce up to 90 percent. Automation is required for safety and health of workers especially when worker have to perform harmful duties. Some of the previously developed robotics applications are Crop Seeding it involves autonomous precision seeding combines robotics with geomapping. Crop Monitoring and Analysis is provided by drone companies like Precision Hawk offers farmer combined packages which include robotic hardware and analysis software. Other applications are Fertilizing and irrigation system, Crop weeding and spraying system, Autonomous tractors, Picking and harvesting system [2]. The system uses basic components like Solar panel, DC motor, Battery, Relay, Motor driver, Relay driver, Bluetooth Module and PIC18F4520 controller. The whole process is controlled by microcontroller. The solar panel is used to charge the battery. This battery used to power vehicle movement as well as to the motor that is used for grass cutting. The ploughing of field and plantation of seed is done by using DC motor. Distance between the two seeds are controlled and varied by using microcontroller. When the robot reaches the end of the field, we can change the direction with the help of Bluetooth command [3]. The advantage of this solar powered multi-function Agri-robot is that it does not require any fuel or petrol to work, as it works on the solar energy. The circuit model is less complex and compact due the use of PIC18F4520 controller.

2. RELATED WORK

The automation in the agriculture could help farmers to reduce their efforts. The vehicles are being developed for the processes for Ploughing, seed sowing, Grass cutter, Sprinkler. All of these functions have not yet performed using a single vehicle. In this the robots are developed to concentrate in an efficient manner and also it is expected to perform the operations autonomously. This idea implements the vehicle to perform the functions such as ploughing, seed sowing, grass cutting and water spraying. Energy required for this machine is less as compared with tractors and agricultural instrument pollution is also a big problem which is eliminated by using solar plate. As there are no efficient equipment's to aid the farmers. There is a need for new techniques to be implemented.

Previously the idea was formulated, design options were finalised. Few of them are described here. In Automated Seed Sowing Agribot using Arduino", Saurabh Umarkar and Anil Karwankar, discussed that the process of seed sowing is a key component of agriculture field. For many varieties of crops, high-precision planting has been developed for a wide range of seed sizes, resulting to uniform seed distribution in seed spacing along the travel path. Wifi is used as receiver. Main drawback of the system is robot moves in only one direction. Whenever there is obstacle power supply is automatically turned off [4]. In "Agribot: Arduino Controlled Autonomous Multipurpose Farm Machinery Robot for Small to medium scale cultivation", M. D. I. Sujon, R. Nasir and Jayasree Baidya determined the effects of various seeding techniques and machines. The robot is performing farming using analogy of ultrasonic detection in order to change its position. The main disadvantage of this system is it does not work well on all types of soil [5]. In "Autonomous seed sowing agricultural robot", P. V. S. Jayakrisna, et.al, discussed that the robot capable of performing operations like automatic ploughing, seed sowing. It also provides manual control when required. It checks the humidity with the help of humidity sensors. The main component here is the AVR at mega microcontroller that controls the entire Solar Powered Multi-Function Agri-Robot process. Initially the robot tills the entire field and proceeds to ploughing, simultaneously sowing seeds side by side [6]. Disadvantage of this robot is on the field the robot operates on automated mode, but outside the field is strictly operated in manual mode. In "GPS based Autonomous Agriculture Robot" developed by S. Kareemulla et.al, the system benefits farmers by performing basic operation of seed sowing. This machine's operation is simple. It is possible to increase the total yield percentage effectively. Labour problem can be reduced. As compared to the manual and tractor-based sowing, time and energy required for this robot machine is less [7]. Also, wastage of seed is less. The disadvantage of model is it consists of only sowing operation.

The above research papers helped to understand the various aspects posed by the research on the agricultural robot. The robots designed in the above literature surveys have many issues with movement of the robot and grass cutting. These problems are effectively solved in this work.

3. PROPOSED SYSTEM

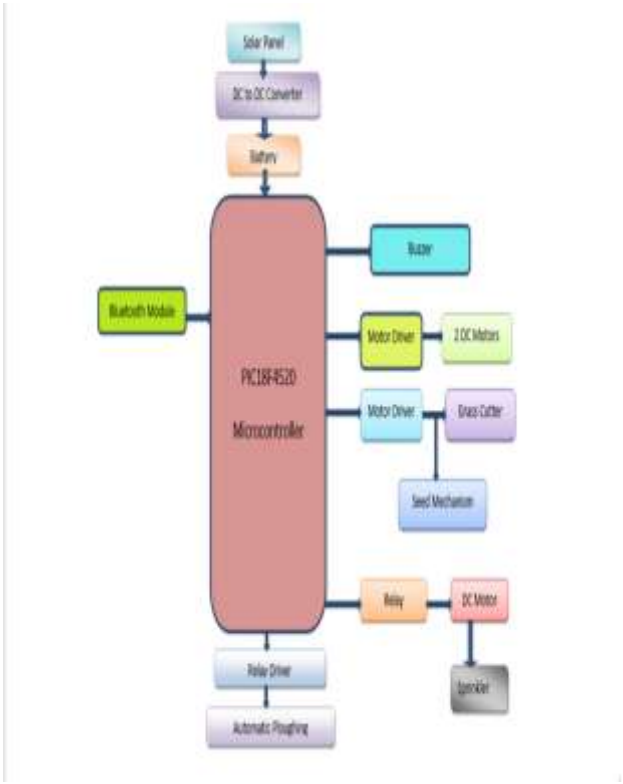


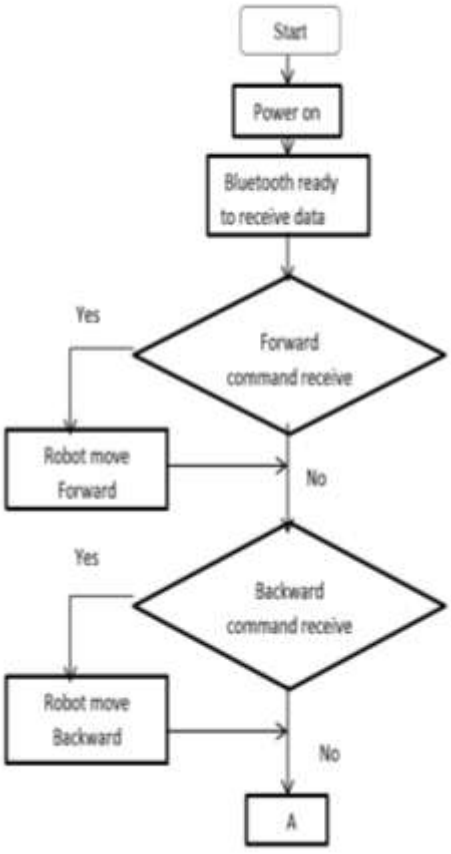
Fig -1: Block Diagram

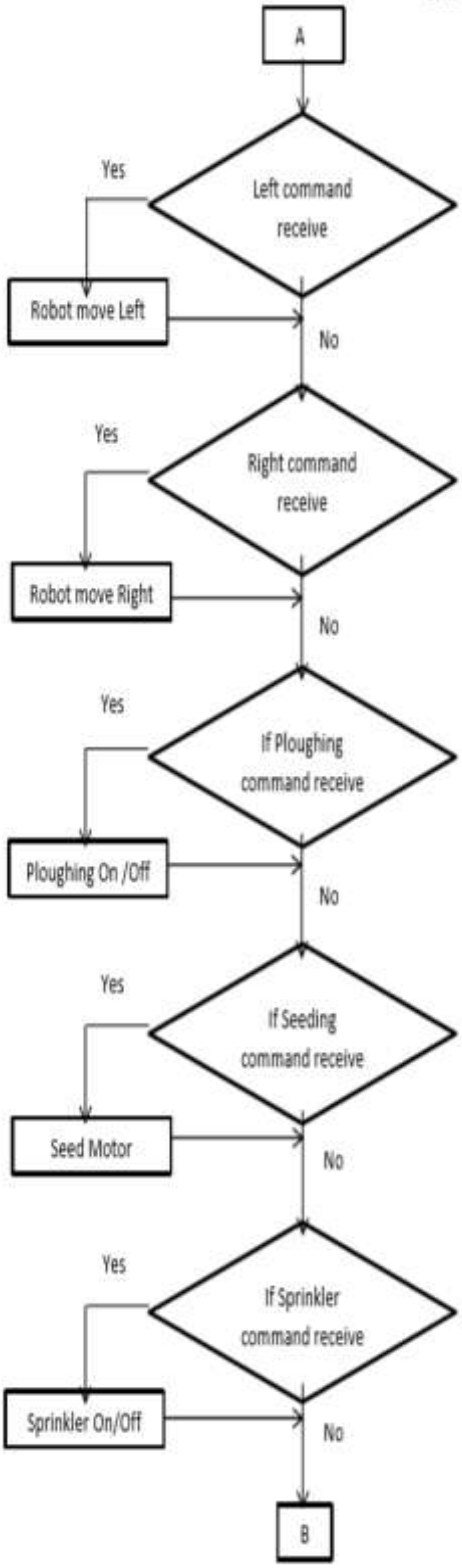
3.1. BLOCK DIAGRAM DESCRIPTION:

The block diagram consists of PIC18f4520 microcontroller which is controller for the whole system as shown in Fig.1, solar panel connected to the battery for storing energy and further it is given to power supply charging circuitry which is providing +5 V for pic board and +12 V supply for driving DC motors using relay motor driver module. Bluetooth HC05 is connected with PIC and wirelessly with Android smartphone to controlling the whole system. In grass cutting operation machine uses two revolving blades to cut a grass surface to an even height. The main wheels are powered by DC motor which is regulated by a Relay switch and movement of wheels is controlled by a remote controller.

4. SYSTEM FLOW

Algorithm of Parameter Measurement System
Step 1: Start.
Step 2: power on.
Step 3: Bluetooth ready.
Step 4: forward command received-robot move forward.
Step 5: backward command received-robot move backward.
Step 6: left command received-robot move left.
Step 7: right command received-robot move right.
Step 8: ploughing command received-robot ploughing on.
Step 9: seed command received-seed motor on.
Step 10: sprinkler command received- sprinkler on.
Step 11: grass cutter command received- grass cutter on.
Step 12: obstacle detected-robot stop and all function stop.
Step 13: stop.





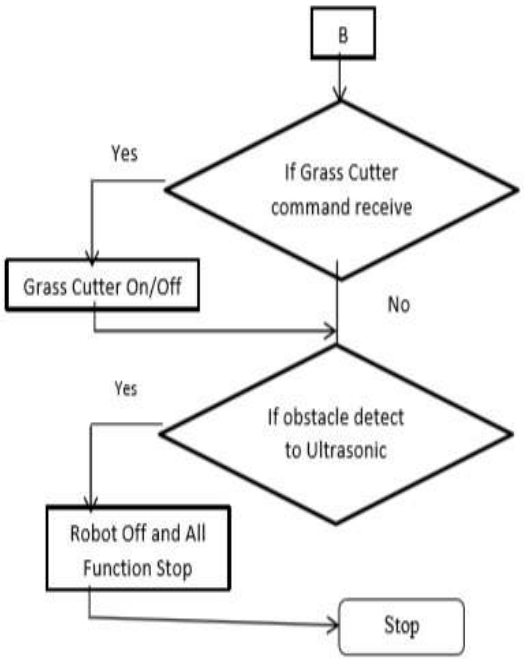


Fig -2: Flow chart of Robot

5. RESULTS AND DISCUSSION

The designed robot gets power from solar panel which converts sunlight into electricity. This electrical energy is given to the charging circuit in order to charge the battery to 12V. This battery gives power to controller, motor driver and other mechanisms.

The entire prototype of solar powered multifunction agri robot is shown in fig: 3.

Fig -3: Prototype of Robot

The prototype was tested on normal agricultural soil for different types of seeds are Wheat, Rice and gram. Funnel is used to store these seeds. All operations of robot are controlled by android app Bluetooth terminal HC-05 as shown in fig.4.

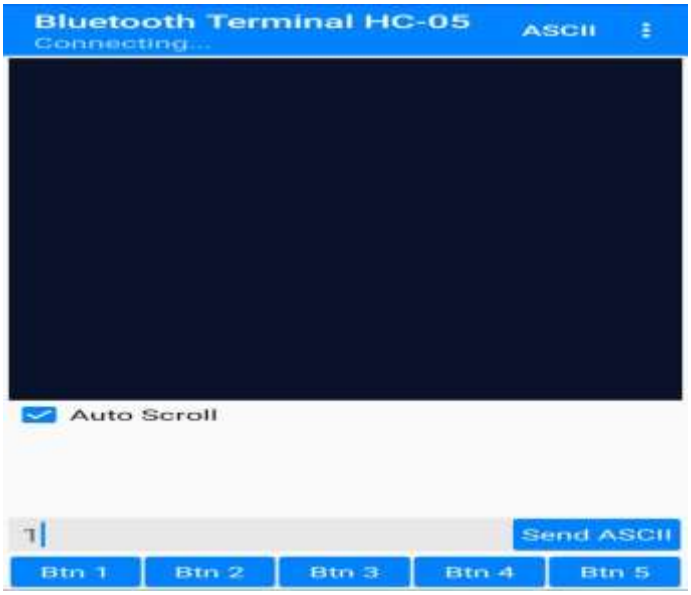


Fig -4: Bluetooth Android App

Firstly it paired app with the HC-05 module. The movement of robot controlled by following commands 0: Stop, 1: Forward movement, 2: Backward movement, 3: Right turn, 4: Left turn

When we send '5' and '7' commands the robot starts to ploughing, simultaneously dispensing seeds side by side as shown in fig:5. For ploughing operation plough is tilts in a downward direction at a specific angle to provide proper dept for rows. Command '8' is provided to move plough to its original position. Funnels are mounted on a slider. Command '5' is sent then slider starts moving to and fro direction. In this operation seeds were distributed in rows, however, the distance between seeds was uniform. Command '6' is used to stop slider. Grass cutting mechanism has a circular cutter provided with sharp edges. Command 'a' is sent to rotate the cutter. Weeds were successfully cut by this cutter as shown in fig:6. 'b' is sent to stop the rotation of the cutter. The container is provided to store the water. 'c' is sent to sprinkle water on field. 'd' is used to stop sprinkling

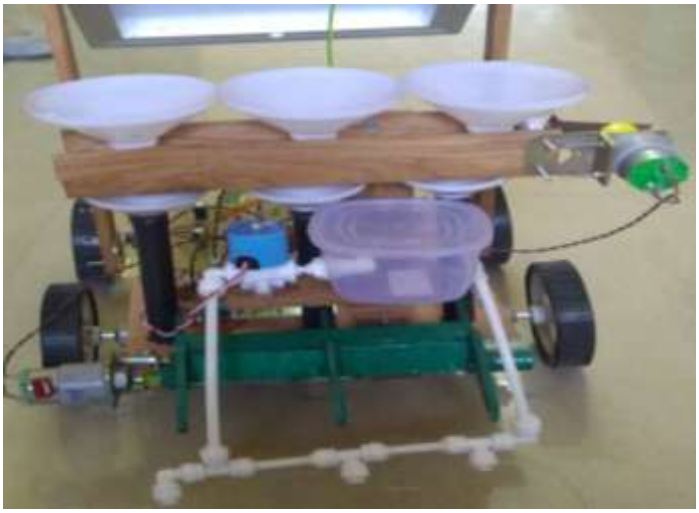


Fig -5: Seed Sawing and Ploughing Operation

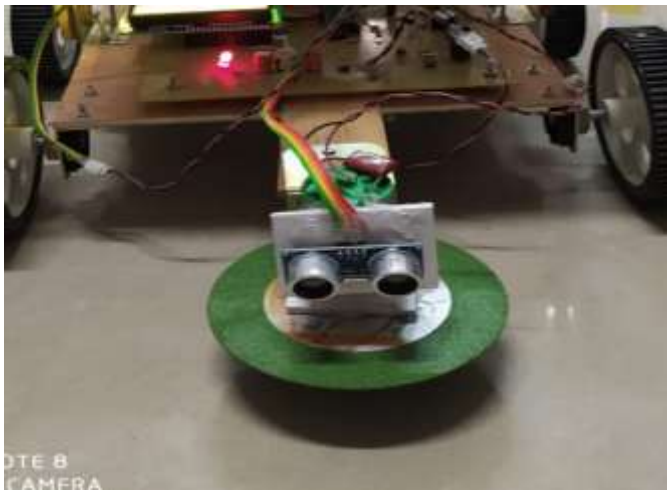


Fig -6: Grass Cutting mechanism

Fig -7: Solar PV Based Charging

Fig.7 shows Solar panel which gives power to the entire circuit. An ultrasonic sensor is used to detect obstacle up to 10m distance. Status of battery and distance between obstacle is displayed on the LCD screen.

From the above results, we conclude the robot has performed ploughing, seed sowing, grass cutting, water sprinkling operations properly.

6. CONCLUSION

Multipurpose farming robot has effectively actualized and tried for operations like ploughing, seeding, grass cutting and water sprinkling. An underlying result of this examination shows that the greater part of these frameworks that work with self-governing, are more adaptable than customary frameworks. The upsides of multipurpose horticultural robots are lessening human intercession, guaranteeing appropriate water system and proficient use of assets. In future, It can be reached out by utilizing ultrasonic sensors and cameras for playing out similar activities without human administrator for estimating the different parameters like soil condition, region secured by the robot and leveling.

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