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Smart Multifunction Agriculture Robot Powered By Solar With Solar Tracking System

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ABSTRACT

Smart multifunctional agriculture robot is designed to reduce efforts of the farmer. This robot perform various agriculture activities like ploughing, seed sowing, mud leveling and water spraying at a time. This robot is powered by solar so the cost of fuel will be reduced. This robot has solar tracking system which helps to use maximum solar energy from sun. This robot required less man power because it can operate using mobile Bluetooth by single person. This robot reduces overall cost for farming and increase productivity.

Keywords: Solar Power, Solar Power Tracking, Mobile Bluetooth, Multifunctional Agriculture Robot.

I. INTRODUCTION

In traditional method for farming works, the types of equipment used to perform various activities are costly and not easy to operate. Farmers need advanced equipment to perform farming procedures. The aim of this robot is to perform activities like ploughing, seed sowing, grass cutting and water sprinkling. This robot gets power supply from solar panels, which is available easily. We can expect the robots performing agricultural operations easily. This project objective is to design a robot with the battery and the solar power including tracking system. The usage of solar with tracking can be utilized for battery charging. As robot work in the field, the rays of sun can be used for power generation.

Farmer can operate this robot through smart phone or remote by sitting at one side and he can operate easily.

II. METHODOLOGY

This robot is designed to reduce human efforts and their time. This robot will able to perform various agricultre activities like ploughing, seed sowing, mud leveling, water spraying. This robot powered by battery. We are using solar energy to charge battery. As this robot works in the field, it can utilize solar energy from sun and this robot has solar tracking system to track the radiation from the sun. Following figure shows the block diagram of agriculture robot.

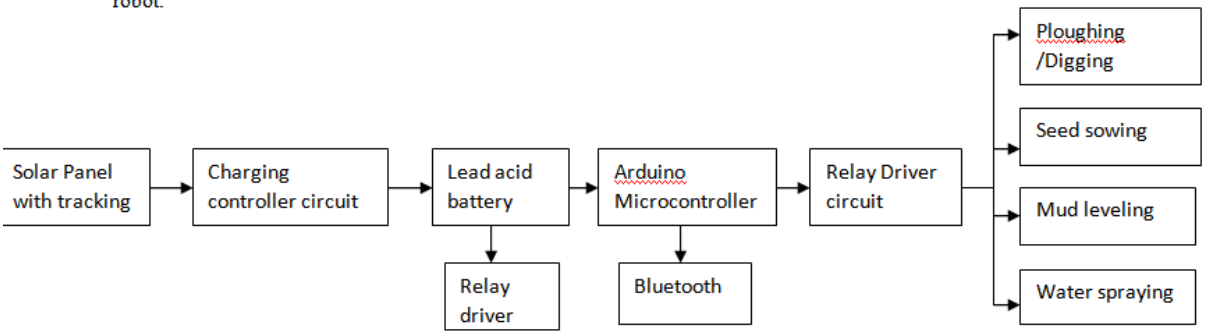

Figure1: Block Diagram

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Solar Panel

Solar Panel is made up from photovoltaic cell. This cell made up from semiconductor material. These PV cells absorb sunlight from sun and convert it into electrical energy in the form of DC. Robot get powerfrom battery which has dc in it and this battery will charge using solar energy.

Figure2: Solar Panel

Framework

Mechanical arrangment of the robot is depend on its framework. The framework of robat consist of plywood,aluminium,wheels .we mount all other required circuit and motors drive on this framework

Figure 3: Framework

Solar Tracking

We are using solar tracking system to utilize fully solar energy. We are using dual tracker, this tracker goesleft,right,up and down.this tacker consist of LDR which sense the light.

Figure 4:Solar Tracking

Bluetooth Module

We are using bluetooth to control robot bluetooth is wireless technology which connect gadgets without cable . bluetooth HC-5 module provide the switching mode between ,master and slave mode using bluetooth we can control robot using mobile phone.

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Figure 5: Blutooth Module

Microcontroller-

It is electronic circuit,we can download program through computer to the microcontroller circuit The five devices in the family are available with 3.5, 7 or 14 Kbytes of self-write Flash memory, up to 256 bytes of data EEPROM, and up to 368 bytes of RAM. All Over time, even the simplest embedded applications gain complexity as new reliability and feature requirements emerge. Due to cost and board space constraints, these systems are typically implemented with a single small Flash microcontroller. Microchip Technology offers a full range of products designed for systems whose control code fits within a small footprint, but require more extensive communication or actuation capability than 8bit microcontrollers traditionally offer.

Figure 6: Microcontroller

DC Motor

We required DC motor for running the robot. We are using permanent magnet DC motor, this motor doesn't need of field excitation arrangement. DC motor has good efficiency because it does not required input power for excitation.

Figure 8: DC Motor

III. COMPONENT USED

Following component are required to build up this agriculture robot.

Table1. List of Component

Sr	Component	Rating	Qty
1	MICROCONTROLLER	PIC,28 pin	1
2	LCD	16*2 Alphanumeric,16 pin	1
3	RELAY	12V/7Ah	4
4	REGULATOR	7805	1
5	BATTERY	12V/7Ah	1

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6	DRIVER	ULN2003	1
7	MOTOR DRIVER	L298D	3
8	BLUETOOTH MODULE	HC-5	1
9	SOLAR PANEL	12V, 300mA	1
10	RESISTANCE	1 LOT	
11	CAPACITOR	1 LOT	
12	SPRINKLER	12V 300mA	
13	DIODE	IN4007	1
14	MOTOR	12V	4
15	MISCELLENEOUS	WIRES,PCB,NUT,BOLT ETC	

IV. CONSTRUCTION OF ROBOT

- Whole robot construct on a framework. This framework is made up from plywood and aluminum strips.
- Four wheels are connected to the framework, which are driven by dc motor.
- Rotor harvester is connected at the front side of frame. This rotor gets power from dc motor.
- At the middle of frame diggers are connected to dig the soil .Pipe is used to store the seed
- Mud leveler is connected at the end of framework. Sprayer is used to spray fertilizer on the crops.
- On above the framework solar panel is placed and connected to the battery.

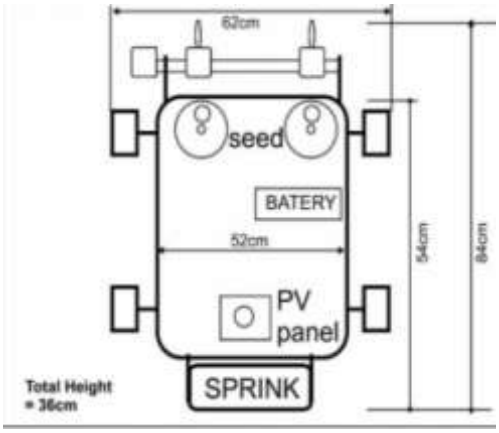

Figure 9: Construction of Robot

V. WORKING OF ROBOT

A. Digging Operation –

Digging means to remove soil and make hole to place seed for sowing. There are three digger are used in digging operation. The diggers are mounted on the middle of the frame. All the diggers are adjustable the diggers are connected to the frame by nut and bolt arrangement. Holes are produced on the diggers. The funnel and diggers holes are connected by using the hoses.

B. Seed sowing Operation-

Seed sowing is the process of planting seed. Tradition method of seed sowing based on assumption of seed to seed sparing& depth of placement which is not efficient & it required lot of timed effort to. Some time it results in backache of farmer.

C. Mud Leveling Operation-

A sheet metal plate is used as soil closer & leveler. The material of sheet metal plate is mild steel. An arrangement of nut & bolt is used for sheet metal plate up & down movement. The leveler is fixed to the frame which closes the soil in the sowed soil & level the land.

D. Water spraying operation –

A water container is used for water storage. A water pump is used for pumping water to the water sprayer. The water flows to the sprayer

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through pipe. The power for pump is regulated by a toggle switch.

E. Weeding Operation –

Weeds are unwanted plant which grows around the crops. Weedcan cause damage because the crop is not ventilated well. And there is more chance on fungal attack. A small rotor on with the curve shape blades is mounted on the frame to remove the weeds around the crops. This rotor is operated by using a DC motor.
Weeding refers to the removed of weeds. Weeding only affects the soil minimally, which is beneficial to clear huge amounts of plants. Weeding is generally done manually rather than with mechanized equipment and also done regularly.

V. DESIGN AND CALCULATION

As per the requirement the following motors are chooses for the robot. The details of the motor chooses are 12 Volt Dc gear motor. From the available motors we select the motor with following specifications operating voltage V=12 Volt.
For Wheels (4 motors) or 300 mA
Current I=12 amps at load speed 60 rpm
As we know total power is given by

Power = voltage × current

P = 12× 1.2

=14.4 Watt

Power of the shaft = 2Pi NT/60

Where N is the rpm of the motors 60 rpm

T=Torque transmitted P=2×P×60×T/60

T=144×60/2×3.14×60=2.29×1000 N-mm

For operations (digging ,seed sowing mad leveling)

Current I = 0.45 A at load speed 60 rpm

P=V×I

=12×0.45

= 5.4 watts

T=5.4×60/2×3.14×60=0.859×1000 N-mm

For pump (1 motor ,250 MA)

P= 3 watts

T=0.477× 1000 N-mm

For control

P= 5×0.3

=1.5 watts

Total power required

P=14.4+5.4+1.5

=24.3 watts

A. Design of Power system

As the robot ids operated using the solar panel. It is very important to design the power
System of the robot, however the design power systemshould be obtained and cost effective formers to offered

Power = 10 watts voltage=12 v

Therefore,

Current = power/voltage

P = V×I

i.e I = P/V

=10/12= 0.833 amp.

Battery specifications =12v/7hours

Therefore Battery power is 12×7= 84 watts

Therefore time required for completed charging of battery

= 84/10 = 8.4 hours

Power consumptions of the robot the motors used :-

Power rating =24.3 watts

Voltage required = 24.3/12 = 2.025 Amps

During No load conditions

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Power rating of servomotor voltage = 4.8 v

Current =0.15 amps

Therefore total power rating of servomotor

4.8×15 = 0.72 watts

Adriano microcontroller power consumptions :-

voltage = 5v

Current =50 MA

Total power consumption arduno board :-

5×0.5 =0.25 Watts

Therefore total power consumptions of seed sowing robot

23.4 watts

The robot should be designed such that it should work

atleast for three hours in field with fall

Charge.

The power consumptions for three hours =60 watts

When load is minimum . Therefore battery to be used =

12 V ,5 AH

But commercially available is 12V,7AH so we choose 12

V,7 AH power capacity of battery : 84 watts . battery

backup when battery is fully charged is 84/24.3 =3.45 hours

B. Solar panel

This project was a 10 watts 12 V solar panel as it is sufficient to charge the battery. The technical Specifications of the solar panel are of follows :-

− Specifications

Maximum rated power (P max) =10 watts.

Voltage at maximum power (V max) =17.3volts

Current at maximum power (I max) = 0.59Amps

circuit voltage (V o.c) = 21.8 volts

HShor tcircuit current(Is.c)=0.64

AmpLength×Width×Depth(inches)= 13.8×11.8×0.98

=159.583

VI. CONCLUSION

Most of the people depend upon agriculture for their occupation. Nowdays population increasing continuously therefore need of food is also increasing. We require such kind of machine which can provide better crops production with less time and with minimum human efforts. This agriculture robot is able to do various farming activities like ploughing, seed sowing, weeding, mud leveling and water sprinkling at a time. In traditional method of farming required more man power and time. This robot required less cost and single machine can do multiple activities at a time, so required time will reduced. This robot increase productivity of crops with less cost. As we control this robot using Bluetooth with Smartphone then single person can do all task. we operate this robot with battery and we are charging battery with solar energy so this robot is ecofriendly and cost of fuel will be minimized. In future we can install camera in this robot to supervise the field, also we can upgrade this robot by using different kind of system like to check PH level of soil, to check availability of water in soil etc.Thus overall this Robot increase accuracy and improve quality of product.

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