Solar Powered Mobile Operated Smart Multifunction Agriculture Robot

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Abstract— The main aim of this paper to design a robot which will perform multiple operations at a time and the farmer which can operate it by siting at one end of the farm via mobile bluetooth. The robot uses maximum solar energy with the help of tracking system. The design of robot made in such way that can perform operations like ploughing, seed sowing, mud leveling and water spraying. The 61.5% of the Indian population depends on agriculture. This robot made to increase the productivity and reduce labour cost within minimum time. The robot replace the traditional techniques of farming with new efficient and accurate techniques. The highlighting is in robot the solar tracking system which will make sure robot perform specific required time.

Keywords: Solar Power, Smart Multifunction Agriculture Robot, Mobile Operate

I. INTRODUCTION

In entire world near about 49% population depends on the field of agricultural and it is primary occupation.The idea of solar powered mobile operated smart multifunction agriculture robot in agriculture is new. The traditional techniques of farming are replaced by this robot and robot can perform the multiple function at a time like ploughing, seed sowing, mud leveling and water spraying. The main thing is that the robot has a solar power tracking system by using it solar energy is collected from all the directions. The robot having a mobile bluetooth module to control the robot and functions by siting at one end of the farm. The agriculture is the most important sector for the Indian economy. Using agriculture robot we can save energy as well as time of the farming process. So farmers are easily take multiple crops in farm within a proper span of session. It gives accuracy while seed sowing by row sopacing arrangements in seed dropper mechanism using time delay. The robot drop the seeds by counting. So there is no wastage of seeds. The movement of robot is flexible that means it can go forward and reverse also left and right.

There are two methods for solar energy tracking. First one is single axis tracking it has limitations because it does track sun in all directions. Second one is dual axis tracking system in this solar plate rotate in all directions as sun moves. That's the key point of robot maximum power point tracking system.

The following table shows the comparison between the traditional farming and improve farming techniques.

Sr. No.	Parameters	Manual	Improve Techniques
1	Man power	More	Less
2	Time Required	More	Less
3	Digging and seed sowing	Manually	Automatically
4	Seed distance	No	Yes
	space		
5	Seed wastage	Moderate	No
6	Energy Needed	High	Less
7	Pollution	No	No
8	Alarm and Display	No	Yes

Table 1: Comparison Between Traditional and Improve Farming Techniques

The above tablet show the comparison between traditional and improve farming techniques. In which traditional techniques having so many drawbacks as well as the the improve robotic techniques are effectively perform the all operations. There is no need of any supply sys6 or transmission line. Easy to control via mobile phone.

The robot is always has a preference for farming because as compared to other method or techniques we need only one time invwstment. As very popular and efficient in India. Along with per the requirement we can made the changes in the robot that means for different types of crops. In future we can implement it by using GPS or GSM module.

II. METHODOLOGY

The figure shows various working areas of the robot. The robot having different part that plays an vital role in the design and the structure of solar powered mobile operated smart multifunction agriculture robot. Those are as follows

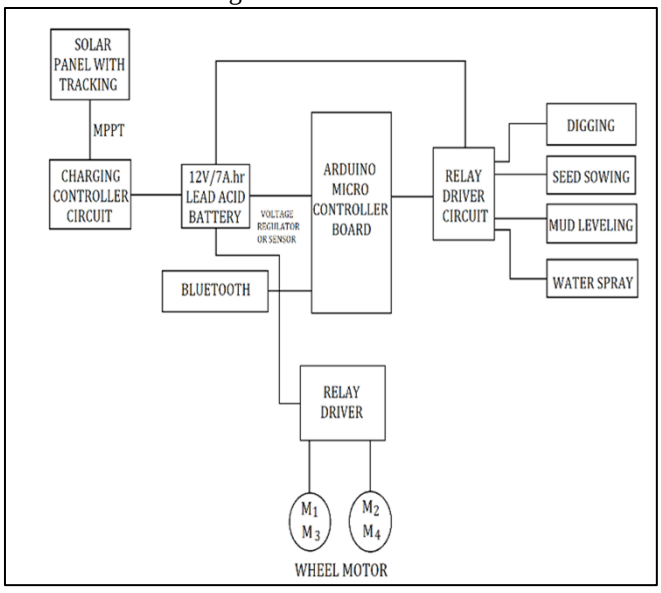

Fig. 1: Block diagram of solar powered mobile operated smart multifunction agriculture robots

A. Solar Panel

Solar panels are made of solar cell arranged in the form of bunch. Solar cell work on the principle of semiconductor

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physics. Solar cells absorbs the solar energy from sun and convert it into DC electric energy.

Fig. 2: Solar Panel

B. Chasis

The chasis is the base of the robot as a mechanical arrangement on which overall working structure will be maunted this is made up of plywood and alluminium strips. The chasis most important because driving machanism is need to fix the wheels on both sides of the chasis.

The driver motors also assembly on the chasis to move the robot forward and reverse or left right.

Fig. 3: Chasis

C. Solar Tracking

The system is operated by combination of hardware and firmware programming. This sketch includes the library for stepper motor library. The values from the LDR1 pin ,LDR2 pin, LDR3pin and LDR4 pin will be read and save LDR1,LDR2, LDR3 and LDR4.Then, the difference between the LDR1 and LDR2 will be taken to move the stepper motor 1 accordingly. The difference between the LDR3 and LDR4 will be taken to move the stepper motor 2 and 3 accordingly. Simple Solar Panel Tracker will automatically move towards the light like a sunflower. Here, the low power solar panel has been used to reduce the weight, if a high power or heavy solar panel is used, the stepper motor will be needed to chooses. The dual axis tracking system requires four light dependent resistors (LDRs).

Fig. 4: Dual axis solar tracking system

D. Bluetooth

The bluetooth module is use to transmite or receive the wireless signals. The bluetooth replace the cables and develop a wireless communication. HC-05 bluetooth module provides the switching mode between master ans slave mode. Using bluetooth module robot can be easily operated via a android mobile phone.

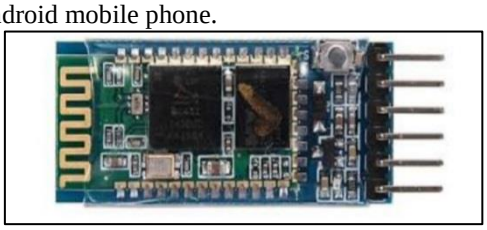

Fig. 5: HC-5 Bluetooth module

E. Microcontroller

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 8-bit microcontrollers traditionally offer.

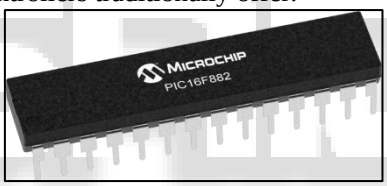

Fig. 6: Microcontroller chip

III. COMPONENTS USED

Following components are used for this complete system

SR	COMPONENTS	RATING/ VALUE	QTY
1	MICROCONTROLLER	PIC, 28 pin	1
2	LCD	16x2 Alphanumeric, 16 pin	1
3	RELAY	12v/7Amp	4
4	REGULATOR	7805	1
5	BATTERY	12V/7Ah	1
6	DRIVER	ULN2003	1
7	MOTOR DRIVER	L298D	3
8	Bluetooth	hc05	1
9	SOLAR PANEL	12V/10W	1
10	RESISTANCES	1 LOT	
11	CAPACITOR	1 LOT	
12	SPRINKLER	12V 300mA	1
13	DIODES	1N4007(For Rectifier of Power supply of microcontroller)	1
14	MOTORS	1) 12V/60 RPM,	4

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		300mA EACH 2) 12V/3 RPM, 150 mA	3
15	MISCELLENEOUS	wires, PCB, nuts/bolts,etc.	1

TABLE 2: LIST OF COMPONENTS

A. Motor used for operation with specifications

Components		Qty	Current in ma	Voltage	Total Current in ma
Motors					
1	Wheels	4	300	12	1200
2	Weeding	2	150	12	300
3	Seeding	1	150	12	150
4	Pump	1	250	12	250
5	Control	1	300	5	300
					2200

TABLE 3: MOTORS USED IN OPERATIONS

B. Mechanical Components

Sr. No.	Component	Material
1	Wheel	Rubber
2	Chassis	Plywood
3	Plough	Mild steel
4	Seeder	Fiber
5	Tank	Plastic
6	Hose pipe	Rubber
7	Support to seeder	Aluminum strip
8	Clamp	Aluminum
9	Spur gear	Fiber

TABLE 4: MECHANICAL COMMENTS

IV. WORKING OF PROJECT

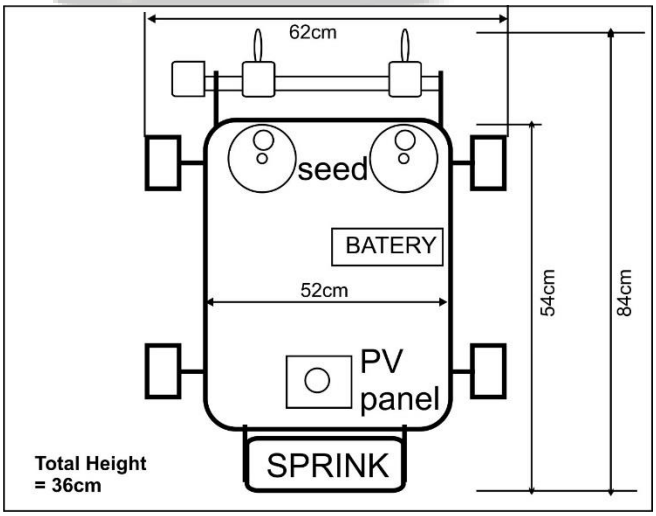

Fig. 7: Working diagram of solar powered mobile operated smart multifunction agriculture robot

The aim of our project is design and develops a multipurpose robot, which is used to reduce time and human effort. The operations are carried by a robot are harvesting, digging, seed sowing and leveling to close the soil and also sprayer to spray a fertilizer. These all operations are performed by using the battery and solar power.

- The frame of robot is made of plywood and alluminium. The four wheels are connected to the frame, which are driven by using a DC motor.
- The front of frame harvester rotor is connected and this rotor is rotate by using DC motor.
- On the middle of frame three diggers are connected to dig the soil. The nut and bolt arrangement is used in the robot, by using nut and bolt up and down position of digger is done.
- Pipe is used to store the seeds. Three hoses are used to connect funnel and digger, into the hoses seeds are flow down with the help of low speed motor.
- At the end of frame the leveler is connected by using leveler the seeds are close in the soil.
- Sprayer is used to spray the fertilizer on the crops. Pump is used to spray the fertilizer and the pump is operated on the DC motor.
- Top of the frame solar panel is mounted. Solar panel is connected to the battery. To operate all system it requires 12V battery.

A. Digging Operation

There are three digger are used in digging operation. The diggers are mounted on the middle of the frame. Digger mechanism is used to digging and seed sowing. 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.

Seed sowing Operation:-

Seed saving is the process of planting seed. Tradition method of seed sawing 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.

B. 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.

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

D. Weeding Operation

Weeds are plants that growing places where they are not wanted. The can be cause damage because the crop is not ventilated well. And there is more chance on fungal attack.

A small rotor on which the curve shape blades are mounted to remove the weeds from soil. 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.

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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 system should 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
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
Shor tcircuit current($I_{s.c}$)=0.64
AmpLength×Width×Depth(inches)= 13.8×11.8×0.98
=159.583

VI. CONCLUSION

In agricultural field the robot enhance the productivity and creates the opportunities. The problems associated with the traditional farming methods can probably be overcome with technology. The robot may be in our but there are an Idea thinking about the replacement of humans with a machine or robot. It is all about how crop production is done with less efforts and time. Crop production is made cheaper and better with the help of a small machine. The robot can made easy way of farming by substituting the human while more dangerous situations takes place in agriculture. These robot also utilizes the sun as a source of energy so there is no use of burning fluids and no pollution. This machine increases the accuracy and improve the quality of products. Nowadays we need such kind of machines in agriculture to increase the level of farming as compared to other sectors.

Fig. 9: Working model

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