

FABRICATION OF SOLAR POWERED HYBRID AGRICULTURAL VEHICLE

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Abstract : In India, near about 70 % people are dependent upon agriculture. So, the agriculture system in India should be advanced to reduce the effects of farmers. Various numbers of operations are performed on agricultural field like seeding, weeding, ploughing etc. Very basic and significant operations are seeding, ploughing, plant cutting. But the present methods of seeding, ploughing and plant cutting are problematic. The equipment's used for seed sowing, grass cutting are very difficult and inconvenient to handle. So there is a need to develop equipment which will reduce the effort of farmers. In this project, we developed a procedure for seed sowing and grass cutting in a single vehicle. The drawbacks of the existing system will be removed successfully in this remote controlled vehicle with the support of solar energy which is freely available in nature and a renewable source of energy which can overcome the deficiency of electricity in remote villages

Keywords- seed sowing, grass cutter machine, solar power

1. INTRODUCTION

Very basic operation is seed sowing & grass cutting. The equipment's used for seed sowing are very difficult and inconvenient to handle. So there is a need to develop equipment which will reduce the man power. The machine can be advanced for sowing seeds in farm with particular distance between seed is adjusted. Agriculture is the main occupation. So this system in India should be advanced to reduce the efforts of plants and other products used to sustain and enhance human life. Agriculture was the key development farmers. Agriculture is the cultivation and breeding of animals, plants and fungi for food, fiber, bio fuel, medicinal in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that nurtured the development of civilization. The study of agriculture is known as agricultural science. The history of agriculture dates back thousands of years, and its development has been driven and defined by greatly different climates, cultures, and technologies. Industrial agriculture based on large-scale monoculture farming has become the dominant agricultural methodology. The machine can be advanced for sowing seeds in farm with particular distance between seed is adjusted. It can automatically sowing seed in land. It can be also used fertilizer sowing instead of seed. The basic requirements of this machine for small scale cropping, they should be suitable for small farms, simple in design and technology and versatile for use in different farm operations. An automatically operated template row planting will designed and developed to improve planting efficiency and reduce drudgery involved in manual planting method. Seed planting is also possible for different size of seed at variable depth and space between two seeds. In the present era the vast majority of the nations don't have adequate talented labor particularly in agrarian area and it influences the development of creating nations. So it's an opportunity to computerize the area to defeat this issue. Remote control applications, all things considered, seem to an ever increasing extent, particularly in farming. Industry assumes an essential part. Presently a day's Robotics is a piece of today's correspondence and correspondence is a piece of progression of innovation, so chosen to take a shot at Robotic field, and plan something which will make human life today's perspective. There are distinctive sorts of portable robots which can be separated into a few classifications comprises of wheeled robot, creeping robot and legged robot. This venture manages a wheeled self-sufficient Robot. It is the piece of Automation; Robot has adequate

2. LITERATURE SURVEY

Dr.Prabhakar Khandait etal[1]: India's record of progress in agriculture over the past form decades has been quite impressive. We know that Indian economy is based on agriculture. Development in agriculture leads to raise economic status of country. India is facing problems due to unavailability of labors and nowadays the wages of labors are also at the highest peak. Payal Srivastava, etal[2]: In present scenario most countries are facing problems due to the old and conventional methods in agricultural sector and it affects the growth of developing countries. So it's time to make some technological advancements in the sector to overcome this problem. Manjesh M N ,etal[3]: The fundamental go for our venture has been to build up a solar powered digging and sand sowing machine, which is sunlight based fueled. In this machine utilized a sunlight based board to catch and change over solar energy into electrical energy which thus is utilized to charge four 12V batteries, which then gives the vital energy to a shunt wound DC engine. Maintain row dispersing and controls seed rate. Omkar R. Sahu, etal[4]: The seed sowing system is effectively use for automatic sowing with great efficiency and accuracy. In this the Hall Effect sensor can be used for converting of rotation into distance. Also by using this system we can protect seeds from damaging as well as increases rate of sowing.

Priyanka R. Tabhane[5]: The human effort and increase the yield. The plantation of seeds is automatically done by using DC motor. The distance between the two seeds are controlled and varied by using Arduino programming. It is also possible to cultivate different kinds of seeds with different distance. P. Baladarshini,etal[6]: The major occupation of the Indian rural people is agriculture and both men and women are equally involved in the process. Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. P.Janagarathinam,etal[7]: The nature inspired the researchers and new innovative ideas come in mind but sometimes they are simple and effective, sometimes cumbersome and critical. The developed kinematic and dynamic models have been examined for tripod gait generation of the six-legged robot. Thorat Swapnil,etal[8]: : Cropping is important and tedious activity for any farmer, and for large scale this activity is so lengthy also it needs more workers. Thus agriculture machines were developed to simplify the human efforts. In manual method of seed planting, we get results such as low seed placement, less spacing efficiencies and serious back ache for the farmer. This seed plantation machine has great potential for

increasing the productivity of the planting. Kalay Khan1 ,etal[9]: A developing country like India is expected to continue to rely more on hand tools for the foreseeable future for cultivation. The use of hand tools for land cultivation is still predominant in India because draft animals and tractors require resources that many Indian farmers do not have easy access to. PushpendraTyagi,etal[10]: Nowadays, pollution is the major issue in the universe. In case gas-poweredlawn mowers due to the emission of gases it is responsible for pollution.

3. MATERIALS AND METHODS:

Instead of using wireless camera we are using smart phone for live streaming of surroundings for spying this can be done with help of BLUETOOTH application which is installed in mobile phone and due to internet services we can easily spy at any time. For wireless communication with Robot unit we are using Bluetooth module and easily control our robot with the help of android Application using USART Technology. Hence Android application is used as a remote control for robot which control movements of motors due to which wheel and is controlled laser shooter.

3.1 CONVENTIONAL SEED SOWING MACHINE:

Another method of sowing the seeds is with the help of a simple device consisting of bamboo tube. This bamboo tube with a funnel on it is attached to a plough. When the plough moves over the field, the tube attached to it leaves the seeds and kept in the funnel at proper depth as well as spacing. The plough keeps making furrows in the soil in which the seeds are dropped by the seed drill [2]. Drawbacks of this system are no proper germination of seeds. Wastage of seeds. No control over the depth of seed placement.

3.2 SOLAR POWERED SEED SOWING MACHINE:

In this system the basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and spacing, cover the seeds with soil and provide proper compaction over the seed [1]. This system uses solar panel which is made up of photovoltaic (PV) cells, which turns sunlight into electricity. The main disadvantage of this project was this system is not automatic.

3.3 HARDWARE COMPONENTS:

The components that are used in the project "FABRICATION OF AGRICULTURAL HYBRID VEHICLE"are as follows,

3.4 LIST OF MATERIALS

SL. NO.	NAME OF THE PARTS	MATERIAL
1	Cutter blade	Sheet metal
2	Solar panel	12v
3	HC-05 Bluetooth	-
4	Wheel	Plastic
5	Funnel	Plastic
6	Dc motor	12v
7	LED Display	-
8	Battery	12v
9	Chassis	MS
10	PCB board	-
11	Switch	-

3.4.1 CUTTER BLADE:

The cutter blade which is placed front of the machine which is attached with motor shaft which rotates when the machine is operated. The cutter blade which is made with thin metal sheet which has spur gear teeth which it rotates clockwise and anti clockwise. The360 degreescutter which is portable cutter and shear to carry the above mentioned activity using solar powered 12 Volt DC motor.



Fig 1: Cutter Blade

3.4.2.SOLAR PANEL:

Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. Solar Photovoltaic panels constitute the solar array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions, and typically ranges from 100 to 365 watts.



Fig 2: Solar Panel

3.4.3. HC-05 BLUETOOTH MODULE:

HC-05 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC. HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data.

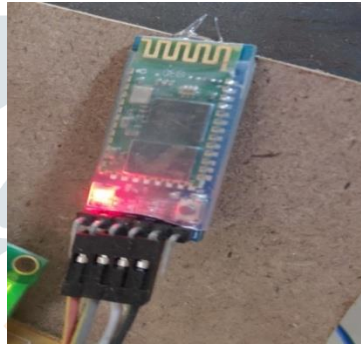


Fig 3: Bluetooth Module

3.4.4.WHEELS:

A wheel is a circular component that is intended to rotate on an axle bearing. The wheel is one of the main components of the wheel and axle which is one of the six simple machines. Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labor in machines.

3.4.5.FUNNEL:

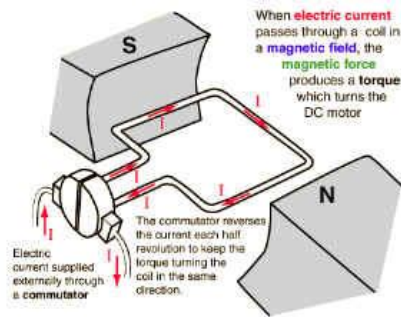
A Funnel is a tube or pipe that is wide at the top and narrow at the bottom, used for guiding liquid or powder into a small opening. We use 2 plastic funnels in which one is used to store the seeds in the seed tank and other funnel is used to drop the seed into the hole with the help of a pipe.



Fig 4: Funnels

3.4.6.DC MOTORS:

A DC motor is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homo polar motor (which is uncommon), and the ball bear in motor, which is (so far) a novelty. By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source -- so they are not purely DC machines in a strict sense.



3.4.7.LED DISPLAY

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p-n junction diode, which emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor.

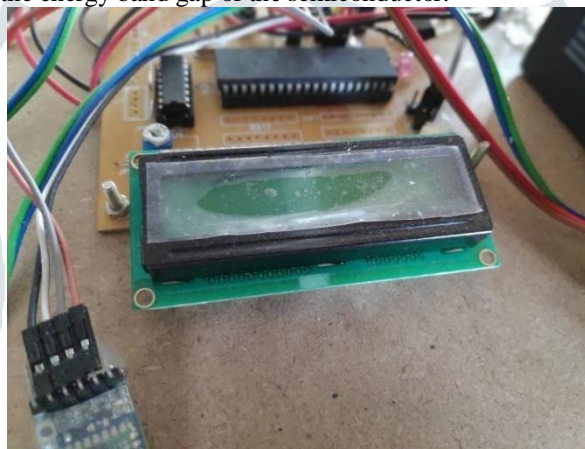


Fig5: LED Display

3.4.8.BATTERY

The rechargeable batteries are lead-lead dioxide systems. The dilute sulfuric acid electrolyte is absorbed by separators and plates and thus immobilized. Should the battery be accidentally overcharged producing hydrogen and oxygen, special one way valves allow the gases to escape thus avoiding excessive pressure build-up? Otherwise, the battery is completely sealed and is, therefore, maintenance-free, leak proof and usable in any position.



Fig6: Battery

3.4.9.CHASSIS

The chassis is made up of iron which is used to hold all the components of the machine i.e., motors, solar panel, battery, seed reservoir, et. We have welded slots to place motors and other equipment.



Fig7: Chassis

3.4.10.PCB BOARD

A printed circuit board (PCB) mechanically supports and electrically connects electronic components or electrical components using conductive tracks, pads and other features etched from one or more sheet layers of copper laminated onto and or between sheet layers of a non-conductive substrate.

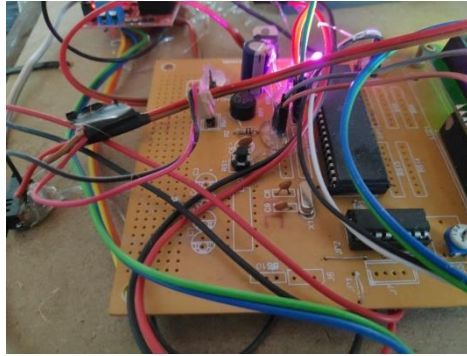


Fig8: PCB Board

3.4.11. SWITCH

A push-button or simply button is simple switch mechanism for controlling some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal. The surface is usually flat or shaped to accommodate the human finger or hand, so as to be easily depressed or pushed. Buttons are most often biased switches, though even many un-biased buttons (due to their physical nature) require a spring to return to their un-pushed state.

4. WORKING:

This machine is made up of mild steel chassis. Four wheels are attached to the frame out of which 2 are attached with two motors which run at 60 rpm. The other two wheels are attached directly to the frame. There is a slot attached to the front side of the frame. In this slot, a cutter motor is placed. A circular cutter is attached to the cutter motor. This cutter motor runs at 1000 rpm. There is a seed tank placed above the chassis. This seed tank acts as a storage for seeds. There are two compartments for the seeding unit. One is for storing the seeds, other is for dropping the seeds. There is a seed motor which rotates at 10 rpm. This is used to transfer seeds from tank to the sowing part. There is a specially designed transfer tool attached to the motor which transfers seeds from storage tank to sowing tank. The seed tank consists of a funnel which is used to put seeds in the seed tank. When the seed is dropped from the tool, it follows its way to the funnel and further through the pipe attached to it. A solar panel is attached to the machine to power the entire machine. A 12v battery is used for storage of charge. It is run by embedded programming, which is connected to the Bluetooth HC-05 module and further to a controller. The controller is used to operate the machine.



Fig9:working model

4.1.CONTROLLER SETUP:

The controller setup consists of an application to operate the device, a medium of transfer which is Bluetooth in our case, controller device. This controller setup is used to operate the machine i.e., to control the movements and functions of the machine. The controller setup consists of

- S2 TERMINAL android application
- HC-05 Bluetooth module

Commands are given to the machine with the help of S2 terminal application to the Bluetooth module. Bluetooth is used as the medium of transfer of commands from controller to the machine.

4.1.1.S2-TERMINAL ANDROID APPLICATION

This application is terminal software for communication with the Bluetooth device by using SPP (RFCOM). This is used as a controller for controlling the machine. We give commands through the application which is used to control the machine. After turning on the machine, we have to connect with the machine through Bluetooth in the operating device (mobile) in the application. Then we are free to operate the machine using various commands 3 are predefined to the machine. These commands can be used to operate the machine.

4.1.2.CONTROL COMMANDS

Control commands are the commands which are predefined to the machine that is to be operated. Control commands are given to the Controller device, which consists of a controller software which is “S2 TERMINAL” in our case. There are various commands used to control the device. They are listed as follows.

MOVEMENT COMMANDS

4.1.2.1.FORWARD

“f” is the command used for the movement of the machine in forward direction . This is to be typed in S2 terminal application and pass the command.



Fig 18: Front Command

4.1.2.2.BACKWARD

“b” is the command used for the movement of the machine in backward direction . This is to be typed in S2 terminal application and pass the command.

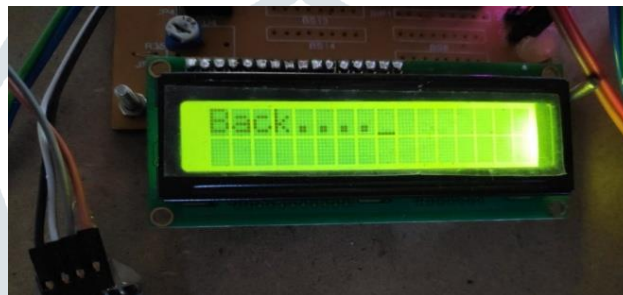


Fig 19:Back Command

4.1.2.3.LEFT

“l” is the command used to turn the machine in left direction. This is to be typed in S2 terminal application and pass the command.



Fig 20: Left Command

4.1.2.4. RIGHT

“r” is the command used to turn the machine in right direction. This is to be typed in S2 terminal application and pass the command.



Fig 21:Right Command

4.1.2.5 STOP

“s” is the command used to stop the movement of the machine. This is to be typed in S2 terminal application and pass the command.



Fig 22: Stop Command

4.2.2 SEED MOTOR COMMANDS:

4.2.2.1 SEED MOTOR CLOCKWISE

“1” is the command used to turn the seed motor in clockwise direction at 10 rpm. This is to be typed in S2 terminal application and pass the command.

4.2.2.2 SEED MOTOR ANTI-CLOCKWISE

“2” is the command used to turn the seed motor in anti-clockwise direction at 10 rpm. This is to be typed in S2 terminal application and pass the command.

4.2.2.3 SEED MOTOR STOP

“3” is the command used to turn the seed motor to OFF. This is to be typed in S2 terminal application and pass the command.

4.2.3 CUTTER MOTOR COMMANDS:

4.2.3.1 CUTTER MOTOR CLOCKWISE

“4” is the command used to turn the cutter motor in clockwise direction at 1000 rpm. This is to be typed in S2 terminal application and pass the command.

4.2.3.2 CUTTER MOTOR ANTI-CLOCKWISE

“5” is the command used to turn the cutter motor in anti-clockwise direction at 1000 rpm. This is to be typed in S2 terminal application and pass the command.

4.2.3.3 CUTTER MOTOR STOP

“6” is the command used to turn the cutter motor to OFF. This is to be typed in S2 terminal application and pass the command.

5. GENERAL CALCULATIONS:

Solar panel: Power = 5w, Voltage = 8.5v

Then current produced by the panel is given as $I = P/V$ $I = 5/8.5 = 0.65$ Ah

Battery: Voltage (V) = 12v, Current (I) = 7.5Ah = 0.116Amp, Power = $V \cdot I = 12 \cdot 7.5 = 90$ WH = 1.8 watts

DC Motor: Volt = 12v D.C Power = 26 watt Rpm = 60 Rpm

Then current required for the pump is given as $I = P/V$ $I = 5/8.5 = 0.65$ Ah

General Calculation:

Following are the general calculation,

Power generated by solar panel = 5 watts

Power = energy/sec

Battery 12V, 7.5Ah current

Power = $V \cdot I = 12 \cdot 7.5 = 90$ WH

Time required charging the battery = $(90/24) \cdot 2 = 7.5$ hrs

* *Note-Time varies because of intensity of sun radiations at different days.

Backup time of cutter = (power stored in battery/power consumed by motor) = $90 / (2.2 \cdot 12) = 3.5$ hrs.

6. CONCLUSION

The following results have been achieved.

1. Seed sowing and grass cutting have been done successfully.
2. Man power is reduced with the use of Software Controller.
3. Solar power is utilized successfully to charge the vehicle.
4. There is no need of any external power since solar can charge the vehicle.

In this project entitled Fabrication of solar powered hybrid agricultural vehicle is successfully completed and the results obtained are satisfactory. It will be easier for the people who are going to take the project for the further modifications. This project is more suitable for a common man as it is having much more advantages i.e., no fuel cost, no pollution and no fuel residue, less wear and tear because of less number of moving components and this can be operated by using solar energy. This will give much more physical exercise to the people and can be easily handled. As we are nearer to Equator, the solar energy (non-conventional energy) is vastly available, so it is easy to charge the battery and is also pollution free. But the initial investments of the solar powered grass cutter is high. At present in order to curtail global warming and ozone depletion, the Government of India is offering subsidy for the solar equipment's. The industries are producing these components in mass productions, so the cost of the system may come down. So in future it is expected to run all equipment's by using solar energy. This system is having facility of charging the batteries while the solar powered grass cutter is in motion. So it is much more suitable for grass cutting also. The same thing

can be operated in night time also, as there is a facility to charge these batteries in day light. The following Advancements can be made Automation of the vehicle. Flexibility of the cutter can be improved. Remote control can be modified with RF.

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