Design of Solar Power based Multipurpose Agriculture Robot

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Abstract:

In India nearly about 70 percentages of people are depending on agriculture. Numerous operations are performed in the agricultural field like seed sowing, grass cutting, ploughing etc. The present methods of seed sowing, pesticide spraying and grass cutting are difficult. The equipment's used for above actions are expensive and inconvenient to handle. So the agricultural system in India should be encouraged by developing a system which will reduce the man power and time. This work aims to design, develop and design of the robot which can sow the seeds, cut the grass and spray the pesticides, this whole system is powered by solar energy. The designed robot gets energy from solar panel and is operated using Wi-Fi/Android App which sends the signals to the robot for required mechanisms and movement of the robot. This increases the efficiency of seed sowing, spraying, ploughing and grass cutting and also reduces the problem encountered in manual planting.

Keywords— Agriculture robot, Seeding, Ploughing, Grass Cutting, Spraying.

I. INTRODUCTION

The primary occupation in a developing country like India is agriculture. But nowadays the number of people involved in agricultural sector is declining due to various reasons. It is essential to improve the efficiency and productivity of agriculture. By using this project, we can perform various tasks for agricultural purposes. Despite large-scale mechanization in agricultural field in some parts of the country, most of the agricultural operations in large number of parts are carried on by humans by using simple tools and implements like wooden plough, sickle, etc. Little or no use of machines is made in ploughing, sowing, irrigating, weeding the crops. This is specially the case with small and marginal farmers. It results in huge wastage of men power and in lower yields per capita labour force. Also During the work farmers must problems. At the time of spraying pesticide liquids, they pesticide liquids are harmful and dangerous for mankind, if they don't pay attention during spraying, they have to suffer problems. Time consumed for spraying the liquids in the field is more. So, we must mechanise the agricultural operations so that wastage of labour force is avoided, and farming is made convenient and efficient. To beat these issues, the mechanization advancements with robots were utilized as a part of agribusiness. The robotics helps the farmers in agriculture to reduce their efforts. The robot which performs functions like automatic seeding system, automatic pest control unit, automatic compost spraying etc is designed to ease the work of the farmers and increase the outcome. This beats the adversity of farmers in farming their land irrespective of the weather conditions.

II LITERATURE SURVEY

[1]. "Agricultural Robot for Automatic Sloughing and Seeding" 2015 Amrita Sega. A, Abrams. E, Ankita. A, Mrs. R. Praveen, Mrs. R. Simeon).

This paper strives to increase a robotic able to performing operations like computerized Ploughing, seed meting out. It also affords guide manage while required and maintains tabs on the humidity with the assist of humidity sensors. The main aspect right here is the AVR At mega microcontroller that supervises the complete process. Initially the robotic tills the complete subject and proceeds to sloughing, simultaneously meting out seeds aspect with the aid of using aspect. On the sphere the robotic operates on automatic mode, however out of doors the sphere is precisely operated in guide mode.

[2]. "Design and Implementation of Seeding Agricultural Robots" (IRAs) (P. Usha, V. Maheshwari, Dr. V. Nandagopal)
In this paper, the robotic device is used to develop the process of cultivating agricultural land without the usage of guy electricity. The intention of the paper is to lessen the person electricity, time and growth the productiveness rate.

[3]. "Automated Farming Using Microcontroller and Sensors" (Abdullah Tanveer, Abhishek Choudhary, Divya Pal, Rajani Gupta, Farooq Husain)
Farming may be accomplished in the use of new technology to yield higher boom of the vegetation. In this mission we're going to check temperature, light, humidity and soil moisture. The paper right here is all approximately computerized manage capabilities

with the latest electronics generation the use of microcontroller and GSM phone line. The mission works routinely and subsequently reduces the manpower

[4]. "IOT Based Smart Agriculture" June 2016 (Nikesh Gondchawar1, Prof. Dr. R. S. Kawitkar2)
In this paper a mission version for agriculture robotic is described the more modern situation of lowering water tables, drying up of rivers and tanks, unpredictable environment gift a pressing wants of right usage of water. To cope up with this, use of temperature and moisture sensor at appropriate places for tracking of vegetation is carried out in a set of rules evolved with threshold values of temperature and soil moisture may be programmed into a microcontroller-primarily based totally gateway to manipulate water quantity.

III EXISTING METHODOLOGY

Agricultural robotic system for agriculture which can be modeled by various purposes using algorithm for comfort to farmers and can be interfaced by using Arduino board and various types of sensors. Various aspects shows Agricultural robot serves better result than manual system. It is expected that recent trends in robots shall make it to be used in enhanced role in future. In agriculture, Agricultural robot can be experienced or several advancements. Implementation of Agricultural robot has significant saving in terms of time, efficiency and saving the wastage of resources and reduced utilization of man power should pay the cost once the system is activated. The scope of the system, especially in metro cities, is located in places where people are unaware of farming. Agriculture is more valuable compared to others fields for occupation. The utility of technology with agriculture consider for automation. The Farming System is a suitable system which aids to sure that it has wide scope for improvement, which in turn eases the agricultural system for the farmers and ultimately helps in effective crop productivity.

IV PROPOSED METHODOLOGY

Many of the system designed for agriculture operations of seed sowing, ploughing, grass cutting and Spraying are based on the camera and machine vision. The navigation of the vehicle is based on Wi-Fi and Mobile controlled system. Use of these systems can achieve the level of accuracy but the final cost of the product is very high. The system proposed in this Project is cost effective and does not require the costly equipment's for its navigation. It is designed to be automatic and light weight. These advantages make it real help to farmers.
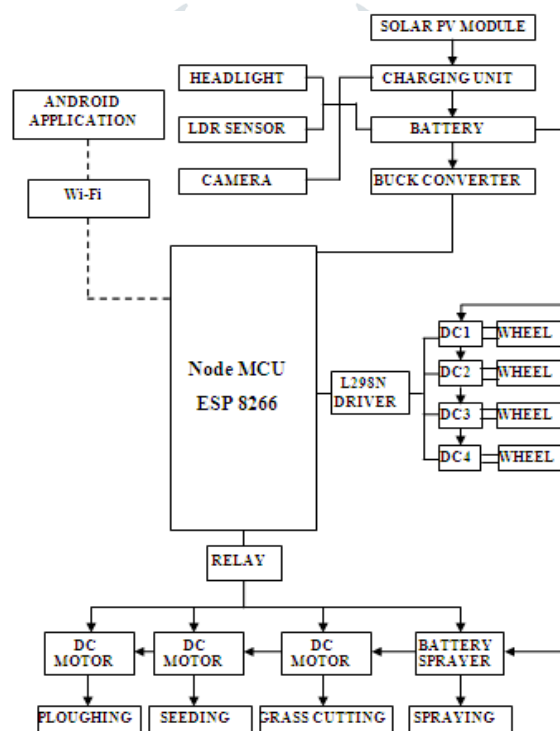

Fig. 1 Block Diagram

V Working

The main impact for our project has been to design a solar operates multipurpose agriculture Robot, which is powered by solar. The solar panel used energy this electrical energy used to charge the battery. The output of the solar is given to the charge controller unit. The function of charge controller unit is to prevent the battery from overcharge by regulating the voltage and current coming from the solar panel to the battery then the output of charger controller is given to the battery to store the energy generated from solar PV cells. The energy stored in the battery is given to the whole system

In the project Node MCU ESP 8266 acts as a heart of whole system and it is used to control the functions. These directions are commanded by the user by clicking on the respective options on the webpage. The command will transmit to the microcontroller. The microcontroller then drives the motor driver circuit to move the robot in directions like forward, reverse, left and right and to perform the operations like grass cutting, spraying, ploughing and seed sowing depending on command given through webpage. The operating voltage required for this Node MCU ESP 8266 is 3.3V this voltage obtains by using buck converter. The buck

converter acts as interface between the battery and NODE ESP 8266. The function of buck converter is to convert 12V to the 3.3V and this voltage given to the ESP NODE 8266 for performing operations.

All this operations are control by android application. The application is connected to NODE ESP 8266 through Wi-Fi support by IP address. Which operation we want to perform you can choose via application like forward, reverse, left and right, ploughing etc. we want to perform the operation as ploughing then go through the application and put the IP address to connect the Node MCU ESP 8266 via Wi-Fi then choose ploughing option. The command given through the application sends the signals to NODE ESP 8266 through Wi-Fi and the operation is performed. Motor drivers act as an interface between the motors and the control circuits. Motor require high amount of current whereas the controller circuit works on low current signals. So the function of motor drivers is to take a low-current control signal and then turn it into a higher-current signal that can drive a motor and also the motor driver which allows speed and direction control of two DC motors at the same time. TheL298N motor driver is used in the project. For pesticide spraying battery sprayer pump is used which operates on the voltage at 12V and 1.7A of current.

The LDR sensor is connected at the top of the solar panel and the connection of LDR sensor is given to the headlights as input. At the night work the head lights are automatically turns on. The LCD displayed is used to display the humidity and temperature. The camera is used for the monitoring the activity done by the robot and to control the directions where to work and where to run which operation.

I.Motion Control :-

For the motion control purpose, four DC gear motors (12V) can be used. The dc motors can be connected to the motor driver circuit. The motor driver converts the low input signal into high input signal. The dc gear motor is used to generate high torque. The motor driver is controlled by the raspberry pi which in turn drives the motors. The locomotion can do autonomously using image processing algorithms; also can be controlled by manual operation in app.

II.Seed Sower :-

In this section we design and fabricate a fully automated seed sower which operates when the user switch ON the seed sower button in the app. It has a funnel shaped seed collector which guides the seeds to a wheel arrangement. The motor is connected to the shaft which contains small bracket for pouring seeds in a wheel. When the switch is on, the seed sower starts implanting seeds into the ground. This ensures uniform implanting of seeds in the field

III.Harvester :-

It's a setup in which a rotating blade cuts the crop as the robot moves. The blade is run by the high-speed motor which ensures smooth cutting of the crop. This setup is suitable for commercial crops likes paddy and wheat.

IV. Monitoring :-

It has a camera which will give a live vision of the field so while it performs its basic operations, we can monitor everything in and around the field. It acts as an eye to access from IOT device. Other sensors like moisture sensor, temperature and humidity sensor, PIR sensor and fire sensors are also used for monitoring and controlling the field.
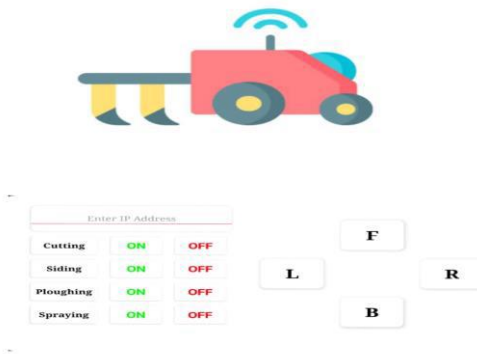

Fig. 2 IOT Controlled Agriculture Robot

Fig. 3 Login & Main Page

A. Ploughing Function

The Ploughing tool is interfaced with the Node MCU ESP 8266. The ploughing tool can be operated in two modes namely ON and OFF. The microcontroller will receive the command to work on any of these two modes and it directs the ploughing tool to plough the field accordingly.

Fig. 4 Ploughing

Table No.1

Sr. No	Parameter	Value obtained by proposed model
1.	Torque of the motor	1.7kg-cm
2.	Speed of the motor	90 RPM
3.	Distance covered by the model	100-120m
4.	Time taken by the proposed model	1 Min

B. Seed Sowing Function

The seeds are stored in a small container. This flip is controlled by the dc geared motor to slide on the strip. The speed of the motor can be controlled as per requires to be seeding and automatically seeds are sown in the field.
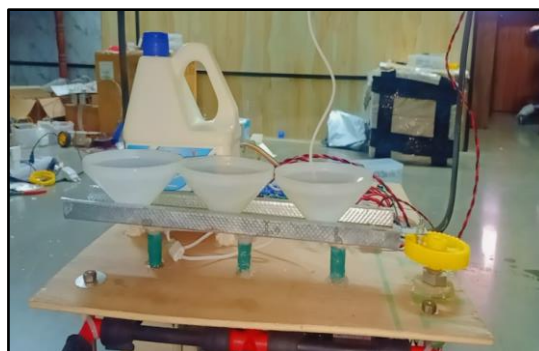

Fig.5 Seed Sowing

Table No.2

Sr. No	Parameter	Value obtained by proposed model
1.	Torque of the motor	7kg-cm
2.	Speed of the motor	10 RPM
3.	Distance covered by the model	3m × 3m
4.	Time taken by the proposed model	1 Min

C. Grass Cutting

Agriculture robot will perform grass or crop cutting using movement of the blades. DC motor will be used to rotate the blades

Fig .6 Grass Cutting

Table No.3

Sr. No	Parameter	Value obtained by proposed model
1.	Torque of the motor	0.5 kg-cm
2.	Speed of the motor	1000 RPM
3.	Distance covered by the model	4m × 4m
4.	Time taken by the proposed model	1 Min

D. Spraying Function

The pesticides are used to protect crop from insects and fungus. Spraying of some pesticides causes health issues to the workers. When chemicals like rodenticides and antimicrobials come into contact with the skin of the farmers they prone skin diseases. Thus, the agriculture robot equipped with pesticide sprayer

Fig. 7 Spraying

Table No.4

Sr. No	Parameter	Value obtained by proposed model
1.	Torque of the motor	0.004 kg-cm
2.	Speed of the motor	1000 RPM
3.	Distance covered by the model	4m × 4m
4.	Time taken by the proposed model	1 Min

VI Future Scope

Since the designed Agriculture robot is used only for Seed sowing, grass cutting, ploughing and spraying of pesticides controlled through internet of the thing, the following features can be added for enhancing the current project work: pH meter can be in order to determine the pH of the soil which helps to identify the suitable pesticide/fertilizer to be employed Moisture level sensor can be employed to know about the moisture content present in the soil of the farmland. GPS can be added to find the location of agriculture robot

VII Conclusion

After we have completed the "Multipurpose Agricultural Robot", we can conclude that, As per the overall performance of the machine, this project will satisfy the need of small scale farmer, because they cannot afford high cost agricultural equipment's. The machine will need less man to work with and will also save time as compared to the ancient and traditional methods. So if we make this available on a large scale, its cost significantly reduce and we hope this will help our farmers and contribute to our Indian agriculture.

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