SOLAR BASED MULTIPURPOSE ARICULTURE VEHICLE

Pagadala Shivani
Department of Embedded &VLSI
Nalla Narasimha Reddy Group of Institutions

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 Arduio uno microcontroller 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.

1.1 INTRODUCTION

In India there are 70 percentage of population chooses agriculture as a primary occupation. 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. system uses basic components like Solar panel, DC motor, Battery, Relay, Motor driver, Relay driver, Bluetooth Module and Arduio uno microcontroller. 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. The advantage of this solar powered multi-function Agrirobot 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 nodemcu controller. However, slabs have a number of drawbacks. Because it causes an increase in the size of all the other structural components, such as beams, columns, and footings, the high weight-to-strength ratio is the most critical concern.

1.2 BLOCK DIAGRAM

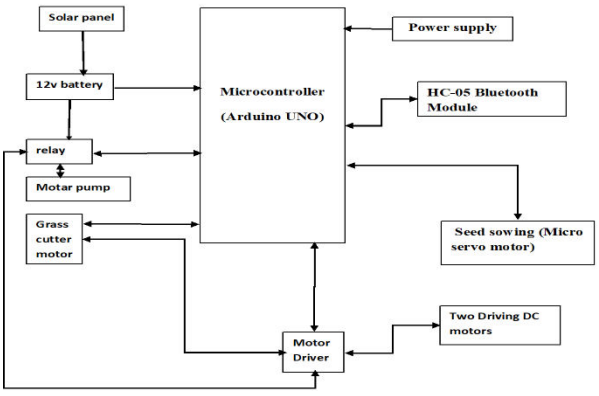


Fig:-Block diagram of solar based agriculture vehicle

1.3 WORKING

The block diagram consists of Arduio uno 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 Arduio uno microcontroller and wireless 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.

1.4 CIRCUIT DIAGRAM

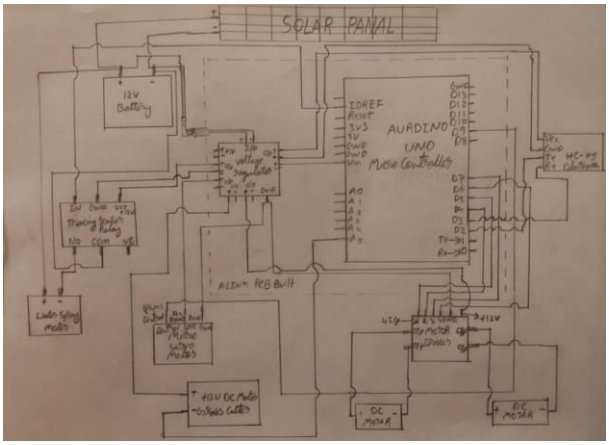


Fig:-circuit diagram of solar based agriculture vehicle

II. LITERATURE SURVEY

Agriculture automation has become an important research area due to increasing labor shortages, rising operational costs, and the need for sustainable farming practices. Several researchers have developed agricultural robots capable of performing multiple farming operations such as seed sowing, irrigation, crop monitoring, and weed removal.

Umarkar and Karwankar (2016) proposed an automated seed-sowing agribot using Arduino technology. Their system automated seed placement and improved sowing accuracy while reducing human effort. However, the robot was limited to seed sowing applications only.

Sujon et al. (2018) developed "Agribot," an Arduino-controlled autonomous multipurpose farm machinery robot for small- and medium-scale cultivation. The robot performed various farming tasks with minimal human intervention and demonstrated improved operational efficiency.

Jayakrishna et al. (2018) introduced an autonomous seed-sowing agricultural robot capable of precise seed placement. The proposed system enhanced crop productivity by maintaining uniform seed spacing and reducing seed wastage.

Kareemulla et al. (2018) presented a GPS-based autonomous agriculture robot for navigation and field operations. The integration of GPS technology improved route planning and reduced manual control requirements, making large-scale farming more efficient.

Ranjitha et al. (2019) proposed a solar-powered autonomous multipurpose agricultural robot controlled through a Bluetooth-enabled Android application. The system performed seed sowing, irrigation, and field monitoring while utilizing renewable solar energy, reducing dependence on conventional fuels.

Shivprasad et al. (2014) designed and implemented a seeding and fertilizing agricultural robot. Their work demonstrated the feasibility of integrating multiple farming functions into a single robotic platform, thereby improving farming efficiency and reducing labor requirements.

Naik et al. (2016) developed a precision agricultural robot focused on seed sowing operations. The robot achieved accurate seed dispensing and placement, contributing to better crop growth and yield optimization.

Santhi et al. (2017) proposed a sensor- and vision-based autonomous agribot for seed sowing. The integration of sensors and computer vision improved navigation accuracy and enabled intelligent decision-making in agricultural environments.

Research Gap

Although previous studies successfully implemented agricultural robots for individual tasks such as seed sowing, fertilizing, and irrigation, most systems were limited in functionality and depended on external power sources. Very few systems integrated multiple agricultural operations into a single solar-powered platform. Additionally, issues related to energy efficiency, cost-effectiveness, and ease of operation remain challenges for small-scale farmers.

III.HARDWARE SPECIFICATIONS

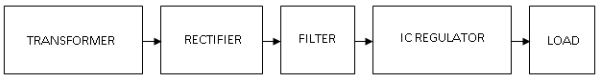
POWER SUPPLY

The power supply section is the section which provide +5V for the components to work. IC

LM7805 is used for providing a constant power of +5V.

The ac voltage, typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

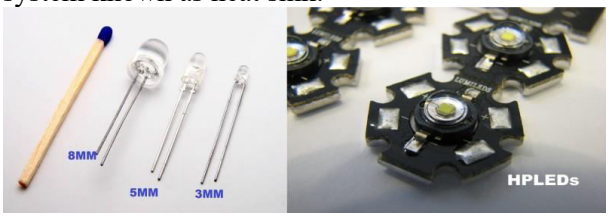
A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

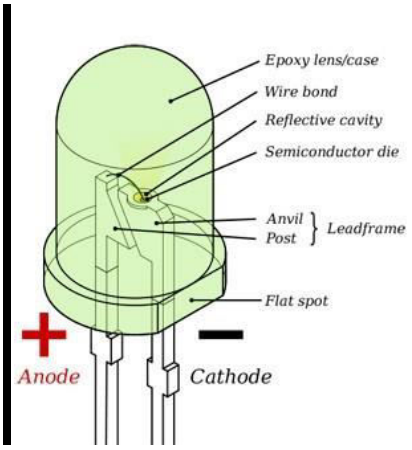


LIGHT EMITTING DIODE(LED)

LED is abbreviation of Light Emitting Diode. It's nothing, but just a combination of semiconductors which emits light when current pass through it . Over the years, semiconductor technology has advanced to bigger heights, Light Emitting Devices have also been a part of this revolution and as a result, Now we have LED's which give better illumination with low power consumption.

Types of LED– There are many types of LEDs available in the market.. As you can see on above pic there is different LEDs according to our requirement and there has been many other are too available depending upon different parameters . And LEDs are choose according to parameters like space required by it, size, intensity, colors, etc. Typical LEDs are in size of 3mm, 5mm and 8mm. Nowadays HPLEDs(high power LEDs) are running in market which emits higher luminous intensity. High power LED's has very high heat dissipation so LED's need to mounted along with a cooling system known as heat sink.





HC-05 Bluetooth Module

- HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.

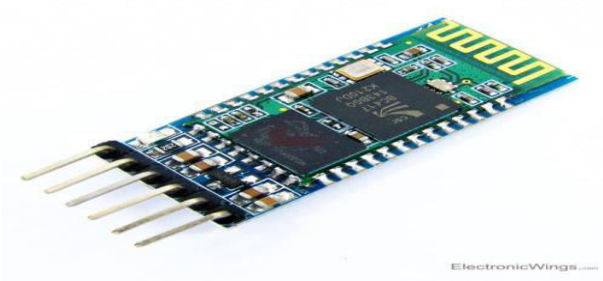


Fig:-HC-05 Bluetooth Module

1. **Key/EN:** It is used to bring Bluetooth module in AT commands mode. If Key/EN pin is set to high, then this module will work in command mode. Otherwise by default it is in data mode. The default baud rate of HC-05 in command mode is 38400bps and 9600 in data mode.

MICROCONTROLLER

A Microcontroller (or MCU) is a computer-on-a-chip used to control electronic devices. It is a type of microprocessor emphasizing self-sufficiency and cost-effectiveness, in contrast to a general-purpose microprocessor (the kind used in a PC). A typical microcontroller contains all the memory and interfaces needed for a simple application, whereas a general purpose microprocessor requires additional chips to provide these functions.

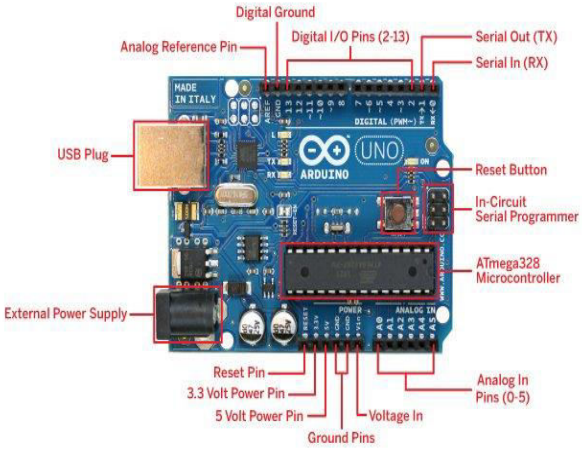
Micro controllers are inside many kinds of electronic equipment (see embedded system). They are the vast majority of all processor chips sold. Over 50% are "simple" controllers, and another 20% are more specialized digital signal processors (DSPs) (ref?). A typical home in a developed country is likely to have only one or two general-

purpose microprocessors but somewhere between one and two dozen micro-controllers. A typical mid range vehicle has as many as 50 or more micro-controllers. They can also be found in almost any electrical device: washing machines, microwave ovens, telephones etc.

Arduino Uno Board

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.



Arduino Board

DC MOTOR

Fig:- 12v DC Motor

BATTERY

Fig:- 12v battery

Defination:- A 12V battery refers to a type of battery that provides a nominal voltage of 12 volts. These batteries are commonly used in various applications due to their versatility and availability.

Voltage: A 12V battery is designed to provide a steady voltage of 12 volts. This voltage is commonly used in automotive, marine, and off-grid power systems, among other applications. It is important to note that the actual voltage of a 12V battery can vary slightly depending on the charge level and load conditions.

RELAY:

Fig:- SONGLE 12V 1-Way tracing sensor relay module

DEFINITION:- Relays are electromechanical devices that use an electromagnet to operate a pair of movable contacts from an open position to a closed position.

The advantage of relays is that it takes a relatively small amount of power to operate the relay coil. However a relay switch circuit can be used to control motors, heaters, lamps or AC circuits which themselves can draw a lot more electrical voltage, current and therefore power.

The electro-mechanical relay is an output device (actuator) which come in a whole host of shapes, sizes and designs, and have many uses and applications in electronic circuits. But while electrical relays can be used to allow low power electronic or computer type circuits to switch relatively high currents or voltages both "ON" or "OFF", some form of relay switch circuit is required to control it.

IV.ADVANTAGES

1. 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.
2. The vehicles are being developed for the processes for seed sowing, Grass cutter, Sprinkler. All of these functions have not yet performed using a single vehicle.
3. Initially the robot tills the entire field and proceeds to water sprinkler, simultaneously sowing seeds side by side.
4. Labour problem can be reduced. As compared to the manual and tractor-based sowing, time and energy required for this robot machine is less.
5. Also, wastage of seed is less.
6. Battery will be replaceable.

DISADVANTAGES

1.Main drawback of the system is robot moves in only one direction.

2.The main disadvantage of this system is it does not work well on no sun light areas

III.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 based multipurpose agriculture vehicle is shown in below figure

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

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 below figure.

Fig -4: Bluetooth Android App

V.CONCLUSIONS

solar-based agriculture vehicles offer a sustainable and efficient solution for various farming operations. By harnessing solar energy, these vehicles provide environmental benefits by reducing greenhouse gas emissions and dependence on fossil fuels. They offer cost savings by eliminating the need for fuel refills and reducing operational costs. Solar-powered vehicles increase efficiency and productivity in agricultural tasks, and their versatility allows for customization based on specific farming needs. These vehicles provide access to remote areas with limited energy availability and contribute to the sustainability and resilience of agricultural systems. Furthermore,

they incorporate technological advancements, automation, and precision farming tools, enhancing overall farm management and productivity. Overall, solar-based agriculture vehicles promote sustainable practices, cost-effectiveness, and technological innovation in the agricultural sector.

Future scope

Advancements in Technology: Continued advancements in solar power technology, energy storage systems, and vehicle automation will enhance the capabilities of solar-based agriculture vehicles. Integration with artificial intelligence, machine learning, and Internet of Things (IOT) technologies will enable intelligent decision-making, remote monitoring, and autonomous operation.

Autonomous Operation: The future of agriculture vehicles lies in autonomous operation. Solar-based agriculture vehicles equipped with advanced sensors, GPS, and machine vision technology will be capable of autonomous navigation, precise positioning, and intelligent operation. This will reduce the need for manual labor and improve overall efficiency.

Environmental Sustainability and Policy Support: With growing awareness and emphasis on environmental sustainability, there is increasing support for renewable energy-based solutions in agriculture. Governments and policymakers may incentivize the adoption of solar-based agriculture vehicles through grants, subsidies, and favorable regulations, further driving their future growth.

REFERENCES

[1] [Online].Available:http://www.fao.com/india/faoin-india/india-at-a-glance/en/ [Accessed Nov 2019].

[2] [Online].Available: http://blog.robotiq.com/top10-robotic-application-in-agriculturalindustry. [Accessed December 2019].

[3] [Online].Available:https://components101.com/wireless/hc-05-bluetoothmodule. [Accessed Nov 2019].

[4] S. Umarkar and A. Karwankar, “Automated Seed Sowing Agribot using Arduino", IEEE Conference on Communication and Signal Processing, April 2016, pp.1379-1383.

[5] M.D.I. Sujon, R. Nasir, M.M.I. Habib, M.I. Nomaan J. Baidya and M.R. Islam “Agribot: Arduino Controlled Autonomous Multipurpose Farm Machinery Robot for Small to medium scale cultivation", IEEE conference on intelligent autonomous systems,March 2018, pp.155- 159.

[6] P.V.S. Jayakrisna, M.S. Reddy, N.J. Sai, N. Susheel and K.P. Peeyush, “Autonomous Seed Sowing Agricultural Robot”, in IEEE Conference on advances in computing, communications and informatics (ICACCI),2018, pp.2332-2336.

[7] S. Kareemulla, E. Prajwal, B. Sujeshkumar, B. Mahesh, and V Reddy, “GPS based Autonomous Agriculture Robot”, IEEE International conference on design innovations for 3Cs compute communicate control, 2018, pp.100-105.

[8] Ranjitha B., Nikhitha M. N. and Aruna K, “Solar Powered Autonomous Multipurpose Agricultural Robot Using Bluetooth/Android App”, IEEE Conference on Electronics Communication and Aerospace Technology [ICECA], June 2019, pp.872-877.

[9] B. S. Shivprasad, M. N. Ravishankara, B. N. Shoba, “Design and Implementation of Seeding and Fertilizing Agricultural Robot”, International Journal of Application or Innovation Engineering and Management(IJAIEM), Volume 3, Issue6, June 2014.

[10] S. Konam, N. Srinivasa Rao and K. Mohan Krishna, “Design encompassing mechanical aspects of ROTAAI: Robot to aid agricultural industry”, in IEEE International conference on soft computing and machine intelligence, 2014, pp.15-19.

[11] C.M. Barber, R.J. Shucksmith, B.M. Donald and B.C Wunsche, “Sketch-based robot programming,” in IEEE International conference of image and vision computing newzealand, 2010, pp. 1-8.

[12] N.S. Naik, V.V.Shete and S.R.Danve, “Precision agricultural robot for seed function”, in IEEE International conference on inventive computational technologies (ICICT), 2016, pp.15-19.

[13] P.V. Santhi, N. Kapileshwae, V. K. R. Chenchela and C. H. V. S. Prasad, “Sensor and vision based autonomous agribot for sowing seeds”, in IEEE International conference on energy communication, data analysis and soft computing (ICECDS), 2017, pp. 242-245.