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Modern Techniques for Precision Agriculture by Semi Robot

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Abstract

Agriculture is the backbone of Indian economy. About half of the total population of our country has chosen agriculture as their chief occupation. As the centuries passed, certain modern techniques were invented in agriculture due to progress in science. These modern techniques include the use of tractors for ploughing the field. This agricultural project is proposed to improvise the technologies in agriculture. Here we focused on environment, cost effective. It is basically an embedded tool for furrowing, seed sowing, mud leveller, and pesticide sprayer. In traditional the ploughing machines are heavily based on fuel which may results in air pollution and it produces CO_2 greenhouses gases. Solar energy is being used to charge the battery, which, acts as a power source to DC shunt motor, Arduino and other components. The entire agriculture system is controlled by mobile using BLYNK the RF technology used for controlling multiple operations simultaneously. It can cover a certain distance. It also contains a camera which is used to monitor the working progress. The multipurpose agriculture equipment is very simple and the various adjustments are made with ease.

Index Terms: Agricultural machinery, electric drives, heavy vehicles, hybrid electric tractors, off-road vehicles.

1. Introduction

In agriculture, the opportunity for robot-enhanced productivity is immense and the robots are appearing on farms in various guises and in increasing numbers. We can expect the robots performing agriculture operations autonomous such as digging the mud, seed sowing, mud closing pesticides spraying and cutting of weeds. Seed sowing process is done by man power alone. After the evaluation in modern agriculture the ploughing, seed sowing, mud leveller and pesticide sprayer are in a separate manner. This type of mechanism requires heavy load and it consumes more cost and also it cause more time to do all these. Watching the farms days and night for an effective report, allowing farmers to reduce the environment impact, increase precision and efficiency and manage individual plants in novel ways. Nearly 58% peoples life is depend on agriculture basis in India. 14% GDP contributed by agriculture. Between 26 and 40 percent of the world's potential crop production is lost annually because of weeds, pests and disease. Without crop protection, these losses could easily double. We have used DC motor and pump motor which has four wheels. The agriculture farm is cultivated by the ploughing machine.

The IR camera detects the weeds or unwanted plants in the fields and these were cutted by the rotating cutting blades, Ultrasonic sensor deducts the blocks in the path with measure the distance between both robot and block. Also senses truing position of our vehicle at end of the cach column. The seed block can be detected and solved using water pressure. The mud leveller is fitted to close the seeds to the soil and to level ground. Pesticides sprayer is used to spray the pesticide and also kill the bug.

2. Related Works

Xuanzuo Liu, David Cebon, Anil K. Madhusudhanam focuses on a new approach for autonomous reversing of a tractor semitrailer vehicle called minimum swept path control (MSPC), MSPC improves the performance of previous path following control strategies, by minimizing the maximum excursion of the vehicle, while guaranteeing acceptable path following accuracy. A linear controller is devised, combining state feedback control with an optimized preview distance. A relationship between the maximum lacteral offsets of the front axle of the tractor unit and the rear axle of the last trailer and the corresponding weights in the control cost function is t established, and the controller is tuned to provide the best performance compromise. Several simulations of a tractor-semitrailer case are run, and the results show that the overall swept path width is reduced by more than 40% when compared with PFC methods.

Christopher Lehnert, Andrew English, Christopher Mccool, Adam W.Tow, and Tristan Perez have proposed a new robotic harvester (Harvey) that can autonomously harvest sweet pepper in protected cropping environments. Our approach combines effective vision algorithms with a novel end-effector design to enable successful harvesting of sweet peppers. Initial field trials in protected cropping environments, with two cultivar, demonstrate the efficacy of this approach achieving a 46% success rate for unmodified crop, and 58% for modified crop. Furthermore, for the more favourable cultivar we were also able to detach 90% of sweet peppers, indicating that improvements in the grasping success rate would result in greatly improved harvesting performance.

Syeda Iqsa Hassan, Usman Illahin have proposed the path following performance of actively-steered articulated vehicles based on measurement signals from two "ground-watching" navigation systems (GWNSs). The GWNSS are described. These use high-speed USB-3 cameras and an image processing computer to measure and calculate off- tracking distance for a path-following steering controller. Full-scale field tests are performed using an experimental articulated vehicle, tested under both open-loop and closed-loop conditions Off-tracking distance at the rear camera with respect to the front camera is controlled to be less than 0.1 m for tests with both GWNSS.

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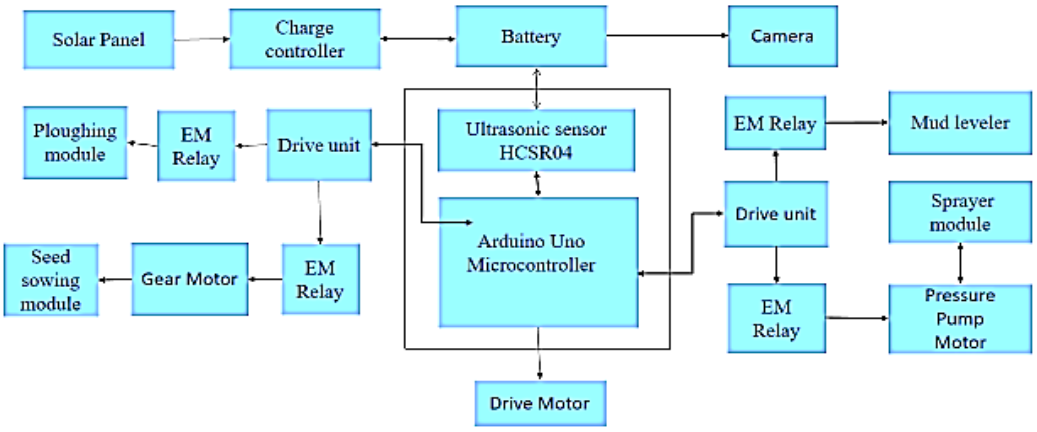
3. Block Diagram



4. Materials and Methodology

Device assembly is built using node MCU ESP8266 microcontroller, DC motor, ultrasonic sensor for obstacle detection, relay, RF, charging unit and motor driven unit. The assemblies of this component are appeared in appropriate places. The vehicle when DC motor starts. It has furrowing tool, seed sowing unit, levelling section, spraying unit. The moment vehicle is controlled by the remote. If there is any obstacle in the way of vehicle it will be signal to the vehicles. The furrowing machine is on to start process.

a) Controller unit
b) DC motor
c) Relay and Switch
d) IR Sensor
e) Stepper motor
f) Power Supply, Battery and Solar Panel

4.1 Controller Unit

This is said to the brain of the project since, it control the entire working model by collecting the information. Arduino Uno Microcontroller is used here.

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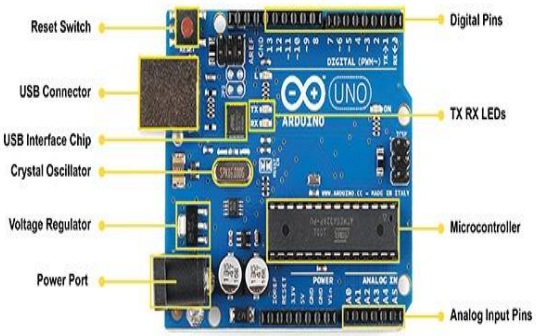
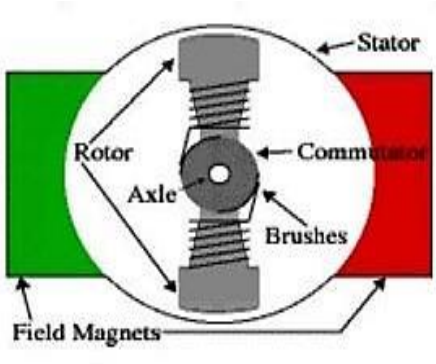


4.2 DC Motor

In any electric motor, operation is based on simply electro magnetism. A current carrying conductor generates a magnetic field. When this is placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and south) polarities attract, while lite polarities (North and south, south and south) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current carrying conductor and an external magnetic field to generate rotational motion.



Let's start by looping at a simple 2-pole DC electric motor (here red represents a magnet or winding with a "north" polarization, while green represents a magnet or winding with a "south" polarization).The stator is the stationary part of the motor this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotors (together with the axle and attached commutator) rotate with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator. The above diagram shows a common motor layout with the rotor inside the stator (field) magnets. The stator is the stationary part of the motor this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotors (together with the axle and attached commutator) rotate with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator. The above diagram shows a common motor layout with the rotor inside the stator (field) magnets.

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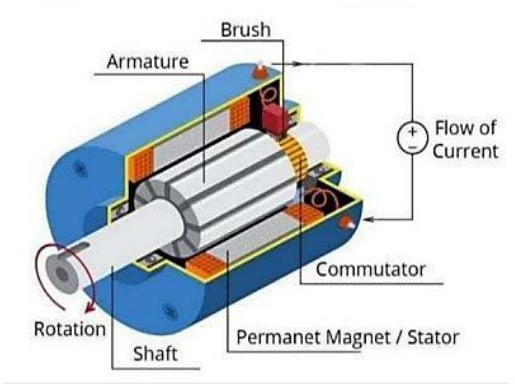

Specifications of DC Motor

- Voltage:12 v
- Power: 1.1 w
- Rpm: 26 rpm.
- Weight: 160 g
- Length: 27mm
- Torque:588mNm
- Shaft diameter: 37m

4.3 Relay and Switch

4.3.1 Relay

Relays are simply switches which are operated both electrically and mechanically. Relays consist of an n electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their applications. Most of the devices have the application of relays. The main operation of a relay comes in places where only a low- power signal can be used to control a circuit. It also used in places where only one signal can be used to control a lot of circuits. They played an important role in switching calls in telephone exchanges. They were also used in long distance telegraphy. They were used to switch the signal coming from one source to another destination.

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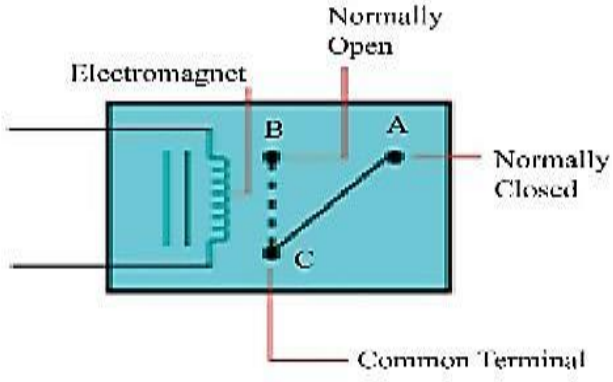


After the invention of computers they were also used to perform Boolean and other logical operations. The high end applications of relays require high power to be driven by electric motors and so on. There are only three main parts in a relay. They are

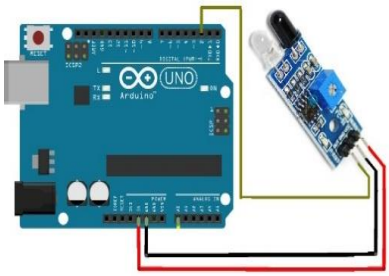
- Electromagnet
- Movable armature
- Switch point contacts

4.3.2 Switch

A relay is an electrically operates a switch is an electronic component or device that can switch an electrical circuit, interrupting the current or diverting it from one conductor to another. The most common type of switch is an electromechanical device consisting of one or more sets of movable electrical contact connected to external circuits. When a pair of contacts is touching current can pass between them, while when the contacts are separated no current can flow. It is used in ON and OFF purpose of our proposed system.

4.4 IR Sensor

This is a multipurpose infrared sensor which can be used for colour detection. The sensor provides a digital as well as Analog output, an on board LED is used to indicate the presence of an object. This digital output is connected to a Arduino. In agriculture field is used both Analog and digital IR sensor used. If the sensors can be placed on our proposed vehicle. It measures the different type of frequencies of light reflectance.



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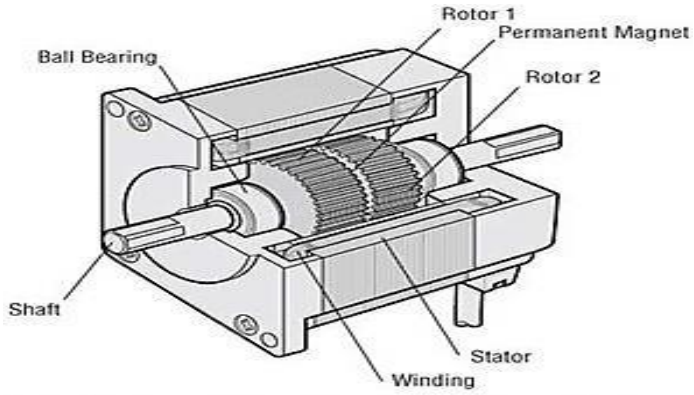
It operates at a frequency range approximately 430THz. But it down to the frequency is 300GHz. We have to use of our device frequency is 300 to 450 GHz. IR sensor have four pins to connected the Node MCU. An infrared sensor emits and /or detects infrared radiation to sense it surroundings. Which is used as obstacle detector is to transmit an infrared signal, this infrared siunces from the surface of an object and the signal is received at the receiver.

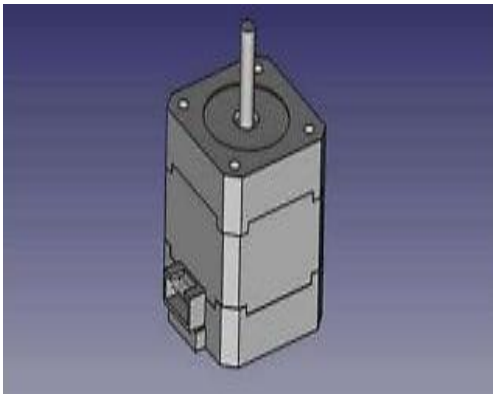
Specifications of IR Sensor

- Voltage: 12V
- Power: 18W
- Size: 120*120*150mm
- Weight: 1.6 Kg

4.5 Stepper Motor

The operations of this motor working on the principle that unlike poles attract each other and like poles repel each other. It is a digital version of the electric motor. The rotor moves in discrete steps as commanded, rather than rotating continuously like a conventional motor. When stopped but energized, a stepper (short for stepper motor) hold its load steady with a holding torque.





4.6 Sprayer

Agriculture sprayer are used to spray and dust probes and require motor change that it will be stand moisture humidity and various conditions.

4.7 Seeders

This type of equipment is used to plays crop seeds into the ground throughout the year, requiring motors to run openers and seed packets.

Specifications of Stepper Motor

- Voltage: 12V
- Current: 400mA Size: 17
- Step angle: 1.8deg
- Inductance per phase: 23mH
- Weight: 0.24kg
- Power: 5w
- Height: 1.5in

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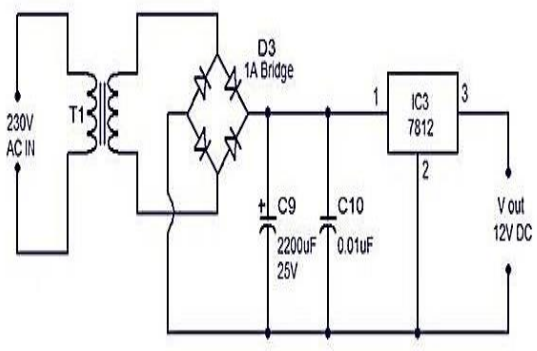
4.8 Power Supply, Battery and Solar Panel

4.8.1 Power Supply

The power supply source build using filters, rectifier and voltage regulators. Starting with an AC voltage, a steady DC voltage is obtained by rectifying the AC voltage, then filtering to a DC level, and finally, regulating to obtain a desired fixed DC voltage. The regulation is usually obtained from an IC DC voltage, regulator unit which takes a DC voltage and provides a somewhat lower DC voltage, which remains the same even if the input DC voltage varies, or the output load connected to the DC voltage changes.



Available power source is an AC voltage arrives at 230V. Since our electronic circuit require only very minimal voltage and current. We use step down power transformer. Step down transformer is designed in away such a way that the input is 230V and the output is 12V.

Specifications of Power Supply

- Repetition rate: 25Hz
- Frequency :50 Hz
- Voltage: 12V
- Current : 1000mA
- Power: 12W
- Length: 86mm
- Width: 150mm

4.8.2 Battery

An electric battery is a collection of one or more electrochemical cells in which stored chemical energy is converted into electrical energy. The principles of operation haven't changed much since the time of Volta. Each cell consist of two half cells connected in the series through an electrolytic solution.

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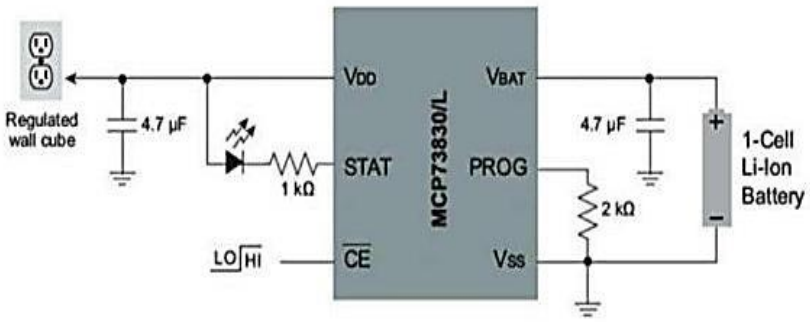
One half cell houses the anode to which the positive ions migrate from the electrolyte and the other houses the cathode in which the negativeenes drift. The two cells are may be connected via a semi permeable membranous structure allowing ions to floe but not the mixing of electrolytes as in the case of most primary cells or in the same solution as in secondary cells.



The electrical energy released in the difference in the cohesive or molecules undergoing electrochemical reaction. It stores the chemical energy. Battery involved in the flow of electronic mechanism. The block diagram of battery connection is shown.

Specifications of Battery

- Voltage: 58V
- Capacity: 375kWh
- No of cells: 3201
- Efficiency83%
- Current: 726 A3634
- Power output: 52.1 kW

4.8.3 Solar Panel

Solar cells or photovoltaic cells are made based on the principle of the **photovoltaic effect**. They convert sunlight into direct current (DC) electricity. But, a single photovoltaic cell does not produce enough amount of electricity. So, solar panel (cluster of solar cells) is used to get large amount of electricity. To charge a battery with a solar panel, connection between the charge Controller and the solar panel has been made.

Specifications of Solar Panel

- Voltage: 12V
- Power: 10W
- Length: 300mm
- Width: 200mm

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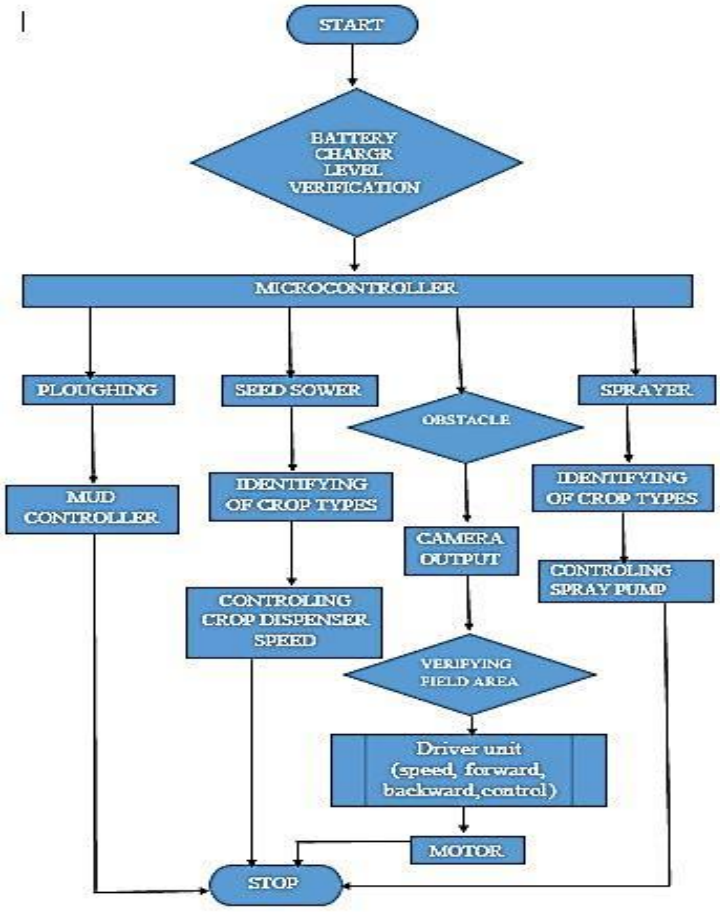

5. Results and Discussions

This project describes final results of a proposed system. Here statuses of all the sensors are monitored by using RF technology. The most common benefit of this project is implemented with portable digging, seed sowing, mud leveler and sprayer which operate on RF communication. The overall implementation cost is minimum and it reduces time consumption and labour costs are less.

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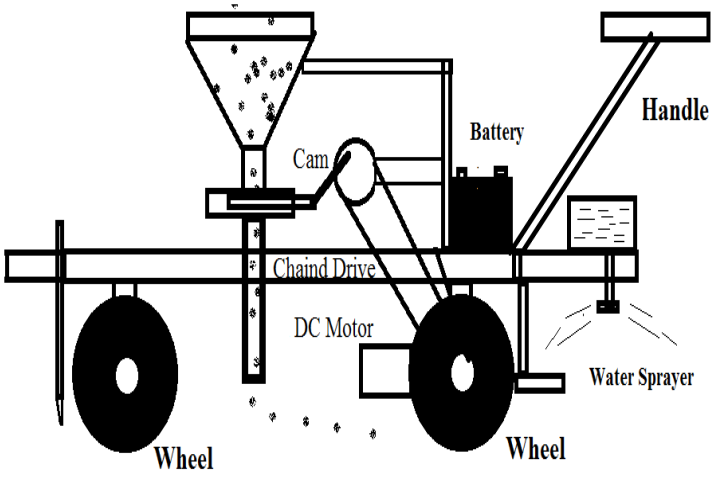

6. Conclusion

In agriculture, the opportunities for robot-enhanced productivity are immense - and the robots are appearing on farms in various guises and in increasing numbers. The other problems associated with autonomous farm equipment can probably be overcome with technology. This equipment may be in our future, but there are important reasons for thinking that it may not be just replacing the human driver with a computer. It may mean a rethinking of how crop production is done. The jobs in agriculture are a drag. Dangerous, require intelligence and quick. Though highly repetitive decisions hence robots can be rightly substituted with human operator. The higher quality products can be sensed by machines accurately. The present situation in our country all the agricultural machine is working on manual operation otherwise by petrol engine or tractor is expensive, farmer can't work for long time manually to avoid this problem, we need to have some kind of power source: system to operate the digging machine

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