An Innovative Model for Multipurpose Agriculture Robot

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Abstract:
The paper aims on the design, development and the fabrication of the robot which can dig the soil, put the seeds, leveller to close the mud and sprayer to spray water, these whole systems of the robot works with the battery and the solar power. More than 40% of the population in the world chooses agriculture as the primary occupation, in recent years the development of the autonomous vehicles in the agriculture has experienced increased interest. The vehicle is controlled by Relay switch through IR sensor input. The language input allows a user to interact with the robot which is familiar to most of the people. The advantages of these robots are hands-free and fast data input operations. In the field of agricultural autonomous vehicle, a concept has been developed to investigate if multiple small autonomous machine could be more efficient than traditional large tractors and human forces. Keeping the above ideology in mind, a unit with the following feature is designed.

Keywords: robot, mud and sprayer to spray water, agriculture, IR sensor.

1. INTRODUCTION

The agricultural has always been the backbone of India’s sustained growth. As the population of India continues to grow, the demand for produce grows as well. Hence, there is a greater need for multiple cropping in the farms and this in turn requires efficient and time saving machines. The paper discusses different types of seed sowing machine which will be helpful for the agriculture industry to move towards mechanization.

1.1 TRADITIONAL SOWING METHODS

Traditional methods include broadcasting manually, opening furrows by a country plough and dropping seeds by hand and dropping seeds in the furrow through a bamboo/metal funnel attached to a country plough. For sowing in small areas dibbling i.e., making holes or slits by a stick or tool and dropping seeds by hand, is practiced. Multi row traditional seeding devices with manual metering of seeds are quite popular with experienced farmers. In manual seeding, it is not possible to achieve uniformity in distribution of seeds. A farmer may sow at desired seed rate but inter-row and intra-row distribution of seeds is likely to be uneven resulting in bunching and gaps in field.

Traditional sowing methods have following limitations:

- In manual seeding, it is not possible to achieve uniformity in distribution of seeds.
- A farmer may sow at desired seed rate but inter-row and intra-row distribution of seeds is likely to be uneven resulting in bunching and gaps in field.
- Poor control over depth of seed placement. Labor requirement is high because two persons are required for dropping seed and fertilizer.
- The effect of inaccuracies in seed placement on plant stand is greater in case of crops.

2. DESCRIPTION OF COMPONENTS

2.1 ROLLER

It is a cylinder made out of mild steel. It has a length of 85mm and outer diameter is 67mm and inner diameter of 8mm.

2.2 BELT

Flat belts were used early in line shafting to transmit power in factories. It is a simple system of power transmission that was well suited to its day. It delivered high power for high speeds (500 hp for 10,000 ft/min), in cases of wide belts and large pulleys. These drives are bulky, requiring high tension leading to high loads, so “v” belts have mainly replaced the flat-belts (except when high speed is needed over power. The Industrial Revolution soon demanded more from the system, and flat belt pulleys need to be carefully aligned to prevent the belt from slipping off. Because flat belts tend to slip towards the higher side of the pulley, pulleys were made with a slightly convex or "crowned" surface (rather than flat) to keep the belts centered. The flat belt also tends to slip on the pulley face when heavy loads are applied.

Many proprietary dressings were available that could be applied to the belts to increase friction, and so power transmission. Grip was better if the belt was assembled with the hair (i.e. outer) side of the leather against the pulley although belts were also often given a half-twist before joining the ends. So that wear was evenly distributed on both sides of the belt. Belts were joined by lacing the ends together with leather thonging or later by patent steel comb fasteners. A good modern use for a flat belt is with smaller pulleys and large central distances. They can connect inside and outside pulleys, and can come in both endless and jointed construction.

3. MOTOR

3.1 D.C. Motor principle

A machine that converts direct current power into mechanical power is known as D.C Motor. Its generation is based on the principle that when a current carrying conductor...
is placed in a magnetic field, the conductor experiences a mechanical force. The direction if this force is given by Fleming’s left hand rule.

3.2 Working of a DC motor

Consider a part of a multipolar dc motor as shown in fig. when the terminals of the motor are connected to an external source of dc supply; The field magnets are excited developing alternate N and S poles. The armature conductors carry currents. All conductors under N-pole carry currents in one direction while all the conductors under S-pole carry currents in the opposite direction.

Figure 3.1 Working of a DC motor

Suppose the conductors under N-pole carry currents into the plane of paper and those under S-pole carry current out of the plane of paper as shown in fig. Since each armature conductor is carrying current and is placed in the magnetic field, mechanical force acts on it. Applying Fleming’s left hand rule, it is clear that force on each conductor is tending to rotate the armature in anticlockwise direction. All these forces add together to produce a driving torque which sets the armature rotating. When the conductor moves from one side of the brush to the other, current in the conductor is received and at the same time it comes under the influence of next pole which is of opposite polarity. Consequently the direction of force on the conductor remains same.

3.3 Principles of operation

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then 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 like polarities (North and North, 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 looking 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). Every DC motor has six basic parts – axle, rotor (armature), stator, commutator, field magnet(s), and brushes. In most common DC motors, the external magnetic field is produced by high-strength permanent 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 rotor (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 geometry of the brushes, commutator contacts, and rotor windings are such that when power is applied, the polarities of the energized winding and the stator magnet(s) are misaligned, and the rotor will rotate until it is almost aligned with the stator's field magnets. As the rotor reaches alignment, the brushes move to the next commutator contacts, and energize the next winding. Given our example two-pole motor, the rotation reverses the direction of current through the rotor winding, leading to a "flip" of the rotor's magnetic field, driving it to continue rotating.

A few things from this -- namely, one pole is fully energized at a time (but two others are "partially" energized). As each brush transitions from one commutator contact to the next, one coil's field will rapidly collapse, as the next coil's field will rapidly charge up (this occurs within a few microsecond). We'll see more about the effects of this later, but in the meantime you can see that this is a direct result of the coil windings' series wiring:

The coreless design also allows manufacturers to build smaller motors; meanwhile, due to the lack of iron in their rotors, coreless motors are somewhat prone to overheating. As a result, this design is generally used just in small, low-power motors. Beamers will most often see coreless DC motors in the form of pager motors.

Again, disassembling a coreless motor can be instructive -- in this case, my hapless victim was a cheap pager vibrator motor. The guts of this disassembled motor are available (on 10 lines/cm graph paper). This is (or more accurately, was) a 3-pole coreless DC motor.

3.4 Limitation of the DC Motor

We never aim at achieving maximum power due to the following reasons:

The armature current under this condition is very large – much excess of rated current of the machine.

Half of the input power is wasted in the armature circuit, in fact if we take into account other losses (iron and mechanical), the efficiency will be well below 50%.

4. BEARING

4.1 Rolling Bearings

4.1.1 Rolling bearing construction

Most rolling bearings consist of rings with raceway (inner ring and outer ring), rolling elements (either balls or rollers) and cage. The cage separates the rolling elements at regular intervals, holds them in place within the inner and outer raceways, and allows them to rotate freely.
4.1.2 Raceway

The surface on which rolling elements roll is called the "raceway surface". The load placed on the bearing is supported by this contact surface. Generally the inner ring fits on the axle or shaft and the outer ring on the housing. Note 1: The raceway of thrust bearing is called "raceway washer," the inner ring is called the "shaft raceway washer" and the outer ring is called the "housing raceway washer."

4.1.3 Rolling elements

Rolling elements classify in two types: balls and rollers. Rollers come in four types: cylindrical, needle, tapered, and spherical. Balls geometrically contact with the raceway surfaces of the inner and outer rings at "points," while the contact surface of rollers is a "line" contact. Theoretically, rolling bearings are so constructed as to allow the rolling elements to rotate orbitally while also rotating on their own axes at the same time.

4.1.4 Cages

Cages function to maintain rolling elements at a uniform pitch so load is never applied directly to the cage and to prevent the rolling elements from falling out when handling the bearing. Types of cages differ according to way they are manufactured, and include pressed, machined and formed cages.

4.1.5 Classification of rolling bearings

Rolling bearings divide into two main classifications: ball bearings and roller bearings. Ball bearings are classified according to their bearing ring configurations: deep groove type and angular contact type. Roller bearings on the other hand are classified according to the shape of the rollers: cylindrical, needle, tapered and spherical. Rolling bearings can be further classified according to the direction in which the load is applied; radial bearings carry radial loads and thrust bearings carry axial loads. Other classification methods include: 1) number of rolling rows (single, double, or 4-row), 2) separable and non-separable, in which either the inner ring or the outer ring can be detached. There are also bearings designed for special applications, such as: railway car journal roller bearings, ball screw support bearings, turntable bearings, as well as linear motion bearings (linear ball bearings, linear roller bearings and linear flat roller bearings). Types of rolling bearings are given in.

4.1.6 Needle roller bearings

Needle roller bearings use needle rollers as rolling elements. The needle rollers are a maximum of 5 mm in diameter and are 3 to 10 times as long as they are in diameter. Because the bearings use needle rollers as rolling elements, the cross-section is thin, but they have a high load capacity for their size. Because of the large number of rolling elements, the bearings have high rigidity and are ideally suited to wobbling or pivoting motion. There is a profusion of types of needle roller bearings, and just a few of the most representative types are covered here. For details, see the catalog devoted to the concerned type of bearing.

4.2 BEARNING UNIT

A unit comprised of a ball bearing inserted into various types of housings. The housing can be bolted onto machinery and the inner ring can be easily mounted on the shaft with a set screw. This means the bearing unit can support rotating equipment without special design to allow for mounting. Variety of standardized housing shapes is available, including pillow and flange types. The outer diameter of the bearing is spherical just like the inner diameter of the housing, so it capable of aligning itself on the shaft. For lubrication, grease is sealed inside the bearing, and particle generation is prevented by a double seal. For details, see the catalog devoted to the concerned type of bearing.

5. BATTERY

In our project we are using secondary type battery. It is rechargeable Type. A battery is one or more electrochemical cells, which store chemical energy and make it available as electric current. There are two types of batteries, primary (disposable) and secondary (rechargeable), both of which convert chemical energy to electrical energy. Primary batteries can only be used once because they use up their chemicals in an irreversible reaction. Secondary batteries can be recharged because the chemical reactions they use are reversible; they are recharged by running a charging current through the battery, but in the opposite direction of the discharge current. Secondary, also called rechargeable batteries can be charged and discharged many times before wearing out. After wearing out some batteries can be recycled.
One half-cell is the positive electrode, and the other is the negative electrode. The electrodes do not touch each other but are electrically connected by the electrolyte, which can be either solid or liquid. A battery can be simply modeled as a perfect voltage source which has its own resistance, the resulting voltage across the load depends on the ratio of the battery's internal resistance to the resistance of the load.

6. WATER PUMP

Water pump is a device which is used to pump the water from one source to another place. It also used to circulate the water flow and transfer the fluid. We generally recommend that on average, you turn over your aquarium four times per hour. This means that if you have a 30 gallon tank, you need a pump and filter with flow rates of around 120 gph.

7. SOLAR PANEL

The term solar panel is used colloquially for a photo-voltaic (PV) module. A PV module is an assembly of photo-voltaic cells mounted in a framework for installation. Photo-voltaic cells use sunlight as a source of energy and generate direct current electricity. A collection of PV modules is called a PV Panel, and a system of Panels is an Array. Arrays of a photovoltaic system supply solar electricity to electrical equipment. The cells are connected electrically in series, one to another to the desired voltage, and then in parallel to increase amperage. The wattage of the module is the mathematical product of the voltage and the amperage of the module. The manufacture specifications on solar panels are obtained under standard condition which is not the real operating condition the solar panels are exposed to on the installation site. A PV junction box is attached to the back of the solar panel and functions as its output interface. External connections for most photovoltaic modules use MC4 connectors to facilitate easy weatherproof connections to the rest of the system. A USB power interface can also be used. Order of module connection Module electrical connections are made in series to achieve a desired output voltage or in parallel to provide a desired current capability (amperes) of the solar panel or the PV system. The conducting wires that take the current off the modules are sized according to the ampacity and may contain silver, copper or other non-magnetic conductive transition metals. Bypass diodes may be incorporated or used externally, in case of partial module shading, to maximize the output of module sections still illuminated. Radiation-dependent efficiency

Depending on construction, photovoltaic modules can produce electricity from a range of frequencies of light, but usually cannot cover the entire solar radiation range (specifically, ultraviolet, infrared and low or diffused light). Hence, much of the incident sunlight energy is wasted by solar modules, and they can give far higher efficiencies if illuminated with monochromatic light. Therefore, another design concept is to split the light into six to eight different wavelength ranges that will produce a different color of light, and direct the beams onto different cells tuned to those ranges. This has been projected to be capable of raising efficiency by 50%. Arrays of PV modules

A single solar module can produce only a limited amount of power; most installations contain multiple modules adding voltages or current to the wiring and PV system. A photovoltaic system typically includes an array of photovoltaic modules, an inverter, a battery pack for energy storage, charge controller, interconnection wiring, circuit breakers, fuses, disconnect switches, voltage meters, and optionally a solar tracking mechanism. Equipment is carefully selected to optimize output, energy storage, reduce power loss during power transmission, and conversion from direct current to alternating current. solar energy that does make it to Earth’s surface is in the form of visible light. Solar cells can use the energy of this light to make electricity. But they don’t work equally well with all forms of light. Different types of solar cells use different wavelengths. This means a cell can use only some of the solar energy that it receives.

Many experts think even bigger power plants using solar panels will be built in the coming years. Someday there may be solar plants able to make as much as 500 megawatts of power. That is about what a typical coal power plant produces today. Solar panels work best when they directly face the Sun. For this reason, the panels are often put on “trackers.” The trackers turn the panels so that they follow the Sun as it moves across the sky.

8. WORKING PRINCIPLE

This project is designed by following blocks, Cam, Chain Drive, Chain sprocket, Seed stopper and Flat face follower. It is simple in construction made up of four wheel used to move the machine manually. It consists of two wheel shaft one is fixed in front and another one at the back side. The bearings are welded on the back wheel supporting shaft with sprocket arrangements which is shown in fig the sprocket is connected to the cam shaft through chain drive. When we move the setup the sprocket starts to rotate. It is easy to operate and more efficient. Sand digger can be located in front of the vehicle so it can digging the soil for better seed sowing process. It can be Up-down movement. When the vehicle is in agriculture field it can be allowed to down by screw arrangement and in normal condition it can be hold up by screw arrangement.

Solar panel can be located at the top of the robot because it can be used to convert sunlight energy into electrical power. So the electrical power can be used to run the water pump for spraying the water and pesticides. And also two tanks water tank and pesticides can be provided to for multi use such as spraying of water and pesticides.
ADVANTAGES

- With help of innovative seed sowing equipment the seed can feed in to the soil continuously without any restriction while in flowing of seed.

- Most of seed sowing equipments machines mentioned above required only one person to operate. Hence it reduces labourer cost.

- These equipments can also be used for sowing different types of seeds.

- Improvement in planting efficiency.

- Increase in crop yield and cropping reliability.

- Increase in cropping frequency.

APPLICATIONS

1. It is helpful for small and medium scale formers

2. It is simplest and easiest method for seeds landing

3. It has reduced much equipment used. It’s one machine used all process

CONCLUSION

Innovative Seed sowing equipments has remarkable influence in agriculture. By using innovative seed sowing equipments we can save more time required for seeding process. And also it reduces lot of laborer cost. It is very helpful for small scale formers.

REFERENCES


