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Design and Fabrication of Automatic Paddy Harvester

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Abstract: Modern agriculture requires field machinery capable of precise, repeatable operations based on models of systems and processes. In this mechatronic design process, applied to three examples, the efficiency of the design process and the performance of the mechanisms can be improved considerably through concurrent, integrated development. Such advanced systems with modern feedback controllers can generate significant demands for data processing techniques. Harvest has developed a new approach to automating a variety of traditionally manual labor tasks based on mobile robot technology. Teams of small, highly intelligent machines work safely with laborers to perform the most physically demanding parts of these tasks, and at a significantly reduced cost.

I. INTRODUCTION

The harvest is the processes of gathering mature crops from the fields. Reaping is the cutting of grain or pulse for harvest, typically using a scythe, sickle, or reaper. The harvest marks the end of the growing season, or the growing cycle for a particular crop, and this is the focus of seasonal celebrations of many religions. On smaller farms with minimal mechanization, harvesting is the most labor-intensive activity of the growing season. On large, mechanized farms, harvesting utilizes the most expensive and sophisticated farm machinery, like the combine harvester. Harvesting in general usage includes an immediate post-harvest handling, all of the actions taken immediately after removing the crop cooling, sorting, cleaning, packing up to the point of further on-farm processing, or shipping to the wholesale or consumer market.

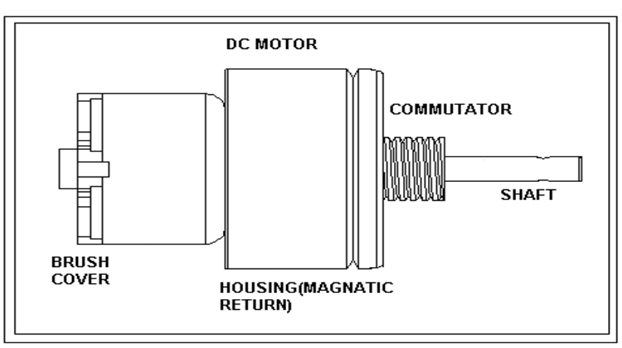
II. LITERATURE REVIEW

A. Paddy Field

A paddy field is a flooded parcel of arable land used for growing rice and other semiaquatic crops. rice can also be grown in dry-fields, but from the twentieth century paddy field agriculture became the dominant form of growing ricepaddy fields can be built adjacent to otherwise natural areas such as rivers or marshes. they can be constructed, often on steep hillsides with much labor and materials. the fields require large quantities of water for irrigation. flooding provides water essential to the growth of the crop. water also provides a favorable environment for the rice strains being grown as well as discouraging the growth of many species of weeds. the water buffalo is the only working animal adapted for life in wetlands so they are extensively used in paddy fields. growing rice has an adverse environmental impact because of the large quantities of methane gas it generates. world methane production due to paddy fields has been estimated to be in the range of 50 to 100 million tones per annum. this level of greenhouse gas generation is a large component of the global warming threat produced from an expanding human population. however, recent studies have shown that methane can be significantly reduced while also boosting crop yield by draining the paddies allowing the soil to aerate, which interrupts methane production.

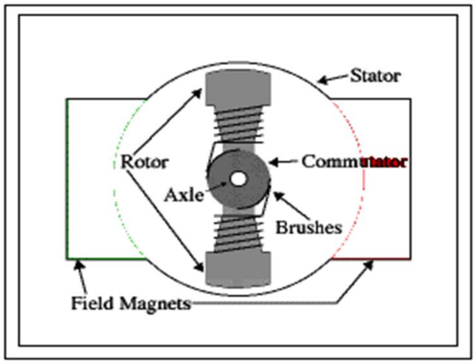
III. COMPONENTS

A. Motor

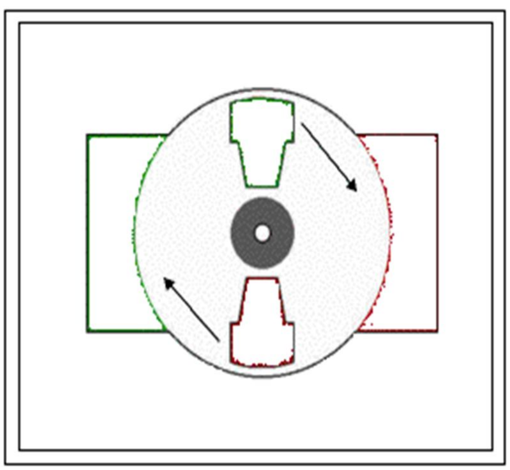


B. Principles Of Operation

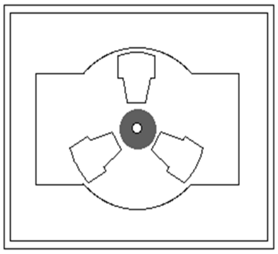
In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic 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).



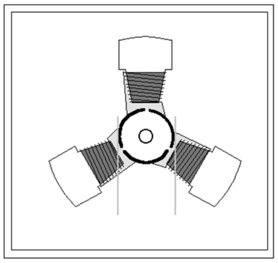
Every DC motor has six basic parts axle, rotor (armature), stator, commutator, field magnet(s), and brushes. In most common DC motors, the external magnetic field is produced by high-strength permanent magnets. The stator is the stationary part of the motor this includes the motor casing, as well as 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. In real life, though, DC motors will always have more than two poles (three is a very common number). In particular, this avoids "dead spots" in the commutator. You can imagine how with our example two-pole motor, if the rotor is exactly at the middle of its rotation (perfectly aligned with the field magnets), it will get "stuck" there. Meanwhile, with a two-pole motor, there is a moment where the commutator shorts out the power supply. This would be bad for the power supply, waste energy, and damage motor components as well. Yet another disadvantage of such a simple motor is that it would exhibit a high amount of torque "ripple" (the amount of torque it could produce is cyclic with the position of the rotor).



So since most small DC motors are of a three-pole design, let's tinker with the workings of one via an interactive animation (JavaScript required):

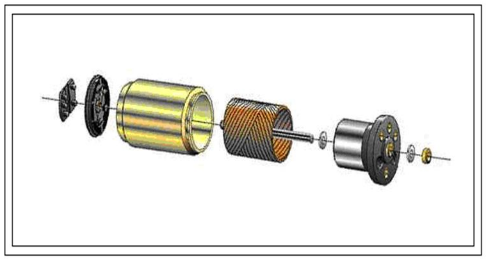


A few things from this namely, one pole is fully energized at a time (but two others are "partially" energized). As each brush transitions from one commutator contact to the next, one coil's field will rapidly collapse, as the next coil's field will rapidly charge up (this occurs within a few microsecond). 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:



There's probably no better way to see how an average DC motor is put together, than by just opening one up. Unfortunately this is tedious work, as well as requiring the destruction of a perfectly good motor. The guts of a disassembled Mabuchi FF-030-PN motor (the same model that Solarbotics sells) are available for (on 10 lines / cm graph paper). This is a basic 3-pole DC motor, with 2 brushes and three commutator contacts. The use of an iron core armature (as in the Mabuchi, above) is quite common, and has a number of advantages. First off, the iron core provides a strong, rigid support for the windings -- a particularly important consideration for high-torque motors. The core also conducts heat away from the rotor windings, allowing the motor to be driven harder than might otherwise be the case. Iron core construction is also relatively inexpensive compared with other construction types.

But iron core construction also has several disadvantages. The iron armature has a relatively high inertia which limits motor acceleration. This construction also results in high winding inductances which limit brush and commutator life. In small motors, an alternative design is often used which features a 'coreless' armature winding. This design depends upon the coil wire itself for structural integrity. As a result, the armature is hollow, and the permanent magnet can be mounted **inside** the rotor coil. Coreless DC motors have much lower armature inductance than iron-core motors of comparable size, extending brush and commutator life.



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.

C. Bearing

A bearing is any of various machine elements that constrain the relative motion between two or more parts to only the desired ype of motion. This is typically to allow and promote free rotation around a fixed axis or free linear movement; it may also be to prevent any motion, such as by controlling the vectors of normal forces. Bearings may be classified broadly according to the motions they allow ad according to their principle of operation, as well as by the directions of applied loads they can handle.
The term "bearing" comes ultimately from the verb "to bear", and a bearing is thus a machine element that allows one part to bear another. The simplest bearings are nothing more than bearing surfaces, which are surfaces cut or formed into a part, with some degree of control over the quality of the surface's form, size, surface roughness, and location (from a little control to a lot, depending on the application). Many other bearings are separate devices that are installed into the part or machine. The most sophisticated bearings, for the most demanding applications, are very expensive, highly precise devices, whose manufacture involves some of the highest technology known to human kind.

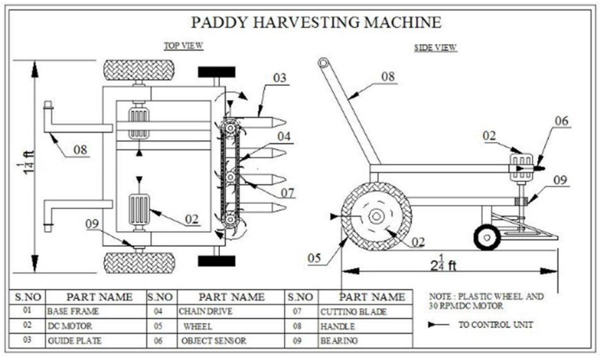
D. Blades

The blade is fixed to the spur gear arrangement. The spur gear arrangement is fixed to the motor shaft. The blade is used to cut the crops in the agricultural areas.

E. Controlling Techniques

With the use of sensor we can sense the approaching crops and can send signals to the processor about the presence of crops in front.
Capacitive proximity sensor

F. Working



It is compact harvester which is having power unit wiper motor having power 100 Watt and torque 0.636Nm. for regulating speed use for motor drive. Chain and sprocket mechanism is used to transmit the power to all operating components. It also consists of hydraulic jack having lifting capacity of 3 tons which help to lift reel wheel for bending of crops inward in counter clockwise motion. Reel wheel assembly is mounted with cutter at its bottom side the movement of cutter is managing from wiper motor through chain and sprocket mechanism. Cutter moves in reciprocating motion. The reel wheel is rotated in clockwise direction which bend crops towards cutter blades due to which the crops get cut and this crops moves towards the screw conveyor with the help of guider. The crops are sensed by the sensor fitted there. The sensor used here is Ultrasonic sensor, where it works on the principle of echo refection and the reflected signal received by the sensor and processed by the controller and it sents output telling the presence of approaching crops. The sensor is primarily calibrated to obtain signal with prescribed range.Now, screw conveyor collects these crops centrally and move it further on conveyor belt which move the crops towards the threshing unit. The crops are get trapped in threshing unit because of this the grains are separated from their chaff and straw. These grains are stored in container having storage capacity of 20 kg to 30 kg and remaining wastage is also stored in another container for the utilization for cattle.

G. Formula

All parameter values what we used in this calculation are approximate only..,

H. DC MOTOR

1500 RPM
24 VOLT
100 WATT
TORQUE OF THE MOTOR

Torque = (P X 60) / (2 X 3.14 X N)
Torque = (100X 60) / (2 X 3.14 X 1500)
Torque = 0.636 Nm

The shaft is made of MS and its allowable shear stress = 42 MPa

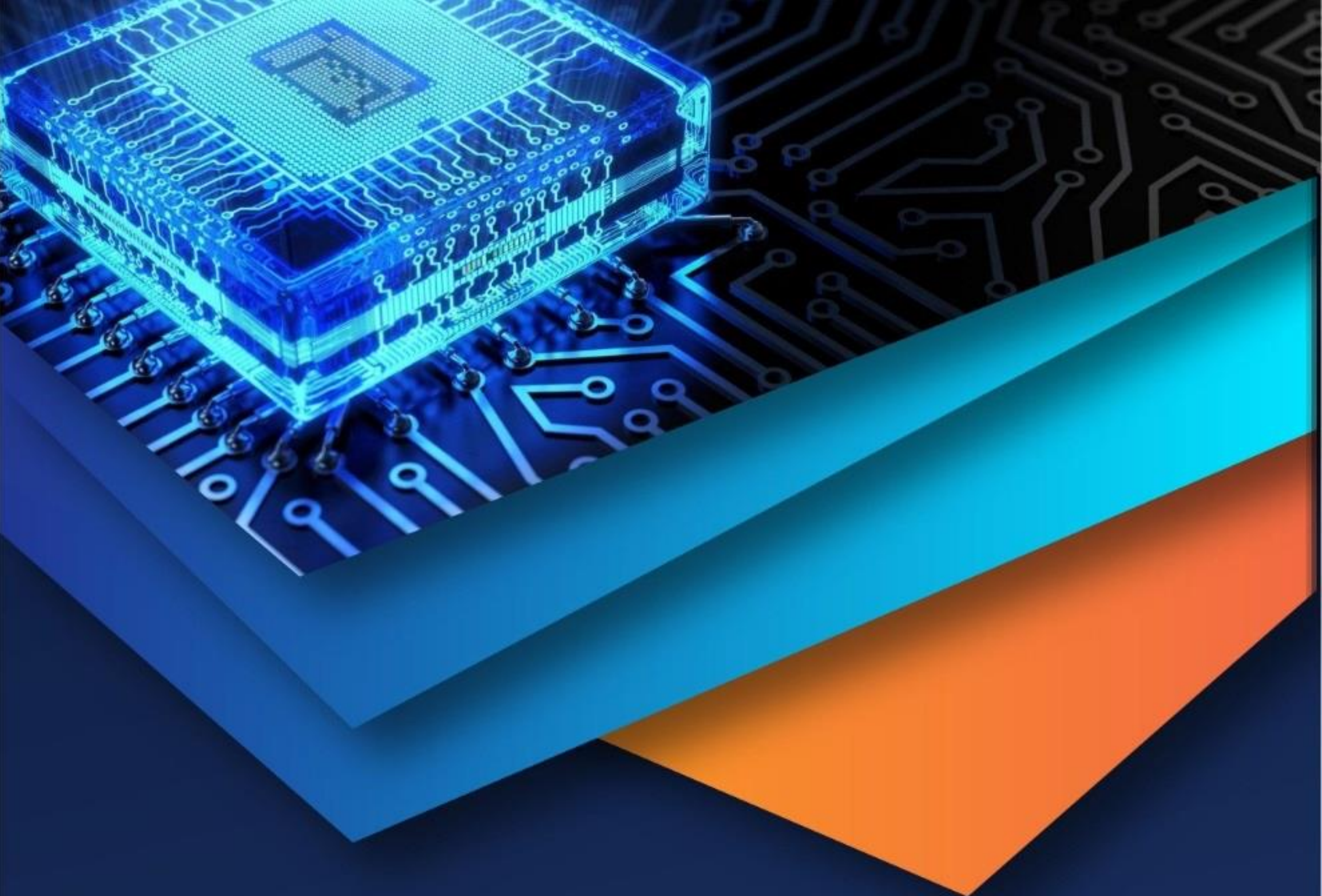
Torque = 3.14 x fs x d ^{3} / 16
6.36 x 10^3 = 3.14 x 42 x d ^{3} / 16
D = 9.17 mm

The nearest standard size is d = 9 mm.
Calculation for bevel gear:
No. of teeth, T = 16
Diameter of the pitch circle, D = 40 mm
Circular pitch,
Pc $=\pi D/T$,
= 3.14*40/16
Pc = 7.85
Diameter of the pitch,
Pd = T/D =16/4

Pd = 0.4 mm
Module,
m = D/T
= 40/16
m = 2.5

IV. CONCLUSION

This project is made with pre planning, that it provides flexibility in operation. This innovation has made the more desirable and economical. This project “PADDY HARVESTER” is designed with the hope that it is very much economical and help full to agricultural fields.This project helped us to know the periodic steps in completing a project work. Thus we have completed the project successfully



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