

AUTOMACHINE OF ELECTRIC REAPER

CH.S.V. Prakash¹, G.Mohini², Koyyana Srinivasa Rao³

¹M.Tech Asst.professor

G.Yerram naidu²

K.Durga krishna²,J.Suresh²

³M.Tech,(Ph.D) Asst.professor

Dept.of Electrical and Electronics Engineering Lendi institute of engineering and technology

Abstract: In this paper work, especially in India, we need to concentrate on certain aspects of increasing the productivity level and subsequent profit of agriculture and reducing the financial issues and thus solving the problems of farmers. Today in India, farmers use conventional methods for cutting / harvesting crops, using human labor but this method consumes a lot of time and energy. It is well known that crops like Jowar, Tuar, Bajra, Maize require more force in contrast to the crops like wheat, rice etc., need. This project presents a vital concept for design and analysis of crop cutters. The crop cutting is an important phase in the field of agriculture. It can be used for cutting dry stalks of grain, breaking trunk of tree. This mechanism is used for harvesting the moderate crop. But a single machine can do a work of 7-8 laborers and help to increase the economy of farmers. The only drawback of machine is that it depends on battery and it works automatically without using man power.

Index terms: Dc motor, Battery, Wheels, Blades.

Date of Submission: 20-06-2020

Date of Acceptance: 10-07-2020

I. Introduction

Crop harvesting is last stage in farming which takes maximum time of farmer among all farming Process. In India harvesting is generally done manually. Thus, our intention is to provide farmer a “CROP HARVESTER IN AGRICULTURAL APPROACH”. This machine consists of simple Mechanism make to run by a DC. Motor which will be economical to farmer and will take less time for harvesting operation. Crop harvesting is a process of cutting the crops close to the ground or pulling plants when they are ripped out. It includes cutting the stems of coral crops like tuar, jowar, bajra, maize, grass etc. close the ground. In our country it is generally done by sharp sickle. On the basis of large number of this crop harvester are in use at today’s date, which are available at different shape and size and on different power supply. Some of them are pneumatic crop harvester, hydraulic crop harvester and crop harvester running on tractor engine. Since they are costlier keeping into consideration the economic ability of our farmer it is required that is should be simple and should fulfill the same intension which are achieved by “CROP HARVESTER IN AGGRICULTURE APPROACH”. This machine is made of run by a DC motor with the help of battery having speed of nearly 1500.

1.1. HISTORY

Before the 18th and 19th century, people produced their food, clothing, and crops mostly by hand and using small tools. This often required much time and energy. The Industrial Revolution brought about change in the way goods were produced. There were several new inventions that allowed for the mass production of products, especially in the field of agriculture. One such invention was the mechanical reaper. The mechanical reaper was invented by Cyrus McCormick in 1831. This machine was used by farmers to harvest crops mechanically. For hundreds of years, farmers and field workers had to harvest crops by hand using a sickle or other methods, which was an arduous task at best. The McCormick mechanical reaper replaced the manual cutting of the crop with scythes and sickles. This new invention allowed wheat to be harvested quicker and with less labor force.

1.2. AGRICULTURE

The agricultural improvements of the 18th century had been promoted by people whose industrial and commercial interests made them willing to experiment with new machines and processes to improve the productivity of their estates. Under the same sort of stimuli, agricultural improvement continued into the 19th century and was extended to food processing in Britain and elsewhere. The steam engine was not readily adapted for agricultural purposes, yet ways were found of harnessing it to threshing machines and even to plods by means of a cable between powerful traction engines pulling a plow across a field. In the United States

mechanization of agriculture began later than in Britain, but because of the comparative labour shortage it proceeded more quickly and more thoroughly. The McCormick reaper and the combine harvester were both developed in the United States, as were barbed wire and the food-packing and canning industries, Chicago becoming the centre for these processes. The introduction of refrigeration techniques in the second half of the 19th century made it possible to convey meat from Australia and Argentina to European markets, and the same markets encouraged the growth of dairy farming and market gardening, with distant producers such as New Zealand able to send their butter in refrigerated ships to wherever in the world it could be sold.

II. Explanation Of Components

1. Battery:



Fig (1): 12V Battery,1.3 Amp hr

In the modern era, electric energy is normally converted from mechanical energy, solar energy, chemical energy etc. A battery is a device that converts chemical energy to electrical energy. The first battery was developed by Alessandro Volta in year of 1800. In the year 1836, John Frederic Daniel, a British chemist developed the Daniel cell as an improved version of the voltaic cell. From that time until today, the battery has been the most popular source of electricity in many daily life applications. In our daily life, we generally use two types of battery, one of them is which can be used once before its gets totally discharged. Another type of battery is rechargeable which it can be used multiple times by recharging externally. The former is called primary battery and the latter is called secondary battery. Batteries can be found in different sizes. A battery may be as small as a wrist watch or may be so big in size that a hall room will be required to install a battery bank. Which is a variation of size, the battery is used anywhere from small wrist watches to a large ship. We often see this symbol in many diagrams of electrical and electronics networks. This is the most popularly used symbol for battery. The bigger lines represent the positive terminal of the cells and smaller lines represent the terminal of the cells connected in the battery. We are often confused about the terms battery cell and battery. We generally refer to a battery as a single electro-chemical cell. But literally, battery does not mean that battery means a number of electrochemical cells connected together to meet a certain voltage and current level. Although there may be a single cell battery, literally, battery and cell are different.

2. BLDC MOTOR:

A brushless DC motor is an electronically commutated DC motor which does not have brushes. The controller provides pulses of current to the motor windings which control speed and torque of the synchronous motor. These types of motors are highly efficient in producing a large amount of torque over a vast speed range. In brushless motors, permanent magnets rotate around a fixed armature. Commutation with electronics has a large scope of capabilities and flexibility. They are known for smooth operation and holding torque.



Fig (2). 200rpm, 2kg torque BLDC motor

It is better to understand the function of a brushed motor. In brushed motors, there are permanent magnets on the outside and a spinning armature which contains an electromagnet inside. These electromagnets create a magnetic field in the armature when the power is switched on and help to rotate the armature. The brushes change the polarity of the pole to keep the rotation on of the armature. The basic working principle for the brushed DC motor and for brushless DC motor are the same, i.e. internal shaft position feedback.

3. Ultra sonic sensor:

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound, i.e. the sound that humans can hear. Ultrasonic sensors have two main components: the transmitter which emits the sound using piezoelectric crystals and the receiver which encounters the sound after it has travelled to and from the target.



Fig (3): Ultra sonic sensor,5V

In order to calculate the distance between the sensor and the object, the sensor emits a pulse of sound by the transmitter to its contact with the receiver. The formula for this calculation is $D = \frac{1}{2}(T) \cdot C$ where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second. As it detects the motion, these types of sensors measure only infrared radiation, rather than emitting it, that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED light-emitting diode and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

4. IR SENSOR:

An infrared sensor is an electronic device, which emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detect the motion. These types of sensors measure only infrared radiation, rather than emitting it, that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes that can be detected by an infrared sensor.



Fig (4): IR sensor

The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

5.IR RECEIVER:

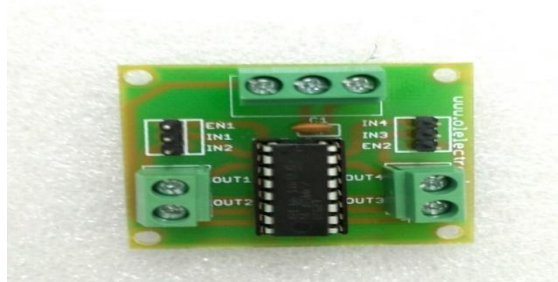
Infrared receivers are also called as infrared sensors as they detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photo diodes as they detect only infrared radiation. The picture of a typical IR receiver or a photodiode is shown below.



Fig (5): IR receiver

6.L293D MOTOR DRIVE:

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC



Fig(6): L293D motor drive

There are 4 input pins for l293d, pin 2,7 on the left and pin 15 ,10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right-hand side. The motors are rotated based on the inputs provided across the input pins as LOGIC 0 or LOGIC 1.

7.Voltage Regulator (7038):

Voltage regulator any electrical or electronic device that maintains the voltage of a power source within acceptable limits. The voltage regulator is needed to keep voltages within the prescribed range that can be tolerated by the electrical equipment using that voltage. Such a device is widely used in motor vehicles of all types to match the output voltage of the generator to the electrical load and to the charging requirements of the battery. Voltage regulators also are used in electronic equipment in which excessive variations in voltage would be detrimental.



Fig(7): Voltage regulator (5v)

8.CAPACITOR 10UF/50V:

A capacitor in its most primitive form consists of two conductive plates separated by a dielectric medium. The term dielectric is just a fancy word for an insulator that can be polarized, i.e. form negative and positive charges on opposite faces. When voltage is applied across these two plates, current flows through the conductive plates. One side gets positively charged (lack of electrons) and the other side gets negatively charged (excess electrons). We're all familiar with the fact that unlike charges attract, so since the plates are oppositely charged, the charges on the plates attract



Fig(8): Capacitor 10uf/50v

9.CASTRO WHEELS:

A **caster** (or **caster**) is an underived, single, double, or compound wheel that is designed to be attached to the bottom of a larger object (the "vehicle") to enable that object to be moved. They are available in various sizes, and are commonly made of rubber, plastic, nylon, aluminum, or stainless steel

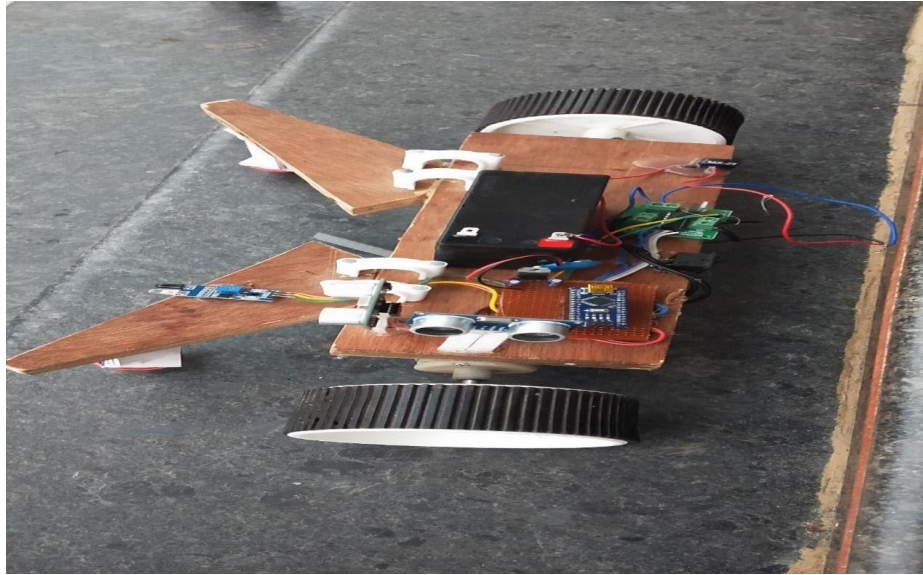


Fig(9): Castro wheels

Casters are used in numerous applications, including shopping carts, office chairs, hospital beds, and material handling equipment. High capacity, heavy duty casters are used in many industrial applications, such as platform trucks, carts, assemblies, and two lines in plants. Generally, casters operate well on smooth and flat surfaces.

III. Working:

The power from the battery is given to the 7805 voltage regulator through the 10UF capacitor. Now the power from the voltage regulator is fed to the Aurdino and the Motor Drive through another 10UF capacitor for the filtering purpose. The Aurdino which is connected with sensors are Ultrasonic sensors and IR sensors. The Ultrasonic sensor which is used for giving the instructions to the Aurdino regarding the Obstacles. Ultrasonic Sensor-1 which is placed at the front side will react to the obstacles appearing in front and Ultrasonic Sensor-2 which is placed at the side will react to the obstacles which appear at the side part of the system, the IR sensor is used for detecting the crop. The movement of the rapper is based on the command from the sensor-2, when the Obstacle appears at the front the rapper will move towards the left side and proceed for its further operation. This process will be continued till completion of one full cycle (one full revolution in field borders) and the field Dimensions will be stored in the Aurdino respectively. Now the data which is stored will be used for the further operation. The calculations are made for the second cycle by using the data stored as field dimensions and excluding the machine length. The data which we get from the second cycle is taken as reference for the third cycle and so on until the reference data will be reduced to zero. All these calculations and data modifications are carried out by the Aurdino based on the programming by which it is made



Fig(10): Auto machine electric reaper

There are two main parts in the ultrasonic sensor viz. transmitter and receiver. The transmitter part converts electrical energy into sound and transmits it. The receiver part receives the echo and turns this received sound waves into electrical energy. This returned echo is measured and used for distance calculation by the ultrasonic sensor. Basically this sensor calculates the time interval between signal transmission and reception of echo and determines the distance of the object from the sensor. As this sensor is used for distance measurement it is known as distance sensor. Piezoelectric crystals are used in the ultrasonic sensor construction due to the fact that these crystals oscillate at a higher range of frequencies.

IV. Calculations:

$$T = TTE \cdot R \cdot w \cdot R \cdot f \dots\dots\dots (1)$$

Total tractive effect (TTE) = $F_{rr} + F_{ha} + F_{la} + F_{ad}$

F_{rr} = force of rolling resistance

F_{ha} = force of hill climbing

F_{la} = force of linear acceleration

F_{ad} = force of aerodynamics

$$F_{rr} = U_{rr} \cdot m \cdot g \dots\dots\dots (2)$$

Where $U_{rr} = 0.07$

Mass (m) = 200kgs

Gravitational force (g) = 9.81

$$f_{ha} = mg \cdot \sin\theta \dots\dots\dots (3)$$

$\sin\theta = 0.1$

$$F_{la} = m \cdot a \dots\dots\dots (4)$$

$$F_{ad} = \frac{\rho \cdot A \cdot C_d \cdot V^2}{2} \dots\dots\dots (5)$$

ρ = density of air (1.25kg/m³)

C_d = coefficient of air drag (1.8)

V = velocity

Speed = 6kmph

$$P_{out} = \frac{2 \cdot T}{60}$$

V. Conclusion

The Electric Crop Cutter we have designed is with a new concept of power transmission mechanism. we aimed to design the Electric Crop Cutter for the small-scale land farmers. The design is compact, easy to operate, low cost and efficient working. The small-scale farmers can use this machine if it further upgraded with small change in the type of cutters used. The cutter we have placed are to be upgraded with design and analysis

process. So the final cutting process can be achieved with better performance. This conceptual design is very helpful for the farmers for better productivity. This machine can be operated by the single labour. This is very useful in the areas where labour scarcity is there, and more over skilled labour is not essential for operating the machine. so everyone can use and operate it easily.

References

- [1]. Hubertus Siebald, Oliver Hensel,” Real time acoustic monitoring of cutting blade sharpness in agricultural machinery”, IEEE/ASME Transactions on Mechatronics, Vol.22, Issue 6, Dec-2017.Mayank Kumar Gupta, Pradeep Tyagi, Shubham Chauhan, “Design and Fabrication of Multi Crop Cutter”, IJARSET, Vol.4, Issue 5, May -2017.
- [2]. Praveen Kiran Mali, Dr. C. N. Sakhali. S. D. Shelare. “A Literature Review on Design and Development of Maize Thresher” Ijpret, 2015; Volume 3 (9):9-14Issn 2319-507
- [3]. Fabrication and performance test of an ultraportable crop cutter” Mr G Maruthi prasad Yadav, GMD JaveedBasha IJRSET Volume 2
- [4]. Farm power source, their availability and future requirement to sustain agriculture product, by N. S.L. Srivastava.
- [5]. State of India Agriculture 2012-13, Indian Government Analysis
- [6]. Relationship between stalk share strength and Morphological Traits of Stalk crop, by Li Liang and YumingGuo.
- [7]. State of Indian Agriculture 2012-13, Indian Government Analysis 2. “Design and Development of manually operated Reaper” Mr. P. B. Chavan, Mr. D. S. Dhondg, Volume12, Issue 3 Ver. I (May. -jun2015), PP 15-22.
- [8]. <http://india.gov.in/topics/agriculture>
- [9]. http://en.Wikipedia.org/wik/Agriculture_in_india.
- [10]. Pressure on farmland the Hindu.4 February 2014.Retrieved 4 February 2014.

CH.S.V. Prakash, et. al. “Design and Development of Fabrication Electric Crop Cutter.” *IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE)*, 15(4), (2020): pp. 01-07.