

DESIGN AND FABRICATION OF AUTOMATED _ MULTIFUNCTIONAL COMPACT TRACTOR BENEFICIAL FOR SMALL LAND HOLDERS

Submitted in partial fulfillment of the requirements for the
award of Bachelor of Engineering degree in Mechatronics
Engineering

by

Darvin V (38090004)

Lokesh G (38090012)



**DEPARTMENT OF MECHATRONICS ENGINEERING
SCHOOL OF MECHANICAL ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of V.Darvin and

G.Lokesh who carried out the project entitled Automated multifunctional compact tractor beneficial for small and medium holders from 01.11.2021 to 10.05.2022.

Internal Guide

Dr. M. SANGEETHA , M.E., Ph.D.,

Head of the Department

Dr. S. PRAKASH, M.E., Ph.D.,

Submitted for Viva voce Examination held on 10.05.2022

Internal Examiner

External Examiner

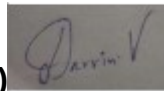
DECLARATION

I Darvin V (38090004) Lokesh G (38090012) hereby declare that the Project Report

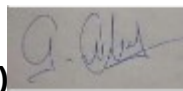
entitled "Design and fabrication of automated multifunctional compact tractor benefit

for small land holder's done by us under the guidance of Dr. M. Sangeetha, M.E., Ph.D., is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Mechatronics Engineering.

1)



2)



DATE: 10.05.2022

PLACE: CHENNAI

SIGNATURE OF THE CANDIDATE

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ABSTRACT

The main objective of this project is to fabricate a multi functional device useful for small land holders. A study was done on the design and fabrication of various automated machines available for specific purpose in agricultural field, to reduce the cost invested for tractors and harvesters, to do farming in most economical and modernized way. Nowadays machines are designed especially for doing specific work. This machine is electric powered so the cost of fossil fuel can be avoided and hence the pollution can be reduced. For Ploughing, Seed sowing, weed cutting, fertilizer spraying, and harvesting separate devices are used. They are neither cheap non-environment friendly. Small land holders find difficult to invest on each and every device and hence they are focusing on low cost ,energy effective and high efficient device .To incorporate all these devices in one compact machine with less cost is beneficial for small land holders. To design and fabricate this compact review on agricultural field equipments was made.

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CHAPTER 1

INTRODUCTION

1.1 AGRICULTURE

Agriculture mainly deals with the process of cultivating crops, livestock and other operations related to it farming refers to the process of planting, harvesting, crop cultivation, land ploughing etc., There has been a significant rise of innovative and useful technologies in the field of agriculture and it is termed as agricultural automation. Farm automation tractor on agriculture field is shown in Fig 1.1



Fig 1.1 Tractor On Agriculture Field

1.2 FARMING AUTOMATION:

Farm automation is the process of upgrading and automating various farming processes through the use of various technology breakthroughs. Farmers all across the world will benefit from this technology, which aims to make labour-intensive and time-consuming agricultural

procedures
easier. With
the help of
farm
automation
and
agricultural
technology
advancemen
ts, farmers
may be able
to devote
more time
and
resources to
their
properties.
Farming
automation
in Fig 1.2
Monitoring
the farm
using
smartphone.



Fig 1.2 Monitoring the farm using smartphone

1.2.1 Innovation in irrigation using AI based drones

Irrigating fruits and vegetables on farms is an important stage in ensuring the health and well-being of the food throughout its life cycle. Despite the fact that irrigation has been used for decades, irrigation technology has remained stagnant.

This is why farmers are looking for drones to assist them in reducing irrigation costs. Drones like the Agras MG-1 can carry 10 litres of liquid in a single fill and cover 6,000 square metres of farmland in under ten minutes.

Drones of this type are capable of studying and responding to numerous aspects of a farm, including altitude, plant types, and even weather conditions. These drones, when linked with monitoring technologies, may easily identify certain areas of the farm that demand more care and match these needs.

1.2.2 Planting using robots

Planting crops throughout massive sections of farmlands generally takes numerous hours of hard labor. This challenge can also be executed with the assist of robots and drones that are able to planting seeds at air. DroneSeed, as an example, is a planting drone that's used to help reforest large the ground and even from the

spaces which have been stricken by wooded area fires. This drone is capable of finding and focused on the best regions at the ground which

might be perfect for seeding. They then use compressed air to shoot the seeds onto the ground without allowing them to scatter because of the wind.

After engaging in the planting process and setting up the irrigation channels, farmers spend an tremendous quantity of time tracking and studying the condition in their

crops manually. This isn't always a precise technology and farmers have had to rely upon existing data to make hopeful selections inside the past. Automation in farming can turn this imprecise technology into an accurate one with the assist of drones that may be constantly sent out to reveal farmlands. These drones can be programmed to are searching for and become aware of various specifics to assist higher inform the farmers. This consists of the use of one of a kind sensors and cameras including infrared technology so one can identify damaged crops, keep a test on dietary ranges, or even provide a 3-D field map to the farmers.

1.2.3 Agrobot

Harvesting season is frequently the most demanding part of a farmer's year.

This process has a lot riding on it, which is why efficiency and precision are crucial. As a result, harvest robots are being created to assist at this critical point. Abundant is a good example of an apple-specific harvesting robot. This bot's use of vacuum technology has been known to make a significant impact in its execution.

Another strawberry-harvesting aid is the Agrobot. Before it can pick Fig 1.3 .the fruit, it uses artificial intelligence to determine its ripeness.



Fig 1.3 Agrobot

1.2.4 Seeding and Weeding Robotics

Seeding and weeding robots have been developed specifically to assist in the seeding and weeding operation. These robots make full use of the resources available by utilising computer vision and artificial intelligence technology.

These robots can even apply fertilisers, and their precision has a significant impact on the region's soil and ecosystem.

Eco Robotics is a firm that is heavily interested in this field and has developed solar- powered robots to perform these tasks.

1.3TRACTOR

A huge internal combustion engine powers the agricultural tractor's wheels, allowing it to move ahead. Old Tractors show in Fig 1.4, like cars and light trucks, use both spark and direct ignition engines. A power take-off shaft is used to convey the power to the engine implemented. The electrical system is also powered, which includes the ignition system and illumination.



Fig 1.4 Old Farming Tractor

In 1901, a British inventor named Dan Albion created the economical successful common tractor. He founded Ivel Agricultural Motors Limited on February 15, 1902, after applying for a patent for his tractor design. It was a tiny and strong agricultural motor. It had two massive back wheels and one solid rubber tyre on the front wheel, comparable to a modern tractor.

Isolated tractors are into two branches based on no. of wheels, mainly the single and two axle tractors being dominant. The lion's share of 4 wheel tractors are two-wheel drive;.In spite of the fact that the essential plan has remained steady for numerous a

long time, encased cabs are presently standard on nearly all more current variations for the security and consolation of the operator.

Most more prepared develop tractors have a manual transmission with three to six prepare extents, now and then expanded into two or three ranges. The system makes a number of specific extents that, when united with throttle assortment, allowing final-drive velocity expanding from lower than one to around 24 miles per hour, with the low speeds being utilized to work in the arrive & higher speeds being utilized on the street. Unsynchronized transmission plans are common on more prepared tractors, requiring the director to stop the vehicle to modify gear wheels. This procedure of operation is normally unsatisfactory for a couple of of the errands that tractors perform, and it has been evaded in several ways over time. Twofold clutching or power-shifting are The engine's control must be exchanged to the instrument or hardware in arrange for the procedures of circumvention for existing unsynchronized tractors.

it to do the assignment for which it was planned. In case the actualize is to be

dragged or something else dragged by the engine's tractive control, this will be fulfilled with a drawbar or hitch framework, or a pulley or control takeoff framework in the event that the instrument is stationary, or a combination.

A drawbar is utilized to associate ploughs and other farming hardware to the tractor. The conventional drawbar could be a steel bar joined to the as portion of the raise adapt box, to that the implement's hitch is secured by a stick vehicle or manufactured

or a circle. The device was effectively connectable and separable, letting the tractor will be utilized for numerous errands on a steady premise. In case the tractor features a swinging drawbar, which can be situated within the centre or balanced

from the middle to allow the vehicle to run exterior the implement's path.

The attachment had to have its own gear and, in the case of a plough, harrow, cultivator, or chisel, a type of lifting mechanism to lift the vehicle out of the field at bends and for transportation. Based on how the torque

was applied, drawbars provided a rollover risk. The coupling between the tool and the tractor was frequently slack, resulting in jerky starts increased wear and tear on vehicle and components.

1.3.1 Drawbar

Drawbar Fig 1.5 show in below, were suited for the first light of computerization since they were basic in guideline and since existing horse-drawn

supplies ordinarily as of now had running adapt when the tractor supplanted the horse. The focal points of diverse hitching strategies got to be apparent as the time of motorization created, coming about to unused changes. Be that as it may, depending on the work of the tractor, the drawbar is still one of the foremost common ways.



Fig 1.5 Drawbar

That some tractor manufacturers made complementary equipment can put directly tractor. Row crop cultivators, belly mowers, row crop cultivators, front end loaders, corn pickers, and corn planters are all examples of agricultural machinery. These permanent mounts were, for the most part, proprietary to each tractor manufacturer. Another downside attachment used to took was time and effort, leading to the tool being attached temporarily with screws or other mounting gear. It was usually not possible to detach and reinstall tool on a daily routine. As an outcome, the vehicle was inaccessible for some other purposes for an extended period of time and was assigned to a specific purpose. A tool was usually mounted at the start of the season and removed at the end of the season.

1.3.2 Three-point hitch

Prior to Harry Ferguson's invention of the three-point hitch, the drawbar system almost the only way to attach equipment. A control lever can be used to raise or lower machinery connected to the three-point hitch hydraulically. The tractor normally provides entire support for the machinery connected to the three-point hitch. A fast hitch, which as linked to three-point hitch, is another technique of attaching an

implement. This allows a specific person to connect an implement more quickly and safely.

Three-point linkage in below Fig 1.6, or a version of it of Ferguson, is almost found on every tractor This hitch allows for the tools to be readily connected and removed

,while also making the instrument to normally operate like it is connected by fixed mounting to the vehicle. When the tool collided with an obstruction in past, the towing connection would be broken or the vehicle would overturn. Ferguson's concept was connecting one upper and two lower lifting arms to a hydraulic lifting ram via the arms .The ram was then attached to the top of the three links, causing the hydraulic system to lift the tool until the obstruction was passed.

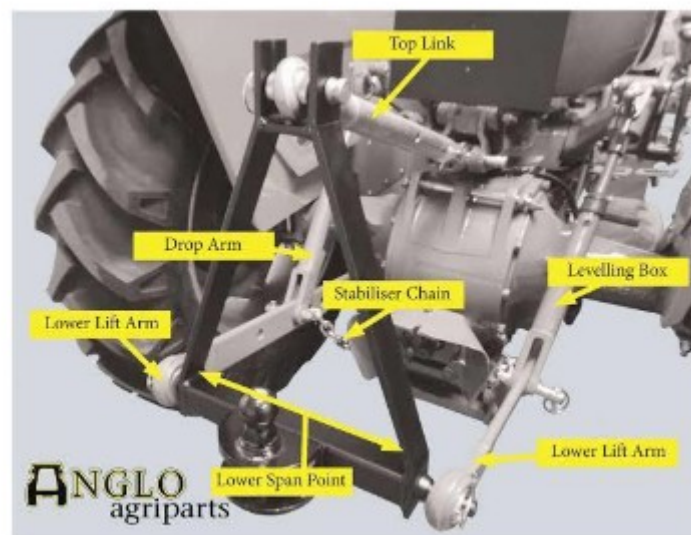


Fig 1.6 Components Of Three Point hitch

Despite pulling an tool attached or producing tractive control by the wheels , a considerable number of tractors have a way to transmit control to another piece of equipment, such as a swather, baler, or cutter. A towed instrument requires its own source of power or a way of passing power from the vehicle to the machinery.

Moving the tractor and machinery with a retractable belt or cable connecting them would be impractical in some cases, technique requires the vehicle to remain stationary when the power is transferred to machinery, or the vehicle to be repositioned for each and every turn and energy set-up has to be reapplied.

1.3.3 Power Take-Off

In most tractors today, a power take-off shaft is utilised to supply power to towed or the stationary equipment. The PTO shaft is normally found in the rear end

of the tractor and can be linked to the drawbar implement. This eradicates the need for a another power source on the tool , which is commonly missing from current farm machinery. A front PTO can be added to a new tractor when it is purchased.

Few modern farm tractors still have manual gearboxes, although they are progressively being replaced by hydraulically operated powershift transmissions, which make operation much easier. tractor Transmission Fig 1.7 show in below

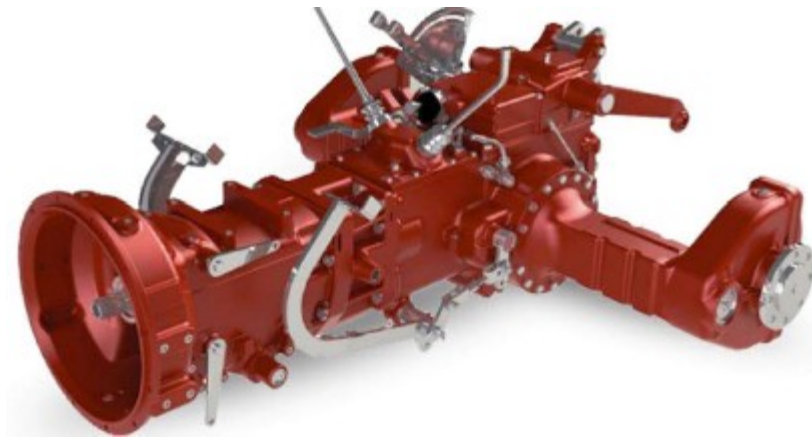


Fig 1.7 Transmission

Powershift gearboxes had the same pedal layout on the floor, with an inching pedal by the left. Pairs of pedal for braking are located on the right side, one for each of the left and right wheels. Throttling speed is also controlled by a lever that, unlike in automobiles, can be set to a preset position.

In addition to the conventional pedal, some contemporary tractors have a clutch control switch on the gear, which allows for gear changes and stopping the tractor without the use of the foot pedal. Other vehicles will have a switch that momentarily boosts throttling speed to improvise the hydraulic flow to front-end loader buckets.

1.3.4 Electric Tractor

Electric tractors herald the start of a new era in agricultural technology. A farmer is always seeking for methods to make his or her job easier or more affordable. And technology offers a way out of this predicament. Electric tractors (shown below Fig 1.8), are advantageous in

agriculture because they reduce fuel consumption. It is battery-powered, making farming simple and affordable.



Fig 1.8 Electric Tractor

1.3.5 Ploughing

A plough, is a farm tool used to loosen or churn soil before to sowing or spreading seed. Ploughing's major objective was turning over the soil on the top, and to bring fresh nutrients above the soil by the decomposition of weeds and remaining of crops. The plough digs trenches called furrows. A field which is ploughed is often to allowed to be dried before being planted in modern times. Cultivating and ploughing evens out the composition of the top 15 to 30cm of the soil, where most of the plants roots grow. ploughing image (shown in below Fig 1.9)



Fig 1.9 Ploughing

For a millennia, the ploughshare, coulter and mould board are used for basic operation of ploughing. Advancements in designing were extensively spread throughout the Enlightenment Age, when design evolved quickly. In 1730, Joseph Foljambe of Rotherham, England, Designed innovative

iron clad design. The Rotherham swing plough, unlike the heavy plough, was entirely formed of the mould

board, coulter and handles. When compared to previous designs it is much light in weight, and it immediately acquired popularity in the United Kingdom. It's probable that it was the first plough to be mass-produced and commercially successful in factories.

James Small made improvements to the design. He eventually came up with a design for a single piece of iron that he cast using mathematical processes, which was an improvement over the plough. The first steel model was invented in 1837 by John Deere, its durable than iron designs and very useful in farming the unsuitable areas

Multiply reversible ploughs are standard on current tractors with three-point linkages. Mold boards on these ploughs range from two to seven, with semi-mounted ploughs having up to 18. The hydraulics on the tractor are used to raise and lower the implements, as well as modify the furrow width and depth. To keep the plough at the right angle in the soil, the plougher must still adjust the tractor's draughting linkage. Modern tractors can automatically control this angle and depth.

1.3.6. Harvesting

Harvesting is the process of gathering the plant's useful part or parts at the point when all of the nutrients have formed and the edible sections have reached the right level of maturity. Harvesting usually occurs 10 to 15 days (Fig 1.10 shown in below) after the grains has attained physiological maturity Each grain has a separate content of moisture and variable physical properties during the period of maturation. The most appropriate harvest time is determined by the duration of the growth cycles as well as the degree of grain maturity.



Fig 1.10 Harvester

Combine-harvesters built for wheat but modified for pulses crops are commonly used to harvest legumes. However, it should only be utilised in big fields that have been levelled prior to sowing and thereafter planted with kinds that are naturally upright and mature at the same time. Due to the scarcity of mechanical harvesters at a reasonable price, mechanised harvesting of pulse crops is minimal. However, there are several designs of reapers that can be used to harvest chickpeas. The adoption of such equipment should be encouraged in order to reduce harvesting costs and, as a result, production costs.

1.3.7. Seed Sowing

Planting seeds is the procedure of sowing. The sown area is usually referred to the agricultural field that has seeds been planted in it. Nowadays, seed sowing operation (Fig 1.11 show in below) is carried out evenly and exactly with the more Precision using the seed drill. The depth at which the seed must be planted in is carried out perfectly. The mechanism of the seed drill is specifically designed to a fluted feeding operation though seeds are not calculated separately. Based upon the types and growth condition of the crop, the rows are generally 8 to 32 cm apart. The seed drill are usually attached with tractors to be pulled. Pickup trucks are used from time to time, considering the necessary draught.



Fig 1.11 Seed Sowing Machinery

1.3.8 Sprayers

Sprayers are liquid-dispensing machines that are commonly used to spray water, crop performance compounds, weed killers, pest control chemicals, and production and manufacturing line materials. Sprayer is an agricultural equipment that sprays herbicides, insecticides, and fertilisers onto crop field. Sprayers vary in

size from easy to carry devices to trailed sprayers linked to a vehicle to self-propelling systems with boom mounts ranging in length from 3- 28 feet to 58- 148 feet, depends upon the tractor's design and area of the land.

Sprayers are made up of numerous components which working together to get the expected output. Its simple as a sprayer (Fig 1.12 shown in below) with a bottle that i



Fig 1.12 Fertilizer Spraying

primed & pushed by a tube, spring-lever, and vacuum, or as complex as a 140-foot boom sprayer with a extended list of components which helping in distributing the spraying liquid.

Agricultural sprayers come in big ranges of design styles, sizes, features, and performance levels. They come in a variety of sizes, from little spot sprayers to giant sprayers that can cover a large area of land and plants. Agriculture sprayers are built in a way to maximise the versatility and performance across a wide range of applications, including crop, vegetation, and soil treatments. To increase crop performance or manage pests, agricultural sprayers are used widely to apply water/chemical combinations containing caustic substances or acid, such as fertilisers and insecticides.

CHAPTER 2

LITERATURE SURVEY

Analysis of a parallel hybrid electric tractor for agricultural applications. Francesco Mocera and Aurelio Soma. The author compared the traditional tractor with the electric tractor and proposed hybrid electric orchard tractor. He fabricated traditional tractor and electric tractor and studied that even though electric tractor as modernized one the power requirement for each and every operations such as ploughing, seed sowing, harvesting the requirement of power is more. He proposed the green energy sources for power generation such as wind mill for running his proposed model to reduce the power.

A design of an unmanned electric tractor platform 2022. Yuan Chuan Chen, Li Wen Chen and Ming Yen Chang. The vehicle is controlled by microcontroller embedded in the system. The tractor uses a four wheel independent suspension system for its movement with two differentials controlled by the reducer to have variations in speed while transporting and performing the operation. ABAQUS and TOSCO software are used for analysis of finite element and topology optimization. The vehicle system has two 7.5 Kwh induction motors and lithium ion batteries as its power source. The weight and size of the tractor is reduced to perform the operation of tillage by rotary plow machinery attached at the rear end of the vehicle. Compact spacing for the system is aligned to overcome the difficulties arises when the agricultural terrain is irregular. The steering system is electronic and configured to move both in forward and reverse directions.

Optimization design of electric tractor for small machinery 2018. Yan Yu Gao et.al proposed an idea of electric tractor for seed sowing machinery with an optimized design. The tractor is modified with electric motor instead of its usual combustion engine, thus making the existing seed sowing machinery attachable by a suspension system with the shaft of power transmission and making the structure to be compact. This tractor comprises of existing seed sowing device, tiller device and power system. Battery is the main power source for the tractor. As the tractor is turned

on the tiller in the front plows the field and drops the seed into the soil by the seeding tube through the door performing closing and opening operation the seed sowing device. By contacting gear tooth directly between two axes the transmission provides

the power and motion. Thereby providing the tractor higher transmission power and longer life.

Study on the development of the electric tractor specifications and traveling and tilling performance of a prototype electric tractor 2013. Yuko UEKA,

Jun YAMASHITA, kazunobi SATO and yoshinori DOI. Yuko UEKA et.al designed an electric tractor using Asynchronous motor by remodeling a 10KW existing IC (internal combustion) engine tractor. By using these tractor emissions of pollutants decreased to notable change when compared to IC engine tractors. The consumption of energy was also reduced for transportation and tillage operation. But remodeling the tractor resulted in increasing the overall weight and has an effect on balancing the body. Since the weight increased, the resistance of rolling is greater and thereby having more efficiency in energy conversion

Tractor performance evaluation of the electric all wheel drive tractor 2022. Seung Yun Baek, Seung Min Baek, Hyeon Ho Jeon, Wan Soo Kim, YeonSoo Kim, Tae Yong Sim, Kyu Hong Choi, Soo Jung Hong, Hyunggunkim and Yong Joon Kim. Seung Yun Baek et.al designed and evaluated the traction performance of an electric All-wheel-drive tractor (AWD). Traction performance is an essential criterion for a tractor design to be effective as it determines load capacity of the tractor when it pulls the equipment attached to its body. A separate AWD system is attached for each of the quadrant axle. The Battery pack and charging system comprises the electric system. The capacity of the battery used is 58.4 KWH. Since each motor is powered by separate batteries the usage time of the vehicle is also increased. Two generators of 13.5KW using petrol engine are used for supplying electric energy to electric motors and batteries. Charging was also possible by regenerative braking or using 220 volt power outlet. The measurement of load is done by using controller area network bus which also consists of the rotational speed of the tractor, current and battery voltage.

Conception of an electric propulsion system for a 9Kw electric tractor suitable for family farming 2019. Rodnei R. Melo, Fernando L M Antunes, Sergio Daher, Hans H. Vogt, Daniel Albiero, Fernando L. Tofoli. For this low

power electric tractor the driving system is customized. The system consists of two three phase induction motors, battery (lead acid) and independent inverters for motors. This tractor is specifically designed for family farming that holds small agricultural lands. A control unit is programmed to assure the operations be safe and flexible. Elipse SCADA was

used in the development of a system monitoring the variables of the inverters. The data transmission occurs between them by Modbus protocol with a Remote Terminal Unit. The electric propulsion system uses an ECU for drive management. Inverters are also controlled by sending signals for the speed and torque management by ECU. The algorithm for microcontroller executes the control strategy. Sensors are used to collect information like speed, torque, temperature, position and voltage.

Development of cooperative controller for dual motor independent drive electric tractor 2020. Mengnan Liu, Chuiquen Wei and Liyan Xu. The strategy for cooperative control aims at the control problem of the power output shaft and discovering functions of speed output by PTO (power take off). They propose to achieve stability control by four types which include closed loop and PID types. While the tractor is running the speed is measured by wheel speed sensor. The velocity is the input signal of the cooperative controller which generates expected speed module by obtaining the required speed through the PTO motor and making the tractor run at fixed proportion

Design and preliminary test of tiny remote controlled electric tractor used in greenhouse 2012. Fuzeng Yang, Yulu, Yongcheng Liu, Yubin Lan, Debo Liu, Zheng pang. In greenhouses they normally use the micro-cultivators which emit harmful emissions to the environment. The structure difference of the electric tractor paves the way for more vehicle performance than the engine tractor. The cost of operation is also lower than the micro-cultivators used in the greenhouses. The electric drive system is mentioned below. The normal requirements of plow and driving are executed steadily but in a slow manner.

Modeling and control of hybrid electric vehicles A case study for agricultural tractors 2018. Chaojia, Wei Qia and Liyan Qu. Chang Jia et.al modeled a hybrid electric vehicle. Power management has a major difficulty for agricultural tractors due to the pulling (traction force) of the equipments attached. The power management system is branched into two benchmark types, the power follower control strategy and thermostat control strategy. Both were analyzed and the PFC stands out to be giving improvised efficiency of the PT system. Particulate matter emission is the

only drawback of this strategy. Thus hybrid electric tractor making a difference in both emissions and fuel economy.

Design theory and performance analysis of electric tractor drive system
2017 XiaofeiZhang. 25HP electric tractor chassis was used for drive system. The layout of the chassis becomes simple to accommodate space for the power pack. The complete operation of signal transfer for the vehicle management system is mentioned below.

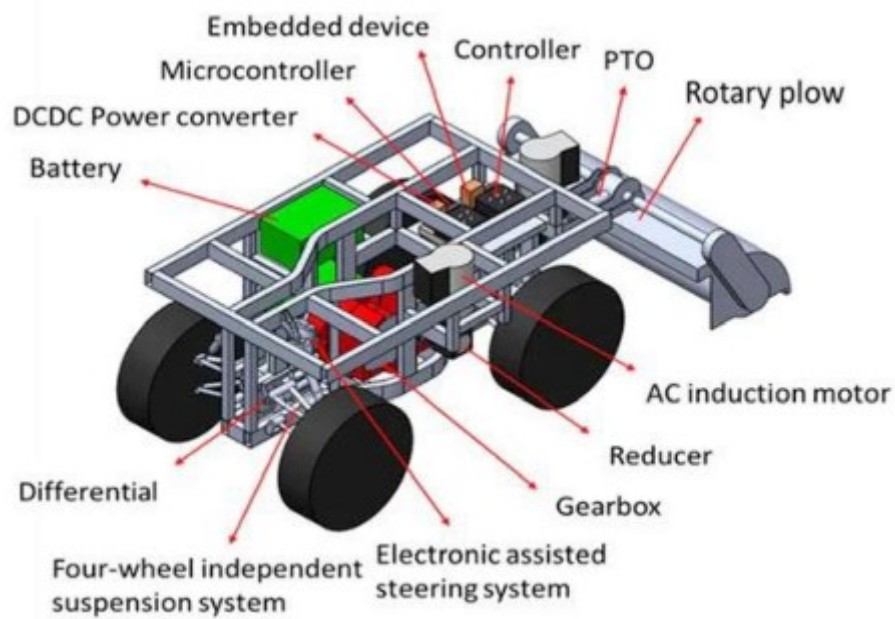


Fig 2.1 Unmanned electric tractor

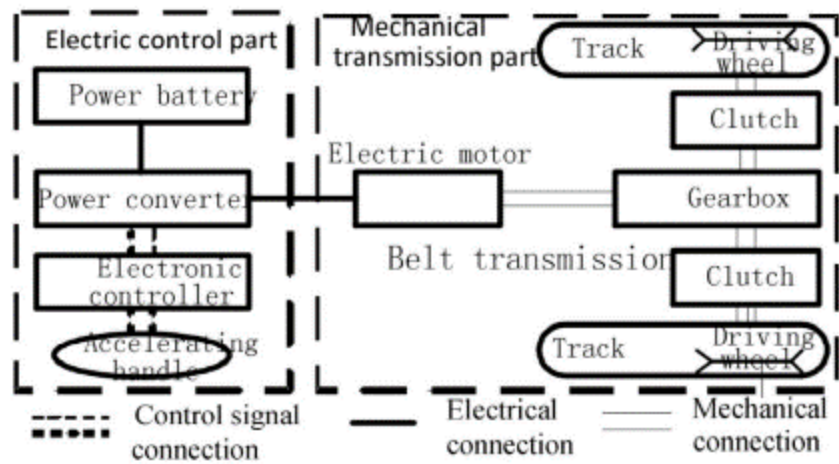


Fig. 2.2 Block diagram for Electric Drive System

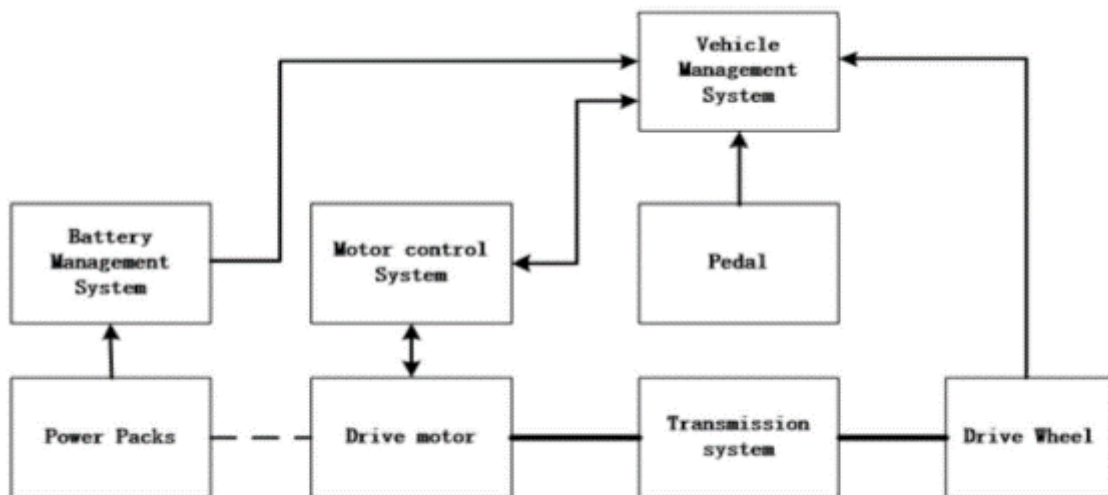


Fig. 2.3. Block diagram Driving System

CHAPTER 3

AIM AND SCOPE OF THE PROJECT

3.1 Mini electric tractor

The main intention of the project is to design shown in below and fabricate a automated multi- functional compact electric tractor beneficial for small agricultural land holders.

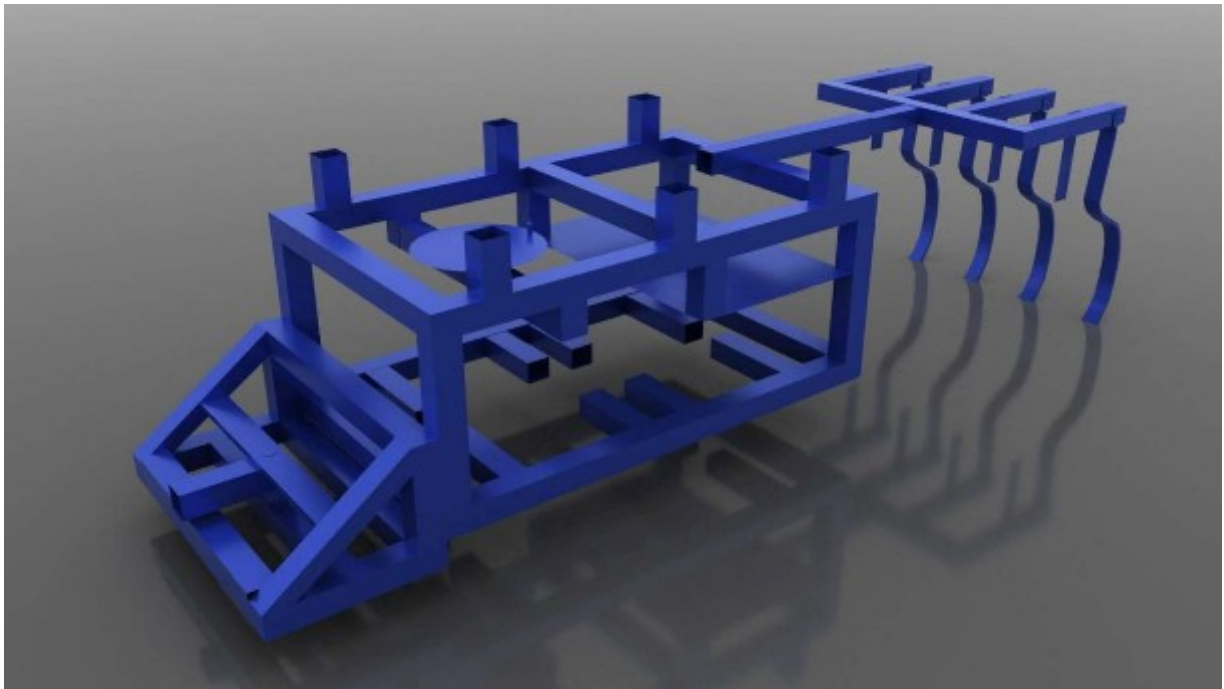


Fig 3.1 Design of electric mini tractor

3.1.1 Block diagram of Mini electric tractor

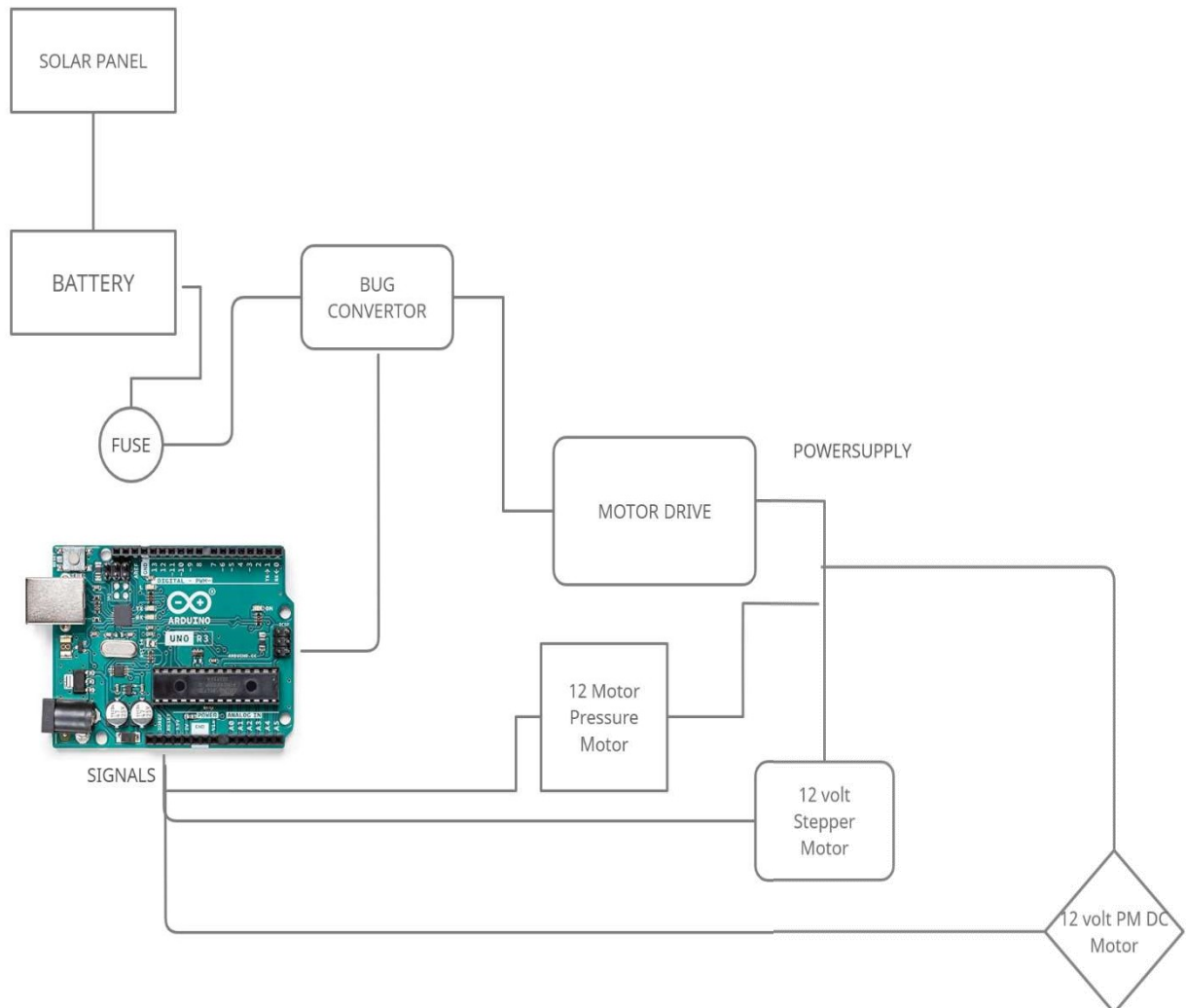


Fig 3.2 Block diagram

3.1.2 Advantages

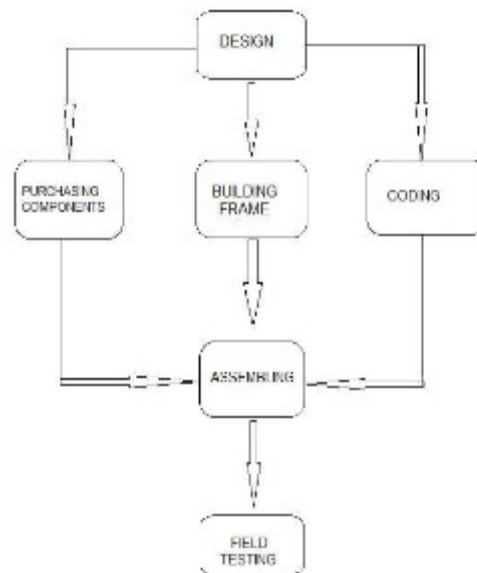
The designed automatic multi-functional compact electric tractor is lightweight and comparatively low cost when compared to other existing electric tractor.

The proposed model uses solar panel as the energy source for recharging the battery, thus making it eco-friendly Low maintenance when compared to other electric tractors.

CHAPTER 4

MATERIALS AND METHODS

4.1 RESEARCH METHODOLOGY



4.2 COMPONENTS

4.2.1. Arduino Uno

Arduino.cc produces the Arduino Uno (Fig 4.1 shown in below). Analogue and digital input/output pins on the board can be utilised to link to numerous types of expansion boards and other circuits. The board has 14 digital I/O and 6 analogue I/O pins, and it can be programmed using the Arduino IDE and a type B USB connector. It works with voltages ranging from 5 to 15 volts and can be operated by a USB cable or an external 9-volt battery as its power source. In appearance, it resembles the Leonardo and Arduino Nano. The hardware reference design is licenced under a Creative Commons Attribution Share-Alike 2.5 licence and its available freely on the Internet.

The Uno board is first of the series of USB-based Arduinos; also served the standardized version of Arduino, along with the version 1.0 of the Arduino IDE, till it was supplanted by subsequent releases. A bootloader is pre-programmed into ATmega328 on the board, permitting fresh code to be uploaded without the use of an external hardware programmer.

Unlike all prior boards, the Uno communicates via the original STK500 protocol and does not require the FTDI USB-to-serial driver chip. Instead, it employs a USB-to-serial converter based on the Atmega16U2 microcontroller

The Arduino project started in Ivrea, Italy. The students utilised a BASIC Stamp microcontroller at the time, which was an expensive investment for most of them.

Wiring was created as a Master's thesis project at Interaction Design Institute Ivrea in 2003 by Hernando Barragan. The purpose of the project was to create a simple, low-cost tools that non-engineers could use to construct digital projects. The



Fig 4.1 Arduino Board

4.2.1.1 Configuration

The microcontroller used in this project is a Microchip ATmega328P. The operating voltage is 5 volts.

7 to 20 volts voltage range

There are 14 digital I/O pins on this board

1 UART (Universal Asynchronous Transfer Mode)

Analog Input Pins: 6 DC SPI: 1 For 3.3V, pin: 20 mA DC I2C: 1 SPI: 1 per I/O
current 50 mA pin current

2 KB SRAM 32 KB flash memory, of which the bootloader uses

0.5 KB. EEPROM (1 KB)

Clock speed of 16

MHz Length: 68.6

mm

The width is 53.4

mm. Weight: 25 g

The two power sources are a DC Power Jack and a USB Port.

4.2.1.2 Communication of Arduino

The Arduino/Genuino Uno connects to a computer board, or other microcontrollers in various ways. The Arduino IDE combines a serial screen that allows direct printed data to be transmitted and from received the board. When data is being transferred through the board, the TX and RX LEDs will streak.

A 100 nanofarad capacitor connects one of the ATmega8U2/16U2's adapt stream control lines (DTR) to the ATmega328's reset line. The reset line lowers long enough to reset the chip when this line is confirmed (taken moo). Other ideas for this arrangement can be found here.

4.2.2 DC Motor Driver L298N Module

Connecting the Motor Driver L289N to the Arduino is the easiest method to control an Direct Current motor

The Motor Driver is used in controlling the direction and rotation speed of 2 Direct Current motors.

It also can be used to drive the bipolar stepper motors

4.2.2.1 DC Motor Control

We must manage the DC motor's speed and rotation direction to get complete control. Duty cycle graph (Fig 4.2 show in below)

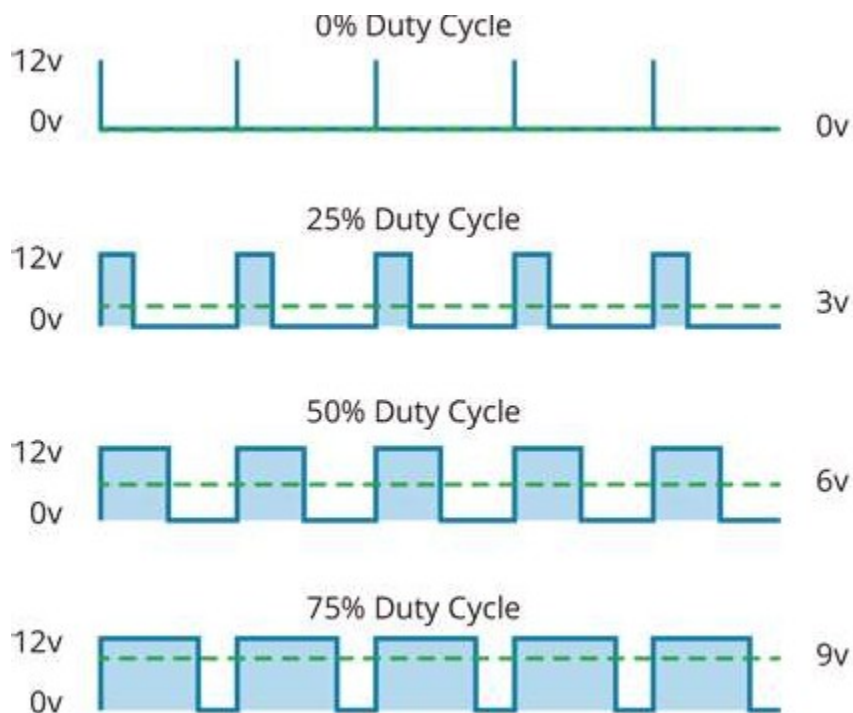


Fig 4.2 Duty cycle graph

H-Bridge—An H-Bridge is a gadget that allows you to regulate rotational Pulse width modulation (PWM) is the method which is used to vary the signal's direction. width.

A Direct Current motor's speed could be controlled with a variable input volt. PWM is a technique for changing the average value of an input voltage by sending a series of OFF-ON pulses.

The word "duty cycle" refers to how the pulse width is proportional to the average voltage.

The applied dc cycle's average voltage rises.

Modulation of Pulse Width As the duty technique increases, the PWM Technique with motor (High Speed) increases. PWM is a technique for modifying the frequency of a signal.

4.2.2.2 H-Bridge

This is a device that allows you to change the rotational orientation. By altering the polarity of the input voltage of a Direct Current motor, the spinning direction could be altered. This can be accomplished by using an H-Bridge.

The motor is in the midst of an H-Bridge circuit(Fig 4.3 show in below), which consists of four switches.



Fig 4.3 L289N Motor Driver

At the same time precisely shutting two switches, the provided electricity's polarity to the motor is reversed. As a result, the motor shifts its spin direction.

4.2.2.3 Power supply

Connecting an Motor Driver L289N module to an Arduino is the most basic and cost-effective methods of controlling DC motors. It is capable of controlling the direction and speed of two Direct Current motors.

One of the simplest and most cost-effective ways to operate stepper motors is interfacing an Motor Driver L289N module with an Arduino. It is capable of controlling both. The L298N motor driver has a voltage drop of nearly 2V. Frequently as a result of a drop in voltage inside the trading transistors of the H-Bridge circuit. 10V will be received by the motor when the terminal of the motor control supply is connected to a 12V. The maximum speed cannot be attained when using a 12V Direct Current motor. To get the maximum of the engine, the engine control supply must be a little high voltage than the motor's real required voltage. In the event that you're using 5V, consider the voltage drop of 2V.

4.2.2.4 Output

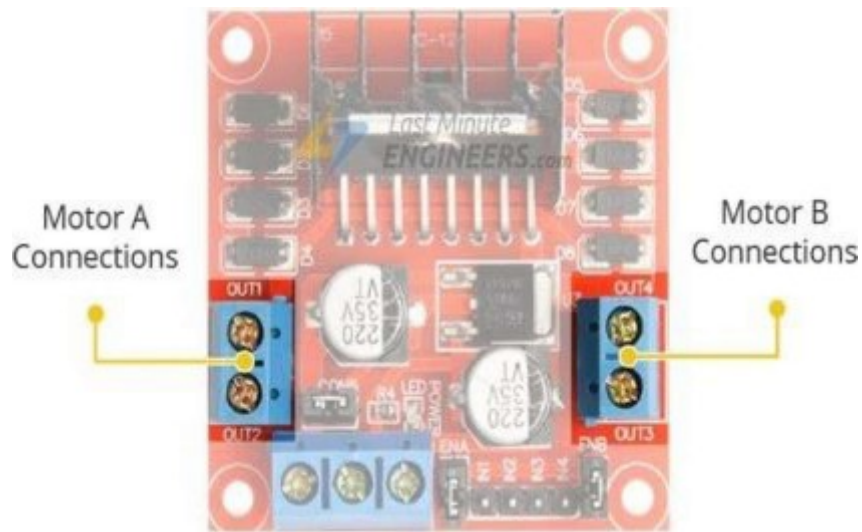


Fig 4.4 Motor Connections

The screw terminals for motors C and D on the motor driver L289N module will be broken out to the two screw terminals of 3.5mm module's edge. Two DC motor of volts ranging from 5 to 35V are connected to the terminals.

The module's each channel will supply 2A to the motors. However, because the total current supplied to the motor is determined by the system's control supply motor connections (Fig 4.4 is shown)

4.2.2.5 Control Pins



Fig 4.5 Control pins of Direction

Two types of control pins for each channel of the module allowing us to control the velocity and turning heading of the engines

simultaneously, namely Pins forcontrolling the course and pins for controlling the speed. The heading control pins

is used in controlling whether the engine turns backward or front. The pins exactly control the switches in the L298N IC's circuit of H-Bridge. Each channel has two course control pins (attached Fig 4.5). The IN 1 and 2 pins used to control engine C's turning heading, while the IN 3 and 4 pins is used to control engine D. The turning heading of an engine is controlled by applying logic LOW (Ground) or logic HIGH (5V) to the inputs.

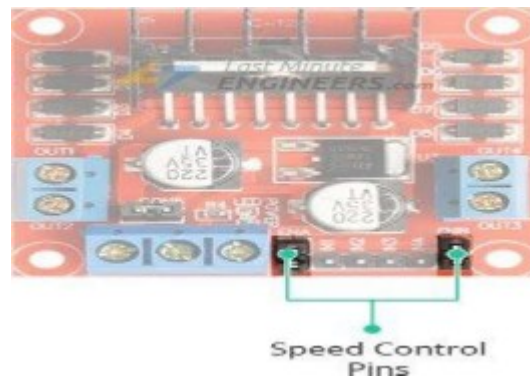


Fig 4.6 Control pins of Speed

The speed control pins ENA and ENB are used to turn the motors on and off as well as control their speed.

The motor stops when the pins pulled LOW and spin when they pulled HIGH.

However, PWM can be used to control the motor's speed.

A jumper is included on the module of these pins .The motor will be activated and runs at full speed when the jumper is in place

4.2.3 DC MOTOR

A Direct Current motor's armature rotates within its magnetic field. The primary working principle of a DC motor is that an mechanical force is experienced when current carrying conductive element is placed inside the magnetic field.

This theory is applied to all types of DC motors (Fig 4.5 attached below). As a result, when constructing a DC motor it is essential to create a magnetic field. The magnetic field is created using a magnet. Magnets of various types, such as permanent magnets and electromagnets can be used.

The magnetic field required for a DC motor to operate is provided using a permanent magnet. The production of these motors is simple.

Field control of this typical dc motor is achieved because the magnetic field intensity of a permanent magnet is constant.

Permanent magnet DC motors are used when the motor's speed does not need to be controlled. In sub-fractional and small fractional KW motors, permanent magnets are commonly used.

A PMDC motor is made up of two main parts. An armature and a stator. The stator, a steel cylinder, is depicted here. Inside the cylinder rim the magnets are placed.

The S-pole and N-pole of each magnet is arranged in an alternative manner in facing the armature, as shown in the diagram below. That is, if the S-pole of one magnet is facing the armature, the N-pole of the next magnet is facing the armature.

The steel cylindrical stator not only holds the magnet on its inner periphery, but it also serves as a low-reluctance magnetic flux return channel.

Despite the fact that field coils are not required in permanent magnet DC motors, they are used in conjunction with them on occasion.

Its because, if permanent magnets lose their strength, field excitation via these field coils can compensate for the loss of magnetic strength. These permanent magnets are frequently constructed from rare earth hard magnetic elements.

The armature of a PMDC motor is comparable to that of a conventional DC motor. The rotor of a PMDC motor also includes commutator, windings, and a core. The core of the armature is made up of a no. of varnished, insulated tubes.

Fastening these spherical steel sheets one after another creates a cylindrical, grooved armature core. The use of varnish insulated laminated steel sheets reduces loss of eddy current in the armature of a PMDC motor.

The conductors of armature are contained in the holes of the armature core's exterior circumference. By connecting the conductors of armature properly, we can achieve armature winding.

The terminals at end of the winding are linked to the motor shaft's commutator elements. Brushes made of graphite or carbon are positioned on the commutator with spring force to deliver current to the armature, just like in ordinary DC motors.

A PMDC motor's operation is fairly similar to that of a DC motor in general. A carrying conductor will be exposed to a mechanical force when it enters a magnetic field, the Fleming's left hand rule specifies the direction of it. Like a PMDC motor, the rotor is located inside the permanent magnet's magnetic field and rotates in the direction of the generated force.

Within the magnetic field of a DC motor, an armature rotates. The main operating principle of a DC motor is based on the fact that when a current conductor is placed inside a magnetic field, it experiences mechanical force.

This hypothesis holds true for all DC motors. A magnet is used in creating the magnetic field. Electromagnets and permanent magnets are two types of magnets that can be used.



Fig 4.7 DC Motor

4.2.4 Lead acid Battery

In 1801, the French scientist Nicolas Gautherot noticed that after the primary battery had been disconnected, wires used for electrolysis experiments will provide a minimal quantity of secondary current. Gaston Planté's lead acid battery, invented in 1859, was the first to be recharged by putting a reverse current through it. Planté's original model was made up of two lead sheets coiled into a spiral and separated by rubber strips. His batteries were used to power railway carriage lights while they were parked at a station. Camille Alphonse Faure improved the design in 1881,

using a lead grid lattice from which a lead oxide solution was compressed to form a plate. It was easy to mass-produce this design.

Because the battery is made of a gel electrolyte rather than a liquid, it may be utilised in a variety of orientations without leaking. In the 1930s, portable suitcase radio sets allowed the cell to be positioned vertically or horizontally due to valve design. The valve-regulated lead acid battery, which includes recent absorbed glass mat kinds and may be used in any position, was created in the 1970s.

Both of the negative and positive plates becomes lead sulphate in the discharge condition, and the electrolyte lose most of its soluble sulfuric acid and it becomes mostly water.

As electrons aggregate, an electric field is produced, which draws H^+ ions while repelling sulphate ions, resulting in a double-layer at the surface. The charged electrode is separated from the solution by hydrogen ions, which prevents further

reaction until charge has been flows out of it's electrode. A larger concentration of watery sulfuric acid is present in the electrolyte solution, which stores the majority of the chemical energy. By electrolysis of water, overcharging by high electrical voltages releases oxygen and hydrogen gas, which bubble out and will be lost. Some lead acid batteries have a construction that enables the electrolyte levels to be checked and completely filled with distilled water to restore any which has been lost.

During the charge, the opposite happens. Electrically induced proton flow or the Grotthuss mechanism, diffusion across the media, or the discharge of an electrolyte media can all cause this motion. The liquid will tend to flow by convection because the electrolyte density is higher only when sulfuric acid concentration is greater. As a result, a liquid-medium cell tend to discharge and charge more quickly than an otherwise comparable gel cell.

Because the electrolyte participates in the charge-discharge mechanism, this battery has one significant benefit over other chemistries: determining the state of charge is as simple as evaluating the relative density of the electrolyte, which decreases as the battery drains. A basic hydrometer made of coloured floating balls of varying density is included in some battery designs. The specific gravity of diesel-electric submarines

was measured and posted on a chalkboard in the control room on a regular basis to show how long the boat could stay below.



Fig 4.8 Battery

The open-circuit voltage of the battery can also be utilised to determine the status of charge. When the connection to the single cells are approachable, the charging current of the each cells can be determined, which can give an indication of the battery's general health; otherwise, the total battery voltage can be evaluated.

4.2.5 Step down Buck Converter

A buck converter is a power converter that lowers the input voltage output voltage. It's to the power supply is switching mode having at least one element for

storage of energy and at least two semi conductors. Filters based on capacitors are frequently added to the input and output of such a converter for reducing the voltage ripples or opposes the voltage supply across the inductor.

Because DC-to-DC converters(Fig 4.9 shown in below), like buck converters are more efficacious when compared with the linear regulators ,their circuits are simple which lower voltages by dissipating energy as heat but the current output is not stepped up , DC-to-DC converters, like the buck converters, are more energy efficacious.

The buck converter's primary operation is described as two switches control the inductor's current. In an ideal converter, all of the parts are supposed to be perfect. When the switch and diode are on, there is no

voltage drop and no current flow, and the inductor has no circuit resistance when it is off. Furthermore, throughout a cycle,

the input and output voltages are assumed to be constant, suggesting that the output capacitance is infinite.



Fig 4.9 Buck Converter

If the switch is turned off when the current is still oscillating, there will always be a potential difference across the inductor, therefore the input voltage source will always be greater than the net voltage at loads. When the switch is turned back on, the input voltage is removed from the circuit, and the current should reduce. The inductor becomes a current source and the current drops thus reducing the voltage across the inductor. The current will flow through the load by using the energy stored in magnetic field of the inductor. The total current will be more than the average current when the current is added to the current flowing and the voltage input is disconnected.

The voltage drop is compensated for by an increase in average current.

4.2.6 Stepper Motor

An electric motor which is internally commutated and powered by a source of direct current is called a brushed electric DC Motor which also uses an electric brush for contact. The stepper motor (Fig 4.10 shown in below)

For more than a century, distribution DC systems are being used to power motors in industrial and commercial facilities, and the brushed motors were the first major commercial usage of electric power to drive the mechanical energy. The magnetic

field's strength or operating voltage can be changed in order to alter the speed of brushed Direct Current motors. Depends upon how the electric field is linked to the energy source, the torque and speed characteristics of a modified for providing stable speed or speed that's inversely proportional to the load brushed motor can be

which is mechanical . In electrical applications, they are still using brush motors.



Fig 4.10 Stepper Motor

Under the external magnetic field an upward force is applied to one side of the positive pole when the current runs through the wound coil around the soft iron core, while a force of downward is applied to the other. The other receives the downwarding force. The force will cause the coil to turn, causing it to rotate based

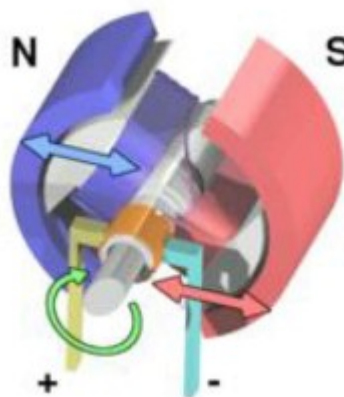


Fig 4.11 Working of Stepper Motor

on the right hand rule of Fleming .To keep the motor moving in the same direction,

every half cycle "direct current" commutator cause the current to run in reversing direction (in a motor of 2 poles).

The motor is troubled when the planes of the coils are parallel to the magnetic fields that is, when the rotor poles are parallel to the magnetic fields. One simple solution is to create a fissure between the commutator plates that is larger than the

brushes' closure. This concept can be found in a few distributed science expand books and is frequently encountered in homebuilt leisure activity engines, such as at science fairs. The engine currently coast thru a substantially circular segment of revolution of two times per insurgency, and the force is beaten, which is a clear disadvantage of this simple configuration. This could be useful for the electrical fans or keeping a flywheel spinning.

The EMF in a DC engine's coil corresponds to the rotational speed, while the torque corresponds to the current. Resistors, variable battery tappings, electronic controls and variable supply voltage, can all be used in controlling speed. You can find a reenactment case here. Turning around either the field or armature associations, but not both, can change the course of a winding field usually by

a unique set of contactor (heading contactor). The viable voltage could be adjusted by putting a resistor in the circuit or using an electronic controllable switching device made of transistors, thyristors, or, in the past, bend rectifiers mercury. Editing in parallel and series. The standard was series-parallel controlling

4.2.6.1 Chopper

The usual voltage supplied to the engine is moved in a chopper circuit by altering the supply voltage extremely quickly. The engine speed shifts as the "on" to off percentage is modified to modify the normal connected voltage. The normal

voltage linked to the engine is equal to the rate "on" time multiplied by the voltage supply. As a result, with 50V supply and a 20% "on" period, the engine's usual voltage will be 10V. During the "off" period, the inductance of armature will cause the current to flow in parallel with the engine through a diode known as a "flyback diode." The supply current will be zero at this time of the point in the cycle, therefore the usual engine current will continue to flow. This current will result in causing an excessively drop of voltage, affects other gears in the circuit and perhaps tripping overburden protector systems. As a result, an resistance of additional with the

armature in series is required to hold the current until the engine turn could build up the counter-emf. The resistance is continuously cut out as the engine revolution increases.

4.2.7 Solar Panel

A solar electric panel, also known as a solar panel, solar cell panel or photovoltaic module, is an installation-ready structure made up of PV cells. Solar power is the main source of energy for generating electric current using the solar panels. PV panels are made using the PV module, whereas PV arrays are made using PV panels. An electrical equipment photovoltaic system's array.

is powered by using the energy from

Edmond Becquerel, a French physicist, was the first to notice that certain materials produce an electrical charge when exposed to light in 1839.

Despite being too inefficient to power even basic electric equipment, these early solar arrays were utilised as a light metre.

The discovery made by Becquerel was not confirmed.

Despite being too inefficient to power even basic electric equipment, these early solar arrays were utilised as a light metre.

The discovery made by Becquerel was not confirmed.

Becquerel's discovery was not confirmed, Willoughby Smith made a discovery in 1873 that light striking selenium will cause a charge to form. Richard Evans Day and William Grylls Adams presented "The influence of light on selenium" in 1876, explaining their approach for replicating Smith's findings.

When exposed to both sunlight and weak, diffused daylight, Charles Fritts an inventor built the earliest marketable solar panel in 1881, which he described, consistent, and of immense force." These panels, however, were inefficient to power plants using coal power were compared.

Russell Ohl developed the solar powered cell layout in 1939, that's still utilised in today's solar panel. He was granted a patent for his invention in 1941.

In 1954, Bell Labs exploited this concept for creating the first economically effective silicon solar cell. The process of thermal oxidation for passivation of silicon surface

at labs of Bell in 1957 was devised by Mohammed M. Atalia. The passivation of surface process has been hard in cell efficiency since then.

Photovoltaic modules harness the photovoltaic effect to generate power from sunlight. Thin-film or wafer-based crystalline silicon cells are used in the majority of modules. The structural element of a module can be the upper or back layer. Cells must be protected against mechanical and moisture damage. The bulk of modules are stiff, however modules of semi flexibility based on cells of thin film are also available.

The photovoltaic box junction is an interfacing ~~output~~ ^{output} to the solar panel's back. MC4 connectors are found on the outside of most photovoltaic modules, allowing for simple weather proofing connection to the entirety of system. Power interface of USB can also be used as well.

Solar electric panels include frames made of metal that comprise bracket, troughs, reflector shapes, and racking components to help support the panel structure.

Because a single solar module can only supply a given amount of electricity, most

installations include ~~many modules that boost the PV~~ ^{many modules that boost the PV} and wiring ~~system's current or~~ ^{system's current or} voltages. A photovoltaic system consists of a number of PV modules, energy storage in a battery pack , a charge controller , inverter, interconnecting wiring, circuit breakers, disconnect switches , disconnect switches, fuses , and, if desired, a solar tracking device. Selected tool with carefullness to optimise energy storage , output , power transmission loss, and dc to alternating current conversion.

Electronics are now being incorporated into solar panels by a number of companies. This enables for distinct MPPT for each module, as well as performance data measurement at the module level for monitoring and problem identification. Many of the solutions use optimizers for power , a DC-to-DC converter designed to maximise the energy harvesting from the solar PV system. Since approximately 2009 , electronics of such kind have been compensating the effects of shading , in which the entire electrical output will not becomes zero when a shadow falls on the cells only one or two cells of the module becomes zero not affecting entire output .

Conducting wires that transfer current away from the modules are used to electrically connect the module and are ranged in matching fault conditions and the rating of current.solar panel (Fig 4.12 shown in below).



Fig 4.12 Solar Panel

Strings of panels make a connection to generate a specific voltage output in series, but they can also be connected in parallel to supply the PV system with the requisite current capabilities.

Bypass and blocking diodes could be integrate in the modules or utilized in external for dealing the shading of partial array and output is maximized. Bypass diode were connected in series with module in allowing current with high resistance in bypassing modules of shading. A blocking diode can be implemented in series with each module of the string to prevent if from the impedance internal of shading strings from short-circuiting of various strings in paralleled connections.

Currently, the bulk of solar modules are made up of silicon crystalline (c-Si) solar cells, which come in both monocrystalline and multicrystalline varieties.Crystalline silicon accounts for about 80% of global photovoltaic production in 2013, with thin- film technologies such as amorphous silicon ,CIGS and cadmium tellurium accounts for the remaining 20%.

4.2.8 Fuse

A fuse is a product safety mechanism that protects an electrical circuit from harm caused by excessive current. The most essential component is a metal strip or wire which start melting when the current it receives is higher, and it causes the current to interrupt or stop . When a fuse blows, an open circuit is created, which must be fixed or rewired.



Fig 4.13 Fuse

There are many distinct fuse designs depending on the application, with differing voltage and current ratings, responding time and capacity of breaking. Fuses (Fig

4.13 shown), are chosen based on their current and time functioning qualities in order of providing protection without creating undue inconvenience which is enough. Wiring standards for most circuits include a maximum fuse current rating. Short circuits, overloading, mismatched loads, and device failure, to name a few, are all causes of fuse operation. When a broken wire contacts a metal frame that is grounded, a short circuit occurs, and the fuse will melt.

Fuses are often used to protect electric motor circuits; minor overloads will automatically activate the regulating contactor, and the fuse will only work if there is a short circuit or large overload.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 RESULTS

The coded Arduino UNO board is connected to the circuit of fuse, voltage regulator, motor drivers and battery. The Arduino board is powered by source of 5v supply to the board. The circuit is connected to the electric mini tractor's an external power

agricultural machinery i.e., the motors assigned to various operations in agriculture. The motor drivers are connected to the fuse forming an other different circuit as the Arduino is not efficient to power the motor drivers which require a voltage input of 12. The fuse intervenes and melts if it exceeds the expected output from the battery to save the circuit from being completely short-circuited and damaged.

The motor drivers receives signals from the Arduino board and operates the motors according to the specific code. The various operations are sequentially coded to perform desired operation at the designated time. The proposed mini tractor s circuit is given below(Fig 5.1).

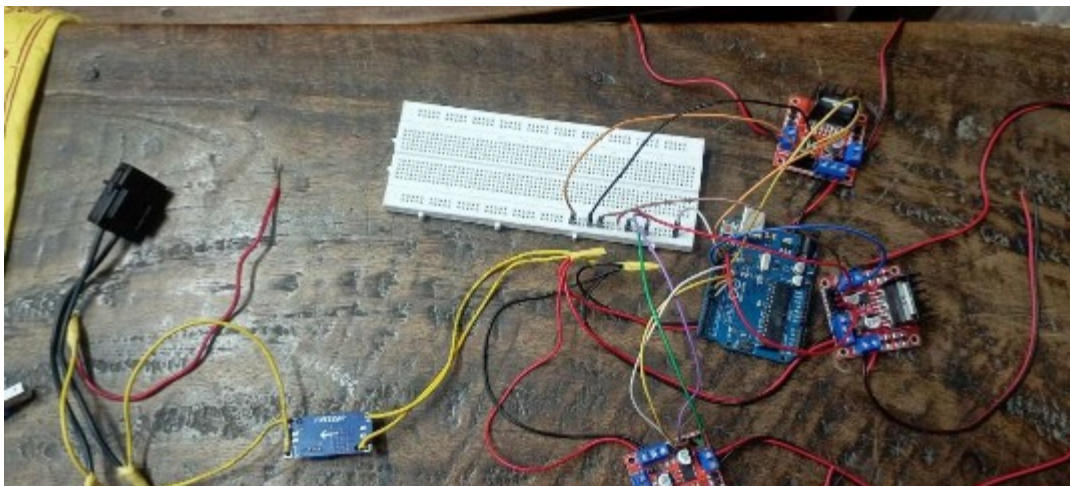


Fig 5.1 circuit connection

5.2 DISCUSSIONS

The operations of each specific code is carried out flawlessly. The various operations are done perfectly by the motors by receiving power supply from the motor drivers.

The movement of the vehicle, the chain drive mechanism is used. The chain drive is connected to the sprockets which in turn connects to the wheels. The tractor consists of two roller bush chains and four pedestal bearings one on each wheel. The device consists of two permanent magnet DC motor, running at a speed of 100rpm, one on each side of the tractor.



Fig 5.2 Assembled mini tractor

A spring loaded chisel plough is attached at the rear end of the tractor and is detachable after use. The chisel plough is a common tool used to get deep tillage with limited soil disruption. The main function of this kind of plough is to aerate and loosen the soil while leaving crop residue at the top of the soil. Unlike other ploughs the chisel plough will not invert or turn the soil. Major advantages of using chisel plough is, it reduces the effect of compaction, reduces soil erosion, low till farming conditions and prevents the formation of surface crusts, which helps water to infiltrate the soil.

Weed cutting operation is carried out with two blades, one being fixed and another moving above it, powered by a DC motor running at 30rpm. The

operation is done using scotch yoke mechanism .The scotch yoke or slotted link mechanism is a reciprocating mechanism , converting the rotational motion into linear motion of a

slider or viceversa. The piston or other reciprocating part is directly coupled to a sliding yoke with a slot that engages a pin on the rotating part.

Seed sowing operation is carried out by two DC motors running at 30rpm. It uses the Whitworth quick-return mechanism. The Whitworth quick-return mechanism is the inversion of a single slider crank chain. Single slider crank chain consists of three turning pairs and one sliding pair. The main aim is to convert rotary motion into reciprocating motion but reversed stroke is quicker in comparison with forwarding stroke. As the name states itself that the forward stroke is slower as it is power stroke while return stroke is quick as it is idle stroke. The major disadvantage is that the idle or return stroke is quicker and it reduces total machining time.

The fertilizer spraying operation is carried out by the 12v dc motor installed in the fertilizer can. The motor operates at 100psi. The flow of the motor is 2liters/min.as per the coding all the operations are executed and the results are noted

Appendix

```
int GND = GND;
```

```
int a=1;
```

```
int b =
```

```
2; int
```

```
in1=7;
```

```
int in2 =
```

```
GND; int
```

```
in3=8;
```

```
int in4 =
```

```
GND; int
```

```
in5=9;
```

```
int
```

```
in6=GND;
```

```
int
```

```
in7=10; int
```

```
in8=GND;  
int in9=11;  
int  
in10=GND;  
int  
in11=12; int  
in12=GND;  
int c = 3;  
int d =  
4; int e  
= 5; int  
f = 6;
```

```

void setup()
{

pinMode(a,
OUTPUT);
pinMode(in1,OUTPU
T);
pinMode(in2,OUTPU
T); pinMode(b,
OUTPUT);
pinMode(in3,OUTPU
T);
pinMode(in4,OUTPU
T);

}

void loop()
{
//MOTOR-A CLOCK WISE MAX SPEED
digitalWrite(in1,HIG
H);
digitalWrite(in2,LO
W);
analogWrite(a,255)
;

//MOTOR-B CLOCK WISE ,MAX SPEED
digitalWrite(in3,HIGH);
digitalWrite(in4,LOW);
digitalWrite(b,255);int GND =
GND; int a=1;

```

```
int b =  
2; int  
in1=7;  
int in2 =  
GND; int  
in3=8;  
int in4 =  
GND; int  
in5=9;  
int  
in6=GND;  
int in7=10;
```

```
int
in8=GND;
int in9=11;
int
in10=GND;
int
in11=12; int
in12=GND;
int c = 3;
int d =
4; int e
= 5; int
f = 6;
```

```
void setup()
```

```
{
```

```
pinMode(a,
OUTPUT);
```

```
pinMode(in1,OUTPU
T);
```

```
pinMode(in2,OUTPU
T); pinMode(b,
OUTPUT);
```

```
pinMode(in3,OUTPU
T);
```

```
pinMode(in4,OUTPU
T);
```

```
}
```

```
Void loop()
```

```
{
```

```
//MOTOR-A CLOCK WISE MAX SPEED  
digitalWrite(in1,HIGH);  
digitalWrite(in2,LOW);  
analogWrite(a,255);  
;
```

```
//MOTOR-B CLOCK WISE ,MAX SPEED  
digitalWrite(in3,HIGH);  
digitalWrite(in4,LOW);  
digitalWrite(b,255);
```

```
delay(2000);
```

```
//STOP
```

```
digitalWrite(in1,LOW);
```

```
digitalWrite(in2,LOW);
```

```
digitalWrite(in3,LOW);
```

```
digitalWrite(in4,LOW); delay(500);
```

```
//MOTOR-A COUNTER CLOCK WISE MAX SPEED
```

```
digitalWrite(in1,LOW);
```

```
digitalWrite(in2,LOW); analogWrite(a,255);
```

```
//MOTOR-B COUNTER CLOCK WISE MAX SPEED
```

```
digitalWrite(in3,LOW);
```

```
digitalWrite(in4,HIGH); analogWrite(b,255); delay(2000);
```

```
pinMode(c,OUTPUT);
```

```
pinMode(in5,OUTPUT);
```

```
pinMode(in6,OUTPUT); pinMode(d,OUTPUT);
```

```
pinMode(in7,OUTPUT);  
pinMode(in8,OUTPUT);
```

```
//MOTOR-C CLOCK WISE MAX SPEED  
digitalWrite(in5,HIGH);  
digitalWrite(in6,LOW);  
analogWrite(a,155);  
;
```

```
//MOTOR-D CLOCK WISE MAX SPEED
```

```
digitalWrite(in7,HIGH);  
digitalWrite(in8,LOW);  
analogWrite(a,155);  
delay(1000);
```

```
//STOP  
digitalWrite(in5,LOW);  
digitalWrite(in6,LOW);  
digitalWrite(in7,LOW);  
digitalWrite(in8,LOW); delay(100);
```

```
//MOTOR-C COUNTER CLOCK WISE MAX SPEED  
digitalWrite(in5,LOW);  
digitalWrite(in6,HIGH);  
analogWrite(a,100);
```

```
//MOTOR-D COUNTER CLOCK WISE MAX SPEED  
digitalWrite(in7,LOW);  
digitalWrite(in8,HIGH);  
analogWrite(d,100);
```

```
pinMode(e, OUTPUT);  
pinMode(in9,OUTPUT)
```

```
;
pinMode(in10,OUTPUT);

//MOTOR-E COUNTER CLOCK WISE MAX SPEED
digitalWrite(in9,HIGH);
digitalWrite(in10,LOW);
analogWrite(e,100);
delay(100);

//STOP
digitalWrite(in9,LOW);
```

```
digitalWrite(in10,  
LOW); delay(100);
```

```
pinMode(f, OUTPUT);  
pinMode(in11,OUTPUT  
T);  
pinMode(in12,OUTPUT  
T);
```

```
//MOTOR-F COUNTER CLOCK WISE MAX SPEED  
digitalWrite(in11,HIG  
H);  
digitalWrite(in12,LO  
W);  
digitalWrite(f,100);  
delay(100);
```

```
//STOP  
digitalWrite(in11,LO  
W);  
digitalWrite(in12,LO  
W); delay
```

```
delay(2000);
```

```
//STOP  
digitalWrite(in1,LO  
W);  
digitalWrite(in2,LO  
W);  
digitalWrite(in3,LO  
W);  
digitalWrite(in4,LO  
W); delay(500);
```

```
//MOTOR-A COUNTER CLOCK WISE MAX SPEED  
digitalWrite(in1,LOW);  
digitalWrite(in2,LOW);  
analogWrite(a,255);
```

```
//MOTOR-B COUNTER CLOCK WISE MAX SPEED  
digitalWrite(in3,LOW);
```

```
digitalWrite(in4,HIGH); analogWrite(b,255); delay(2000);
```

```
pinMode(c,OUTPUT);  
pinMode(in5,OUTPUT);  
pinMode(in6,OUTPUT);  
pinMode(d,OUTPUT);  
pinMode(in7,OUTPUT);  
pinMode(in8,OUTPUT);
```

```
//MOTOR-C CLOCK WISE MAX SPEED  
digitalWrite(in5,HIGH);  
digitalWrite(in6,LOW);  
analogWrite(a,155);  
;
```

```
//MOTOR-D CLOCK WISE MAX SPEED  
digitalWrite(in7,HIGH);  
digitalWrite(in8,LOW);  
analogWrite(a,155);  
delay(1000);
```

```
//STOP  
digitalWrite(in5,LOW);
```

```
W);  
digitalWrite(in6,LOW);  
digitalWrite(in7,LOW);  
digitalWrite(in8,LOW);  
delay(100);
```

```
//MOTOR-C COUNTER CLOCK WISE MAX SPEED  
digitalWrite(in5,LOW);  
digitalWrite(in6,HIGH);  
analogWrite(a,100);
```

```
//MOTOR-D COUNTER CLOCK WISE MAX SPEED
```

```
digitalWrite(in7,
```

```
LOW);
```

```
digitalWrite(in8,
```

```
HIGH);
```

```
analogWrite(d,
```

```
100);
```

```
pinMode(e, OUTPUT);
```

```
pinMode(in9,OUTPUT)
```

```
;
```

```
pinMode(in10,OUTPU
```

```
T);
```

```
//MOTOR-E COUNTER CLOCK WISE MAX SPEED
```

```
digitalWrite(in9,HIG
```

```
H);
```

```
digitalWrite(in10,LO
```

```
W);
```

```
analogWrite(e,100);
```

```
delay(100);
```

```
//STOP
```

```
digitalWrite(in9,
```

```
LOW);
```

```
digitalWrite(in10,
```

```
LOW); delay(100);
```

```
pinMode(f, OUTPUT);
```

```
pinMode(in11,OUTPU
```

```
T);
```

```
pinMode(in12,OUTPU
```

```
T);
```

```
//MOTOR-F COUNTER CLOCK WISE MAX SPEED
digitalWrite(in11,HIGH);
digitalWrite(in12,LOW);
digitalWrite(f,100);
delay(100);
//STOP
digitalWrite(in11,LOW);
digitalWrite(in12,LOW); delay
}
```

CHAPTER 06

CONCLUSION

In the previous researches the agriculture machine is operated electrically and the requirement of power sources are large and hence green energy sources such as solar power source wind power source can be used. In the proposed model, the unmanned automatic agriculture machine is designed for any one operation, in the proposed model all the operations such as ploughing, seed sowing, seed weeding, harvesting and fertilizer spraying can be combined. Traditional tractors are made use of diesel fuel which pollutes the environment and it can be replaced by solar cell battery as energy source. In some previous research, battery pack, charging device and generators are used in vehicle used in agricultural field and this can be replaced by green energy source which reduce the weight of the vehicle. In some agricultural machines sensors are used to record the speed, velocity and position and those sensors can be incorporated in the proposed model. Green house tractors are fabricated by researchers for doing specific work, it is controlled by a remote and their speed is less and it is not suitable for agricultural field. In some tractors emission of particulate caused a major problem and hence the use of fuel should be avoided in the proposed model. In other model electric chassis drive system is used with vehicle management systems. Thus the proposed model make use of green source of energy for power supply, operations such as ploughing, seed sowing, weed cutting , fertilizer spraying and harvesting are incorporated in a single system. The weight and size of the vehicle are reduced and it is of highly economical and it is suited for small scale farmers.

REFERENCES:

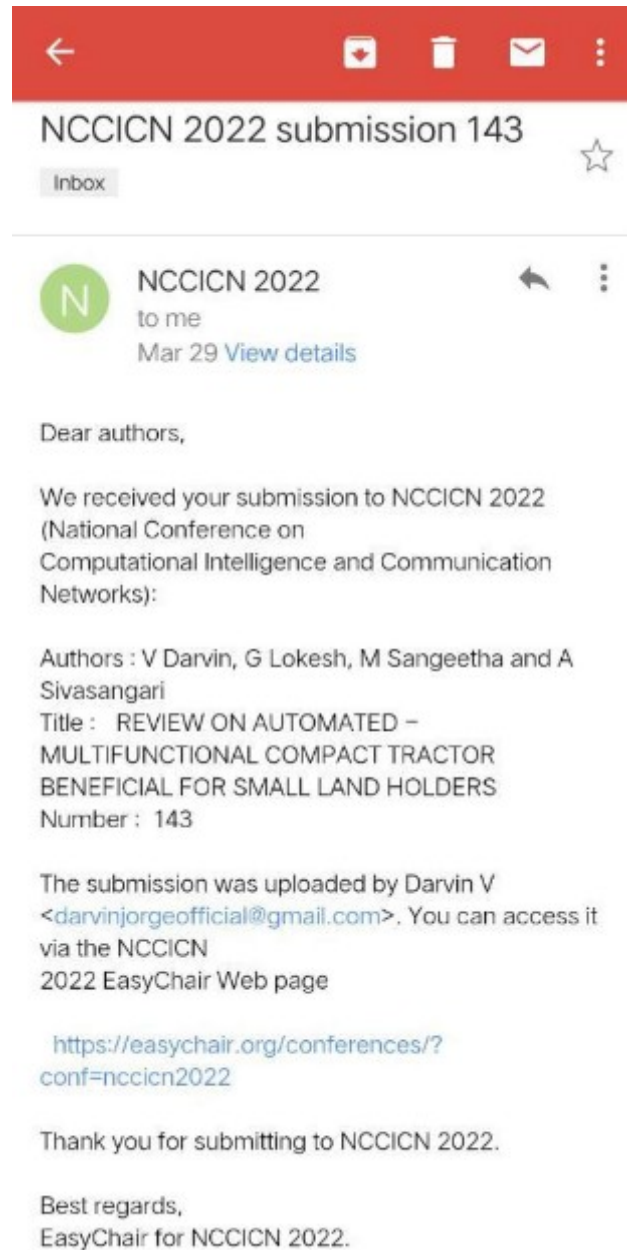
- [1]. Francesco Mocera and Aurelio Söm Analysis of a Parallel Hybrid Electric Tractor for agricultural Applications, *Energies*, 2020, 13(12), 3055, <https://doi.org/10.3390/en13123055>.
- [2]. Yuan Chuan Chen, Li Wen Chen and Ming Yen Chang, "A design of an unmanned electric tractor platform". *Agriculture* **2022**, 12(1), 112, <https://doi.org/10.3390/agriculture12010112>.
- [3]. Yan Yu Gao ,Xi Wang and Jian Jun_Li Optimization design of electric tractor for small machinery. 3rd International conference on automation , 2018 ,56-63.
- [4].Yuko UEKA , Jun YAMASHITA, kazunobi SATO and yoshinori DOI, "study on the development of the electric tractor Specifications and traveling and tilling performance of a prototype electric tractor", *Engineering in agriculture environment and food* , 2013 , 6(4), 160-164.
- Joon Kim, "Tractor performance evaluation of the electric all wheel drive tractor" , *Sensors*, 2022 (22), 185.
- [6]. Rodnei R.Melo, Fernando L M Antunes, Sergio Daher, Hans H.Vogt, Daniel Albiero, Fernando L.Tofoli, "Conception of an electric propulsion system for a 9Kw electric tractor suitable for family farming" *IET electric tractor applications*. 2019 (13) (12).
- [7]. Mengnan Liu, Chuiquen Wei and Liyun Xu, "Development of cooperative controller for dual motor independent electric tractor" ,*Mathematical problems in engineering* , 2020,12, <https://doi.org/10.1155/2020/4826904>.

- [8]. Fuzeng Yang ,Yiulu,Yongcheng Liu , YubinLan ,Debo Liu , Zheng Wang, eliminary test of tiny remote controlled electric tractor used in greenhouse” , Applied mechanics and materials 184-185 (2012), 1533-1541.
- [9]. ChaoJia , Wei Qia and LiyanQu , “Modeling and control of hybrid electric vehicles A case study for agricultural tractors” Institue of electrical and electronics engineers 2018, 978-1-5386-9310-0/19.
- [10]. XiaofeiZhang , “Design theory and performance analysis of electric tractor drive system” ,International Journal of engineering research and technology 2017, 6 (10) , Paper ID : IJERTV6IS100066.

OUTCOME OF THE PROJECT

- The Project has been submitted as Journal Paper to NCCICN 2022 (National Conference on Computational Intelligence and
- Communication Networks) Submission No: 143
- Reference Link : <https://easychair.org/conference/?conf=nccicn2022>

- Screenshot of Reply mail from NCCICN 2022



- Journal Paper First Page:

REVIEW ON AUTOMATED –MULTIFUNCTIONAL COMPACT TRACTOR BENEFICIAL FOR SMALL LAND HOLDERS

V.Darvin¹, G.Lokesh¹, M.Sangeetha², A.Sivasangari³

¹Final year students, Department of Mechatronics Engineering, Sathyabama institute of science and technology, Chennai-600119, Tamil Nadu.

²Associate Professor, Department of Mechatronics Engineering, Sathyabama institute of science and technology, Chennai-600119, Tamil Nadu.

³Associate Professor, Department of Information Technology, Sathyabama institute of science and technology, Chennai-600119, Tamil Nadu.

*Email: sangeetha_prod@sathyabama.ac.in, darvinjorgeofficial@gmail.com

ABSTRACT: The main objective of this project is to fabricate a multi –functional device useful for small land holders. A study was done on the design and fabrication of various automated machines available for specific purpose in agricultural field, to reduce the cost invested for tractors and harvesters, to do farming in most economical and modernized way. Nowadays machines are designed especially for doing specific work. This machine is electric powered so the cost of fossil fuel can be avoided and hence the pollution can be reduced. For Ploughing, Seed sowing, weed cutting, fertilizer spraying, and harvesting separate devices are used. They are neither cheap non-environment friendly. Small land holders find difficult to invest on each and every device and hence they are focusing on low cost, energy effective and high efficient device. To incorporate all these devices in one compact machine with less cost is beneficial for small land holders. To design and fabricate this compact review on agricultural field equipments was made.

Keywords: Multi functional Device, Ploughing, Seed Sowing

1.INTRODUCTION

Francesco Mocera et.al analyzed a parallel hybrid electric tractor for agricultural applications. The author compared the traditional tractor with the electric tractor and proposed hybrid electric orchard tractor. He fabricated traditional tractor and electric tractor and studied that even though electric tractor as modernized one the power requirement for each and every operations such as ploughing, seed sowing, harvesting the requirement of power is more. He proposed the green energy sources for power generation such as wind mill for running his proposed model to reduce the power.

Yung- Chuan Chen et.al proposed the design of an unmanned electric tractor platform. The vehicle is controlled by microcontroller embedded in the system. The tractor uses a four wheel independent suspension system for its movement with two differentials controlled by the reducer to have variations in speed while transporting and performing the operation. ABAQUS and TOSCO software are used for analysis of finite element and topology optimization. The vehicle system has two 7.5 Kwh induction motors and lithium ion batteries as its power source. The weight and size of the tractor is reduced to perform the operation of tillage by rotary plow machinery attached at the rear end of the vehicle. Compact spacing for the system is aligned to overcome the difficulties arises when the agricultural terrain is irregular. The steering system is electronic and configured to move both in forward and reverse directions.

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