



Literature Review on Two Wheeler Operated Sickle bar Mover

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ABSTRACT

The aim of this study is to perform a literature review for my project for understanding and analysis the project concept in brief. Several criteria in engineering aspects must be considered to develop an idea for this project. This project called as integrated design because of the function of the machines researched and it is found a new machine concept as it will operate with the help of two-wheeler. The machines will also design on suitability for the grass (hay) mostly in lawn, yards, grounds, farm, road side, etc. This project is more related to the engineering design field, so all the criteria in the design specification must be followed to get the best result at the end of the project. The proposed work is focus on design and fabrication of sickle bar mover used in grass (hay) cutting machine, shrub. In present work, we collect data related to our project under literature review of various research papers, thesis, project report, etc. so that it can be help full for taking correct decision while performing design calculation , CAD modeling ,etc. also some modification will be done for ease of operation. After that result will be discuss and design will finalized.

I. INTRODUCTION

Lawn maintenance and landscaping remain the most important constraints to keeping clean and fresh looking gardens and yards. Places that experience incessant rainfall throughout the year results in fast and tall growing grasses which are detrimental to the environment and purpose of keeping the lawn landscapes. Land clearing involves the removal of vegetation such as trees, bushes, shrubs grasses etc. for that different lawn mower are invented with different designs, and each suited to a particular purpose.

The first tool ever used to cut grass to a more desirable length was the scythe. The scythe has a

simplest design, containing wooden handle with a curved blade attached perpendicularly to the end. Until the 19th century, the scythe was the only option for cutting grass, which proved to be long tedious process. The first actual mower was invented in 1830 by Edwin Beard Budding. Budding was an engineer from England who first discovers the idea of mower from a cylindrical machine used for cutting in mill. The mower that he developed was composed of a large roller which provides power to cutting cylinder using gear. The cutting cylinder contains several blades connected in series around the cylinder. His innovation opened the door for numerous advancement in lawn cutting. Current lawn mowing includes a multitude of

applications and each of these applications includes different types of technologies. Some are completely electric, some are hybrid, but like the prominent driving vehicles, the most popular lawn mowers are gasoline driven. Even though one may have an engine being gas powered, the deck lifting system may be mechanical, electrical, hydraulic, or even a combination. Essentially, three main types of mowers exist now days walk-behind, riding and tow-behind mowers [1],[4].

In this project we will fabricate tow behind mover. Tow-behind mowers are used for much larger areas, like massive fields, large lawn, yards, play ground and are used much more in agriculture and road sides [1]. Two-wheeler tows these sickle bar mechanism and provide power to mechanism. And cut the hay (grass) or whatever needs to be cut. Basic components are sickle bar, cutting blades, drive system, cam, etc.

II. LITERATURE REVIEW

Design and Fabrication of Lawn Mower: [2] A lawn mower is an equipment to maintain the beauty of lawn. For the domestic purpose and in villages, people cannot spend more money on heavy machineries as well as power cut problem present such places, so considering these drawbacks they design a lawn mower without any power source which reduce the power consumption and power cut problem also overcome. The main component are used in this mover are wheels spiral cutter, spur gears, bed knife etc. The working of this mover is simple the wheel are the important part of mover for transmitting power to spiral cutter through spur gears as a result rotary motion obtained during rolling motion(forward motion) of wheel grass comes in between spiral blade and bed knife causes cutting of grass due to shearing. After survey this

we conclude that this paper is based on design and fabrication of mover it is simple in construction and very innovative concept. The conceptual design report of this paper highlights the design process used for this project. This report contains useful information with regards to the thought process and techniques used in analyzing alternative solutions. The background and context for this project are discussed in detail in this report and test revealed that, higher grass cutting nature of the field surface affected the efficiency of the machine.

Fabrication and Analysis of Lawn Mower:[3] In this project they fabricate the grass cutting machine use for agricultural field and the crops in the field. This is a new innovative concept mainly used in agricultural field. It is simple in construction and consist of motor, gear arrangement, cam, chain and sprocket, lead screw, wheel, control unit, Blades (sickle bar) etc. The working principle of this arrangement is as mention it consist of two cutter one movable cutter another fixed cutter the movable cutter blade is connected to the cam link and cam is rotating help of electric motor. When the motor to start running the shaft is rotate and it rotate the cam arrangement produces reciprocating motion of movable blade and the cutting process is carrying out. And also the grass cutter vehicle is move with the help of motor. The motor is connecting with the chain and sprocket arrangement and the pulley is coupled with wheel shaft. So after all these study we observed that this work focus on fabrication of electrically operated mower by using sickle bar mechanism used as cutter (blade) also in this project static structural analysis of sickle bar (blade) carried out determines the displacements, stresses, strains, and forces in structures or components caused by loads that do not induce significant inertia and damping effects. This project "GRASS CUTTER" is designed with the

hope that it is very much economical and help full to many agricultural areas. But drawback is it is dependent on electric power supply.

Design and operating characteristics of a push type cutter bar mower:[4] The aim of this study was to design, fabricate, and test a push type cutter bar mower for use by small-scale enterprises in forage harvesting. Forage harvesting in Turkey has been mechanized to a lesser extent than is desirable. Especially in the small farms, harvesting is still done manually, due to the high prices of mowers and the dependence on tractors. The mowers can be classified into two groups, tractor-drawn and self-propelled types. The biggest disadvantage of the tractor-mounted type mower, however, is over-dependency on the availability of a tractor, for these reasons, a push type cutter bar mower was selected for solving farmers' problems in terms of cost and versatility on various terrains of small-scale enterprises. The mower designed in this study consists of cutting units, transmission unit, power unit, handle, frame, and transporting. The cutting unit attached to the main frame, has two-knife bar sections; the upper one reciprocates over the stationary bottom one. The stroke length and the width of the standard type knife are 50.8mm. Transmission unit which reduced engine speed (Bell 1989) consisted of a worm-gear, bearings, bevel gears, chain and sprockets, crank, and pitman. After fabrication some analysis are carried out on performance of mover i.e. (operational characteristics) is find out. The relation between Effective field capacity and fuel consumption vs. forward speed; and Effective harvesting capacity and specific fuel consumption vs. forward speed .Is finding out experimentally. Here it is found that the forward speed of the machine should be selected considering grass density to avoid any blockage on the cutter bar.

Design and Fabrication of Lever Operated Solar Lawn Mower and Contact Stress Analysis of Spur Gears:[5] The name itself suggests the solar energy is used in this mover for its operation. The main component used in this project are solar panel, spur gear, DC motor, rotor blade, Arduino board(controlling rotor speed), ultrasonic sensor and battery. The main issue in a mower is the height of the grass cut cannot be adjusted spontaneously because the height adjustment of the rotor blade is done by lifting the whole deck with the help of wheel support and this mechanism takes time at least (4-5 minutes) to adjust the rotor. In this proposed lawn mower has a spur gear displacement mechanism is used and rotor blade height adjusted by lever attached to it and that can proportionally changes the height of the grass cut of the lawn and required grass cut can be achieved. It takes total time less than 20 seconds for adjusting blade height. So finally they conclude that use of lever operated solar lawn mower saves the electricity, minimizes the time taken to adjust the height, prevents the collision occurrence and also motor speed controlling facility. Again the FEA-analysis of spur gear for contact stress is carried and compares it with theoretical value and software value. Theoretical result obtained by Lewis formula and Hertz equation and results found by AGMA/ANSI equations are comparable with Finite Element Analysis of spur gear. It is noticeable that the Lewis formula can be used for a quick calculation of the stress on the root of gear tooth.

Design and Development of a Solar Powered Lawn Mower:[6] In this paper the effect of non renewable and renewable sources used as primary input on environment is observed with considering the noise effect on human. Parameters for selection of different parts used in lawn mower are discussed and the most appropriate and suitable part selected

by comparing other. Main part of the mower are Solar Panel, Battery, Dc Motor, cutter(rotary).After completing the fabrication of mower the performance tasted on different type of grass that is

Elephant grass, stubborn grass, Spare grass and Carpet grass.

Table 1

Sample plot	Average height of the grass before mowing (mm)	Average height of the grass after mowing (mm)	Expected height of the grass after mowing (mm)
Elephant grass	224	90	100
Stubborn grass	234	92	100
Spare grass	111	70	80
Carpet grass	70.5	56.5	50

The statically significance of the observation is found out by Chi-square statistical analytical

method. And the result table obtained for this is as shown in table below. ($x^2 = (O - E)^2/E$)

Table 2

Average height of the grass after mowing (mm) O	Expected height of the grass after mowing (mm) E	O-E	(O-E) ²	$x^2=(O-E)^2/E$	Time
90	100	-10	100	1	490
92	100	-8	64	0.64	470
70	80	-10	100	1.25	450
56.5	50	6.5	42.25	0.84	430

And finally conclude that the efficiency of the machine was found to be 93% for effective field capacity. The machine has proved to be a possible replacement for the gasoline powered lawn mowers.

Design, fabrication and evaluation of a spiral blade lawn mower: [7] In this project manually operated apparatus for cutting grass was designed, fabricated and tested. The main parts of the mover are Bed knife, Wheels, Spiral blade, cylinder shaft, Pinion. The objective of the study is to design and develop a locally fabricated non engine powered spiral blade lawn mower affordable by peasant farmers. After complete fabrication performance of mower conducted for finding out the field capacity and

field efficiency and that is obtained 0.115 ha/hr and 63.2% respectively. Also it is observed that the machine was seen to be more effective when working in a dry soil condition, because there is proper gripping of the tiers in a dry condition of the soil. High moisture content and undulated nature of the field surface affected the efficiency of the machine. And finally they conclude that field efficiency, increases with increase in operational time. The graph obtained after different test are as shown,

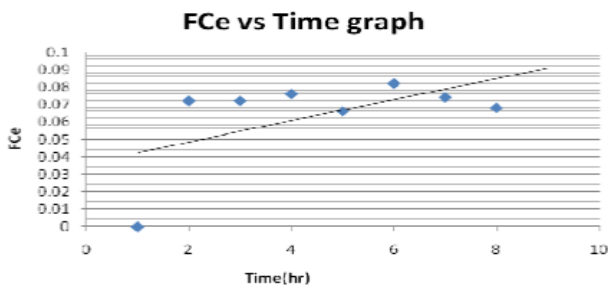


Figure 1. The relation between effective capacity and operational time.

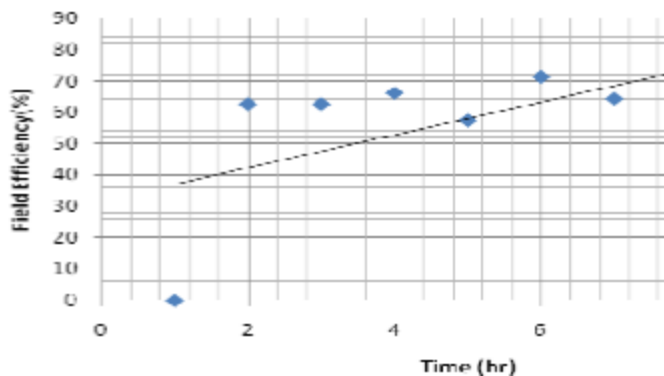


Figure 2. The relationship between field efficiency and operational time.

Design and Fabrication of Low Cost Portable Lawn Mower: [8]

In this project they designed the eco friendly lawn mower considering an initiative step in green technology as well as portability, flexibility of mower. Prototype of the designed system is fabricated so that it achieves its stated aim .i.e. compact in size, light weight and cost effective. The main parts of this prototype lawn mower consist of a DC motor, a pulse width modulation (PWM) device for controlling the motor, bicycle frame and wheels as the body structure, and a rechargeable battery. For safety operation, the motor will be controlled by a PWM device as since the motor has a high rotational speed of 19,300 RPM. As for the cutting head, nylon strings will be used as the trimmer instead of traditional cutting blades (spiral blade, sickle bar) due to cost effectiveness, safety,

and flexibility. The main thing observed in this mover that it operates around acute areas consist of trees, poles or fences and avoid the damage to the cutting edges. Thou it can only be used as an individual home appliance and cannot are a universal solution as a mower as it serves low area.

Design and Fabrication of Grass Cutter:[9]

This research paper based on the literature survey for design the grass cutting machine used in agricultural field for cutting the crops as well as shrubs. The purpose of this study is to finding out the most suitable lawn mower. Sickle bar cutting blade are used as cutter and power from engine transmitted to cutter through shaft and gear arrangement. The main focus of this project is to reduce human effort needed, minimize the quantity of labor that needed in a particular farm operation and ease in field operation within minimum time. After completing the literature the idea cleared and found out great portion of farmland can easily cut or brushed with lawn mower in one day. This project reduced number of personnel that needed in a particular farm operation, reduce manpower, and improve the economy of the country.

Solar Based Grass Cutter Using Remote Control Technique:[10]

The reason behind the fabrication of this cutter is constantly increase in cost of fuel which is not economical. In this project the solar energy is used as energy source. The main components of this mover are Solar panel, Battery, Relay, DC motor, RF module, Blade. The RF module is new concept is used in this project. The RF module is used to communicate wirelessly with another device. The RF module includes a complete line of transmitter, receivers and transceivers it provide very simple way to control transmission. The RF signals can travel through large distance for long range application it can be even transmitted

when there is an obstacle. HT12D encoder IC will convert parallel data to serial data and this given to RF transmitter. RF receiver receives the transmitted data. HT12D decoder converts the serial data to parallel data and this given to controller for follow the given command. Finally it is found that this study is helpful for understanding the value of renewable sources. In this project the intelligence system is used for controlling the lawn mower. The mower is controlled by remote as well as the sensor are used which helps to detect object which can damage the cutter during operation. This report was important in technological point of view. Various advantages are determined like; low maintenance, AC supply can be used for charging as well, No need of skilled person and eco-friendly. But on the other side major disadvantage is it cannot be used in rainy season and the intelligence system is quite uneconomical.

A Review and Comparative Analysis of Solar, Electric and Gasoline Lawnmowers: An Extensive Study:[11] A lawn mower is a machine consists of variety of components such as blades, rotor and motor used in household applications in order to cut the grass up to some particular height that can be varied according to the design criteria of mower blades. In nineties the mover are run by electric source. But nowadays newest technologies are utilized and different concept is used to like catalytic converters used to reduce the air pollution. But again there is chances of air pollution so, In order to shut down all the problems, the RC-SOLAR type of mower is currently employing in grass cutting machine. The main purpose of the paper is to summarize the literature review of different technologies pertaining to the lawnmowers running on gasoline, solar and electric power. Furthermore, the designing, fabrication and review result discussions are also studied in this

project. Through the comparative study of three types of lawn mower the author deduced following key points.

1. Solar powered mowers are more efficient, noiseless and no pollution when compare with gasoline mowers that produce a lot of noise and affect the environment.
2. The muffler can be installed in order to reduce the noise of motor as low as 7-10 decibels.
3. The cutting effectiveness of the blade can be increased by improving the slice to push and to obtain good strength.

Design analysis of rotary lawn mower [12]: In this project the author has addressed and provided solution for adjusting the cutting height of blade through wheel mount holes at different positions on the main frame of the mower. The author also designed essential component required to operate the mower smoothly and as per planed such as Bevel gear, V-belt drive, shaft bearing design, and mover frame. The frame is structural member which forms the backbone of lawn mower. Initially the introduce two frames but a small change is cross bar are used in one frame so, to choose most appropriate frame structural analysis is done by using ANSYS workbench4. Here they found out the various mechanical parameter like maximum deflection max. Principle stress, max. Principal strain, max. shear stress, max. Normal stress and strain energy. And conclude that all this parameter is reduce by 30%to 40% by using cross bar in frame. Again they implement new concept used in height adjustment of mower which is simple to operate. The frame design ensures better strength and reliability which was proved using the analysis results, the frame was found to be safe under

loading. The height adjustment module provides a simple yet effective means of cutting height adjustment, the stresses developed on it was also analyzed and was found to be safe under limits.

Electric Grass Cutter by Using Scotch Yoke Mechanism [13]: The paper discusses different aspects of grass cutter machine which will be helpful for the agriculture firm to move towards mechanization. In this paper they highlight the mechanization of the Agricultural firm in India is still in a stage of infancy due to unavailability and the less knowledge of advanced tools and machinery. The main objective of this project is to design a grass cutter machine that is affordable as compared to currently available grass cutting machine, simple and can be fabricated in a regular machine shop, less in weight and can be easily handled. In this study electric power mover is fabricated the main component are motor, linear blade (sickle bar), scotch yoke mechanism. The principal of operation is mover similar like other mover but new concept used in transmission system i.e. scotch yoke mechanism is used. This mechanism is used to convert the rotating motion into the reciprocating motion. The slider (Yoke) is directly couple to blade as a result blade reciprocates and cutting of grass takes place. And finally they achieve there objective having low cost, simple in operation and effective than other mower.

Lawnmower blades US Patent [14]: This present invention relates to lawnmower blades there design alignment and blade position and the cutting force on the grass. In this patent he introduce the blade design for more effective cutting of grass. The blade is flat at the center position and the cutting edges are provided at the end of blade at lower surface. But such types of blades are not produces more cutting force but quite in operation. The inventor

introduces modification in this blade so that maximum cutting force is obtained. A hump is produce on blade at the end but opposite to the cutting edges. Hump is open mouth shape and it is found that the ejecting force obtained for grass cutting is more which is more suitable for previous blade. Such type of blades are commonly use in rotary blade type mover.

Design Modification And Performance Comparison Of Lawn Mower Machine By Mulch And Flat Type Cutting Blade [15]: The needs for development of effective and economic grass cutting research work is under taken entitled “Modification and performance evaluation of lawn mower” and its objectives are fabricate mulch type and flat type blade and Performance of these fabricated blade in field is found out. The main component of this project is power unit, supporting frame, blades. After successful completion of this fabrication according to designed parameter the performance test is carried out by using mulch and flat type of blade. The field efficiency of mulch type of cutter is 93.7% and flat type cutter gives 83.17%. Also the effective field capacity of machine using mulch blade is 0.0506 ha/hr while flat type blade is 0.0440 ha/hr. Then conclude that the mulch type of cutter is efficient than the flat type cutter.

III. CONCLUSION

Lawn mowers are an important part and used many different places throughout the world. They play big role in agriculture field. In literature survey we found that there are so many different types of lawns movers available. Also various concept and design are introduced on lawn mower by different researchers. Some movers are eco friendly such as solar operated mover but they cannot be used in rainy season. Various remotely operated solar based

mover are available i.e. intelligence system are used for their operation. Some movers are operated by human power which can be used for small size of lawns. The main point we observed in survey is, which operating parameters and performances are important for good lawn mower such as Effective field capacity, fuel consumption, forward speed and grass density. Also we found that how analysis of various parts of mover is done and importance of blade (cutter) geometry for proper cutting of grass. In this way the detail studies of lawn mower its component, working mechanism from literature and available source help to appraise deep knowledge of mover. After successful completion of this project more flexibility in grass cutting operation will be obtained as compare to heavy machinery. Last there is always a scope for modification.

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