

Design And Fabrication Of Semi-Automated Lawn Mower

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Abstract- Evolution of early period to the modern period is mainly due to the advancement in technologies. Every field has its own development in their innovations. Agriculture is the major field, where technological advancement is required for the development. Major purpose of our paper is to establish a new kind of Lawnmower. Here we have developed a semi-automated lawnmower which may be a replacement for commercial manual lawnmower that is being used widely .This device doesn't require any manpower for their operation, it can be operated by an android device. Commercial lawnmowers are bulkier and are not compatible, but this device is compatible and light-weight. Since it is made up of UPVC(Un-plasticized polyvinyl chloride).Generally alternating current or fuels are used as a power source for commercial lawnmowers whereas this device can be operated by means of battery or solar source.

Keywords: Grass cutting, Android controlled.

I. INTRODUCTION

A lawnmower is a instrument that uses several blades to cut grass surface to even level. The height of grass to be cut may be fixed while designing the mower[6]. In our lawnmower the height of grass to be cut will be adjusted. The movement of wheels in our lawnmower is in a way that the mower move freely in all the directions, such that it can move in 360°. This can be achieved by using the Zero turn mechanism in the front wheel[12]. The rear wheels are powered by a pair of DC geared motor on either side. The motors used in the forward and backward motion is controlled by the motor driver integrated circuits[10]. The system totally depends on the DC power source, which is provided by a conventional battery-pack[11]. Since this mower operates in direct current, it is much efficient than the commercial ones. The blade is powered by a high speed DC motor. Speed of the motor is nominally adjusted according to the nature of the grass in the lawn. Unlike commercial lawnmower which is operated by human effort, this can be easily controlled by an

Revised Manuscript Received on August 05, 2019

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android device[6]. Arduino technology is implemented in our system to control all the necessary operations. The signal transmission is attained by the Bluetooth module embedded in the control unit[8]. Since UPVC material is resistant to the external damaging factors, the frame of our lawnmower is fully fabricated with UPVC pipes and joints. Durability of the frame is increased by usage of this type of material[3].

II. OBJECTIVES

- It must be easy to handle.
- It must be portable and cost-efficient.
- It must be remotely controlled.
- It should have an increased durability.
- Damaged parts can be easily replaced.
- It must be Eco-friendly.

III. COMPONENTS USED

A. Frame

A Frame is physical entity to which other components are fixed. Frame is equally considered to a skeleton in organisms. Frame plays important role in withstanding the dynamic load of the machine without undergoing any form of distortion or deformation.

B. Wheels

Generally wheels helps in motion of any bodies. Basically wheels are used in transmitting the torque or power from any source in-order to move the body in desired direction. The wheels are mounted in the required axis to transport loads to destined positions.

C. Electric motors

Electric motors are machines which change electrical into mechanical energy, that is used for various purposes. Electric motor works basically on two principle, one is magnetic field and other one is winding current flow. Electric motor operates in two different power sources which are Direct-current and Alternating-current.

D. Blade

Blade is a tool used to chop, slice or trim materials. Blades are always harder than the materials on which they are used. Blades are connected with electric motors in modern devices to obtain the expected level of cutting. Blades generally have the cutting edges along which the force is exerted over the material to be deformed.

E. Arduino Uno circuit

Arduino is a type of micro-controller unit which is used widely in every field of technology. It can be programmed according to our need. It is programmed using basic c ++ codes and Arduino codes. This circuit

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interacts with all the connected components and reacts to the input signals from connected devices. Signal transmission for Arduino can be achieved by various wired and wireless connection devices. There are several types of this Arduino some of the familiar types are Arduino Mega, Arduino Leonardo, Arduino Due.

F. Motor driver module

Motor driver integrated circuits are used in automotive for controlling the movements. Motor driver acts as current amplifier. Motor driver amplifies low-strength control signals into high-strength signals. These high-power current signals are responsible for the movement of the motors. Some of the Common motor driver integrated circuits are L293D and L293NE.

G. Bluetooth module

Bluetooth module is generally an wireless communication device. Bluetooth transmits short wavelength Ultra High Frequency radio waves ranges between 2.400GHz to 2.485GHz. Physical transmission range of the Bluetooth is between 10m to 100m. Bluetooth module can be connected with any control units for signal transmission. Commonly used Bluetooth modules are HC-05.

IV. SELECTION OF MATERIAL

Material selection is generally based on the necessary properties, which cause in impact in the final product. Some of the external factors which affect the product are surface finish, rigidity, chemical stability etc., Material selection also depends on other factors like physical, mechanical, chemical properties and manufacturing point of view. Various physical properties which are considered in selection of material are thermal conductivity, coefficient of thermal expansion, specific gravity, melting point. Other than physical properties mechanical properties like strength at various load such as tensile, compressive, shear, bending, torsion, impact, dead, gradual. Factors like utilization of scrap, appearance and non-maintainability of the designed parts will also playing a major role in material selection.

Table no 4.1 Bill Of Materials

PART NAME	MATERIALS	QUANTITY
FRAME	UPVC	1
WHEEL	PLASTIC	4
CONTROLLER	-	1
MOTOR	-	3
BLADE	STAINLESS STEEL	1
BATTERY(12 V,9Amps)	-	1

V. METHODOLOGY

The fabrication of the mower starts from cutting the UPVC pipes according to the dimensions. The pipes are then fitted based on the structural design of the frame. The joints between the pipes are done using the UPVC couplers. Slots for the motors are machined in the lathe for the perfect fit of the motor. Rear wheels are connected with the motors fixed at the pipes. High speed motors are used for operating the blades. The connection from the motors are given to the motor driver circuit. Signal transmission from the remote android device is received by the Bluetooth module fixed to the Arduino circuit. Arduino circuit and the motor driver

circuit are connected with each other by male and female connecting wires. The Arduino circuit is fed with codes which helps in movement of the motors. The android device is given with an application which is programmed according to the required control features. According to the signal intervention from the android control device movement is managed by the control unit.

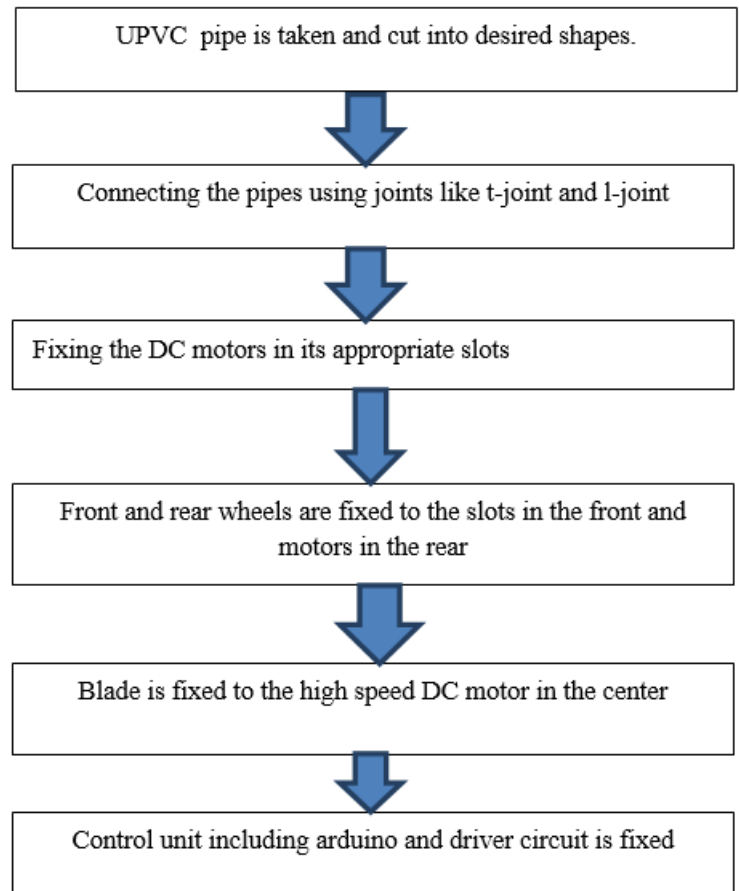


Fig5.1 Methodology

VI. FABRICATION

Frame is made of pipes of material called UPVC. The process of making the frame starts with the cutting of the pipes with the hacksaw blades to their desired dimensions. Edge of the pipe which contains the rough surface is scrubbed by salt paper to form a smooth surface. The outer surface of the pipe is polished with turpentine liquid. Slots are machined at the required pipe edges by using lathe tools. Then the pipes are fitted according to the design using the L-joints, T-joints, straight joint couplers which are also made of the same UPVC material. The joints are reinforced using the Cyanoacrylate adhesive. Here we are using the geared DC geared motors. Low speed and high torque DC motor is used for the movement in the rear wheels. The motor which is responsible for the rotation of the blade is a high speed and low torque type motor. The motor shafts are modified according to the wheels and blade hole's diameter. Front wheels in this system is given with 360° rotatable castor wheels. Front wheels work on the basis of Zero-turn

mechanism which allows the wheels to move freely in all the directions. Rear wheels are given with the robotic wheels. The robotic wheels are made of combination of ABS-plastic and the tread in the wheels are made of flexible rubber. Blade is fabricated from a SS plate of thickness of 3mm. Blade is cutout in a shape such that it has curve at the both sides of the center point. The curve is in opposite directions faces in alternate directions to each other. Cutting edge is created on the curve faces using the graphite grinding wheels. A slot is created at the perfect center of the blade which helps in fitting the blade to motor shaft which is already fixed to the frame. The central control unit consist of an Arduino circuit, motor driver circuit and Bluetooth module. All this circuits are connected with each other using male and female connecting wires. An Android UNO application is developed which helps in controlling the system.

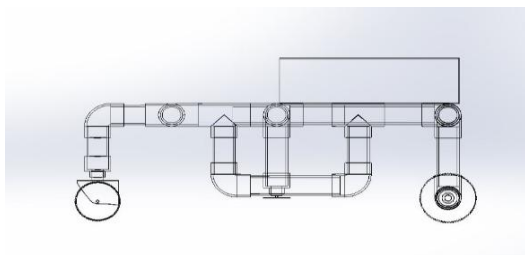


Fig6.1 Side View of the Semi-Automated Lawnmower

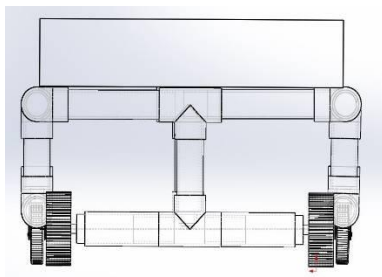


Fig6.2 Front View of the Semi-Automated Lawnmower

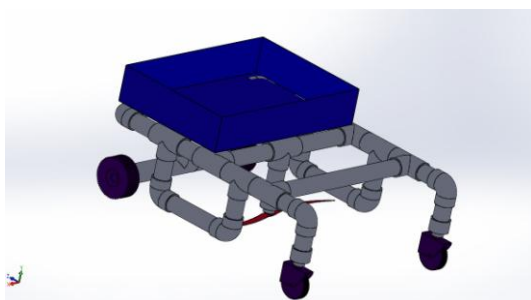


Fig6.3 3D view of the Semi-Automated Lawnmower

VII. WORKING PRINCIPLE

The system includes a frame with a set of front wheels and rear wheels. Only the rear wheels are powered and the front wheels are ideal. The rear wheel rotation is based on the rotation of the motor shaft connected to it. Front wheel

rotation is not based on any power source but it alters itself to the movement of the rear wheels. The total movement of the wheels are controlled by the central control unit. The central control unit work based on the signal input from the user with in the help of the android application. The signal transmission is achieved with the help of the Bluetooth module. Here we are using the HC-05 Bluetooth module. The major power source for this all system is lithium-ion battery. The battery exerts a power of 12v with 9amps of current strength. It is very efficient because it is rechargeable frequently upon its usage. The major application of this system is to cut the grass to required height. The cutting clearance of the blade can be adjusted with the help stepper motor shaft. While cutting the grass there are chances to meet with an obstacle, it can be avoided by sensing them using the sensors which are connected with control unit. The grass that is being cut is collected in the vacuum collector fixed at the mower.

VIII. MERITS

- Direct manual effort is reduced with semi-automated system.
- No special skills or technique is needed to operate the mechanism.
- It is compact in size, easily portable, cost-efficiently.
- Replacement of the damaged parts are easy in this system.
- Mass production of this machine is highly cost-efficient.

IX. APPLICATION

- It is used in the industrial lawns.
- Apart from industries, lawnmower is used in public places like hotels, hospitals, schools and colleges etc.

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AUTHORS PROFILE



N. Ramachandran, Assistant Professor, Department of Mechanical Engineering, Sri Krishna College of Engineering and Technology, Coimbatore. I have completed my Under Graduation at Shri Angalamman College of Engineering and Technology, Trichy. And also, I have completed my Post Graduation at Bannari Amman College of Engineering, Sathyamangalam. I have Published 14

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