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DESIGN AND ANALYSIS OF SEMI-AUTOMATED GRASS CUTTER

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ABSTRACT

The development of technologies is primarily responsible for the transition from the ancient to the modern era. Every field has seen unique advancements in invention. The primary industry where development necessitates technological innovation is agriculture. Our paper's main goal is to create a new type of lawnmower. Here, we have created a semi-automated lawnmower that could take the place of the extensively used commercial manual lawnmower. This gadget can be operated by an Android device, thus it doesn't need any labor to function. While commercial lawnmowers are heavier and incompatible, this gadget is lightweight and compatible. Because UPVC, or unplasticized polyvinyl chloride, is used to make it. For commercial purposes, fuels or alternating current are typically utilized as power sources.

Keywords: Grass cutting, Android controlled.

I. Introduction

A lawnmower is a device that makes use of numerous blades to cut grass floor to even stage. The height of grass to be cut may be constant while designing the mower [6]. In our lawnmower the peak of grass to be cut may be adjusted. The movement of wheels in our lawnmower is in a manner that the mower pass freely in all the guidelines, such that it may circulate in 360˚. This may be finished via using the Zero turn mechanism inside the front wheel [12]. The rear wheels are powered by way of a couple of DC geared motor on both facet. The motors used inside the forward and backward movement is managed by the motor motive force integrated circuits [10]. The system completely depends at the DC strength supply that is provided by means of a traditional battery-% [11]. Since this mower operates in direct cutting-edge, its miles a great deal efficient than the industrial ones. The blade is powered with the aid of a high speed DC motor. Speed of the motor is nominally adjusted according to the nature of the grass inside the garden. Unlike industrial lawnmower that's operated through human attempt, this could be easily managed with the aid of an android device [6]. Arduino generation is carried out in our system to govern all the vital operations. The signal transmission is attained via the Bluetooth module embedded within the manipulate unit [8]. Since UPVC cloth is proof against the external damaging elements, the body of our lawnmower is absolutely fabricated with UPVC pipes and joints. Durability of the body is improved by way of usage of this type of material [3].

II. OBJECTIVES

- It have to be easy to deal.
- It ought to be transportable and cost-efficient.
- It ought to be remotely controlled.
- It have to have an elevated sturdiness.

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- Damaged elements may be effortlessly replaced.
- It have to be Eco-friendly.

III. COMPONENTS USED

Frame

A Frame is physical entity to which other additives are constant. Frame is similarly considered to a skeleton in organisms. Frame plays critical function in withstanding the dynamic load of the device without undergoing any shape of distortion or deformation.

Wheels

Generally wheels facilitates in motion of any our bodies. Basically wheels are utilized in transmitting the torque or power from any supply in-order to transport the body in favored direction. The wheels are established within the required axis to transport hundreds to destined positions.

Electric motors

Electric vehicles are machines which alternate electrical into mechanical strength, that is used for diverse functions. Electric motor works basically on two principle, one is magnetic subject and other one is winding modern drift. Electric motor operates in two exclusive power sources that are Direct-contemporary and Alternating-current.

Blade

Blade is a tool used to cut, slice or trim materials. Blades are always harder than the materials on which they're used. Blades are connected with electric automobiles in present day devices to gain the anticipated stage of slicing. Blades normally have the slicing edges along which the force is exerted over the cloth to be deformed.

Arduino Uno circuit

Arduino is a kind of micro-controller unit that is used extensively in each discipline of technology. It can be programmed in keeping with our need. It is programmed using basic c ++ codes and Arduino codes. This circuit interacts with all the linked additives and reacts to the input alerts from connected gadgets. Signal transmission for Arduino may be achieved by means of diverse wired and wi-fi connection devices. There are numerous forms of this Arduino some of the acquainted sorts are Arduino Mega, Arduino Leonardo, Arduino Due.

Motor driver module

Motor driver included circuits are utilized in automobile for controlling the movements. Motor motive force acts as modern amplifier. Motor driver amplifies low-power control alerts into excessive-power indicators. These excessive-strength modern indicators are liable for the motion of the vehicles. Some of the Common motor motive force incorporated circuits are L293D and L293N.

Bluetooth module

Bluetooth module is typically an wireless communication tool. Bluetooth transmits brief wavelength Ultra High Frequency radio waves stages between 2.400GHz to two.485GHz. Physical transmission variety of the Bluetooth is between 10m to 100m. Bluetooth module may be connected with any manipulate gadgets for sign transmission. Commonly used Bluetooth modules are HC-05.

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IV. SELECTION OF MATERIAL

Material selection is usually based at the essential properties, which cause in effect in the final product. Some of the outside factors which affect the product are surface finish, rigidity, chemical balance etc., Material choice also relies upon on different factors like bodily, mechanical, chemical residences and manufacturing factor of view. Various physical residences which can be taken into consideration in choice of fabric are thermal conductivity, coefficient of thermal expansion, precise gravity, melting point. Other than physical houses mechanical homes like strength at diverse load which include tensile, compressive, shear, bending, torsion, impact, lifeless, gradual. Factors like utilization of scrap, appearance and non-maintainability of the designed elements will even gambling a main role in fabric choice.

V. METHODOLOGY

The fabrication of the mower begins from reducing the UPVC pipes in keeping with the dimensions. The pipes are then outfitted primarily based on the structural design of the body. The joints among the pipes are achieved the usage of the UPVC couplers. Slots for the motors are machined in the lathe for the ideal fit of the motor. Rear wheels are linked with the cars fixed at the pipes. High velocity vehicles are used for running the blades. The connection from the vehicles are given to the motor motive force circuit. Signal transmission from the far off android tool is acquired by means of the Bluetooth module constant to the Arduino circuit. Arduino circuit and the motor motive force circuit are connected with every other via male and female connecting wires. The Arduino circuit is fed with codes which facilitates in movement of the automobiles. The android device is given with an utility which is programmed consistent with the desired control functions. According to the signal intervention from the android control device movement is controlled by means of the manipulate unit.

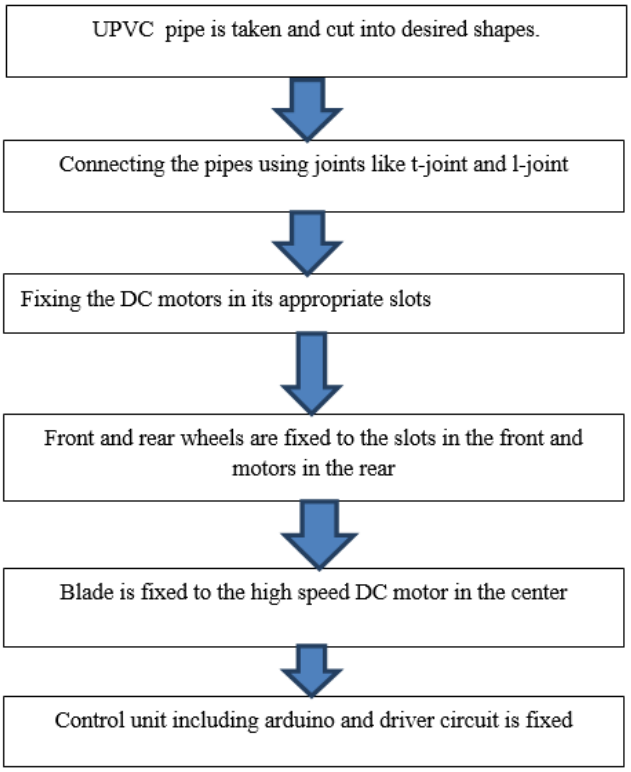

Fig 5.1 Methodology

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VI. FABRICATION

Frame is product of pipes of cloth referred to as UPVC. The process of creating the frame starts with the reducing of the pipes with the hacksaw blades to their preferred dimensions. Edge of the pipe which contains the hard surface is scrubbed by salt paper to shape a clean surface. The outer surface of the pipe is polished with turpentine liquid. Slots are machined at the desired pipe edges by using using lathe gear. Then the pipes are geared up in line with the layout using the L-joints, T-joints, immediately joint couplers which might be also fabricated from the same UPVC cloth. The joints are reinforced using the Cyanoacrylate adhesive. Here we're using the geared DC geared motors. Low speed and excessive torque DC motor is used for the motion inside the rear wheels. The motor that's liable for the rotation of the blade is a high velocity and coffee torque type motor. The motor shafts are modified in line with the wheels and blade hole's diameter. Front wheels on this system is given with 360˚ rotatable castor wheels. Front wheels paintings on the idea of Zero-turn mechanism which permits the wheels to move freely in all the guidelines. Rear wheels are given with the robotic wheels. The robot wheels are product of aggregate of ABS-plastic and the tread within the wheels are manufactured from flexible rubber. Blade is made of a SS plate of thickness of 3mm. Blade is cutout in a form such that it has curve on the both facets of the center point. The curve is in opposite guidelines faces in trade instructions to every other. Cutting part is created at the curve faces using the graphite grinding wheels. A slot is created at the appropriate middle of the blade which enables in fitting the blade to motor shaft that's already constant to the body. The critical manage unit encompass an Arduino circuit, motor driving force circuit and Bluetooth module. All this circuits are connected with every other the usage of male and lady connecting wires. An Android UNO software is evolved which helps in controlling the gadget.

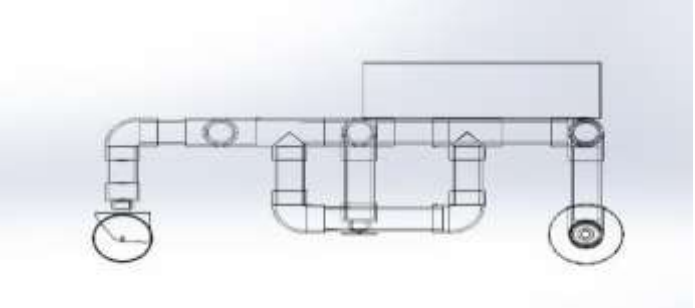

Fig 6.1 Side View of the Semi-Automated Lawnmower

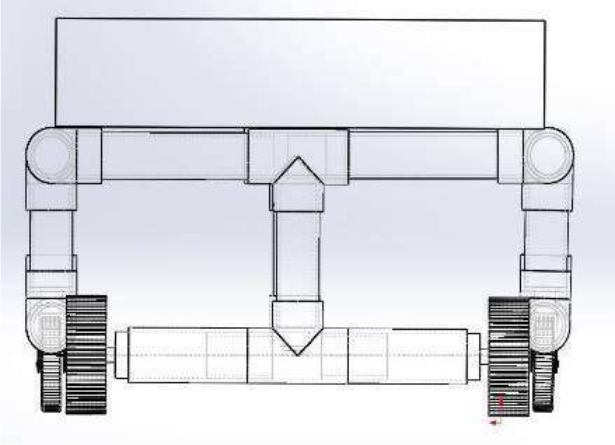

Fig 6.2 Front View of the Semi-Automated Lawnmower

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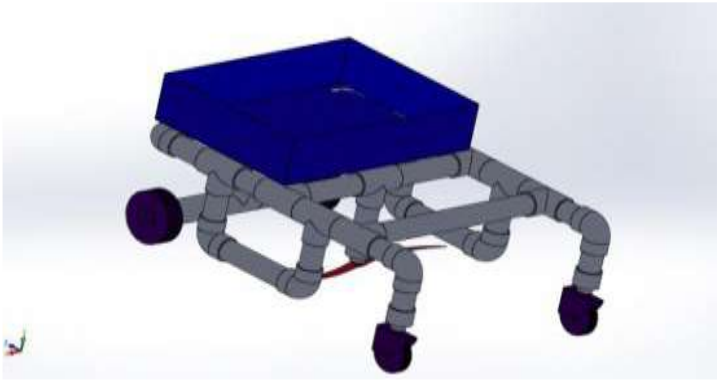

Fig 6.3 3D view of the Semi-Automated Lawnmower

VII. WORKING PRINCIPLE

The system includes a frame with a hard and fast of the front wheels and rear wheels. Only the rear wheels are powered and the front wheels are perfect. The rear wheel rotation is based totally at the rotation of the motor shaft related to it. Front wheel rotation is not primarily based on any strength supply however it alters itself to the movement of the rear wheels. The general motion of the wheels are managed with the aid of the primary manipulate unit. The valuable manage unit work primarily based at the signal input from the user with in the help of the android software. The sign transmission is accomplished with the help of the Bluetooth module. Here we are using the HC-05 Bluetooth module. The main power source for this all machine is lithium-ion battery. The battery exerts a energy of 12v with 9amps of cutting-edge power. It could be very efficient because it's far rechargeable often upon its usage. The major utility of this system is to cut the grass to required height. The cutting clearance of the blade may be adjusted with the assist stepper motor shaft. While slicing the grass there are chances to meet with an impediment, it is able to be averted by sensing them using the sensors which might be connected with manipulate unit. The grass this is being cut is accumulated within the vacuum collector fixed on the mower.

VIII. MERITS

- Direct manual effort is decreased with semi-automatic system.
- No unique skills or technique is needed to perform the mechanism.
- It is compact in size, effortlessly transportable, cost-correctly.
- Replacement of the damaged components are clean on this system.
- Mass production of this gadget is rather fee-efficient.

IX. APPLICATION

- It is used within the commercial lawns.
- Apart from industries, lawnmower is used in public locations like inns, hospitals, colleges and colleges etc.

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VIII. ANALYSIS REPORT

Here creo is used for three-dimensional modeling and analysis stress, strain, deformation in the frame pipe by using ansys software

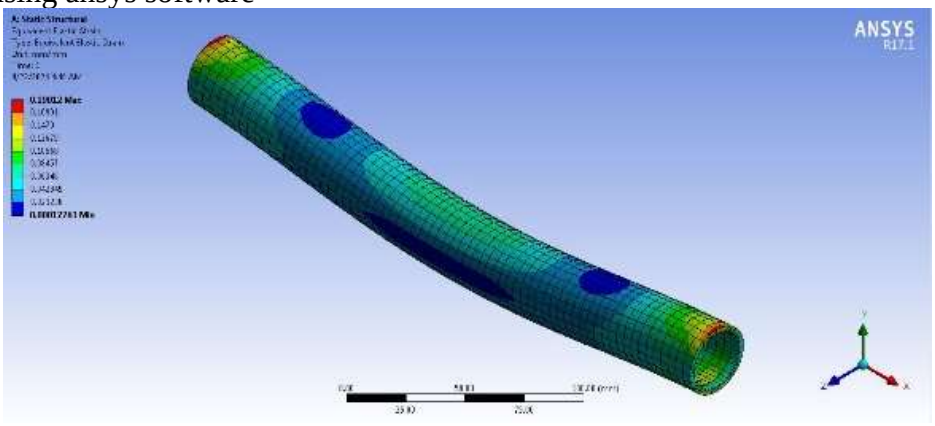

FIG. 8.1 Three-dimensional modeling and analysis of stress

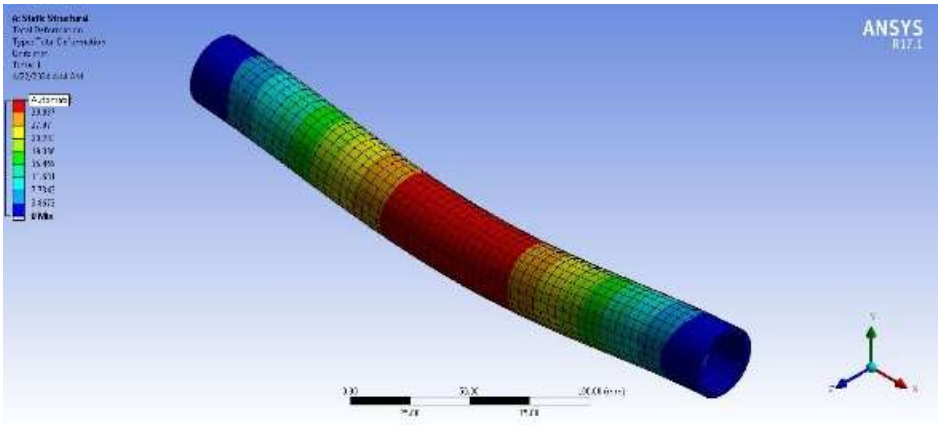

FIG 8.2 Three-dimensional modeling and analysis of strain

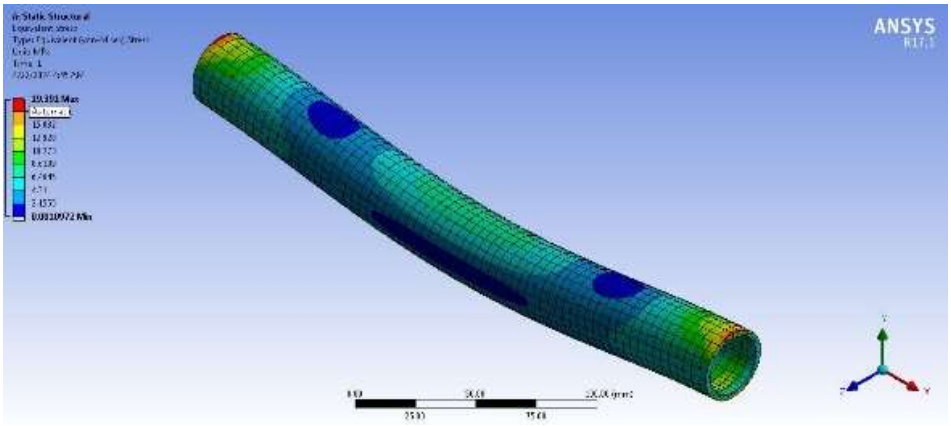

FIG 8.3 Three-dimensional modeling and analysis of deformation

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REFERENCES

1. Evaluation of lawn tractor noise using acoustic and psychoacoustic descriptors Engineering in Agriculture, Environment and Food, Volume 9, Issue 1, January 2016, Majid Lashgari, Ali Maleki.
2. Fatigue testing of UPVC pressure pipe International Journal of Fatigue, Volume 6, Issue 2, April 1984. A. Christie, B. Phelps.
3. Study on additives for UPVC Additives for Polymers, Volume 1993, Issue 11, November 1993, No authors available.
4. Strip-tillage using rotating straight blades: Effect of cutting edge geometry on furrow parameters Soil and Tillage Research, Volume 155, January 2016. A. Matin, J. M. A. Desbiolles, J. M. Fielke.
5. Hollis, Scott. "Cordless electric lawn mowers: these battery-powered machines are clean, quiet and easy to maintain" Mother Earth News 209 (April–May 2005): 67(4). General Reference Center Gold. Gale. Fairfax County Public Library. 7 Apr. 2009.
6. "The History of the Lawn-Mower". Backyardrefuge.com. Retrieved 2018-11-19.
7. "Arduino-Arduino Uno SMD". Www.arduino.cc. Retrieved 20 February 2018.
8. "The Arduino Foundation: What's Up?" Hackaday. 2017-06-19. Retrieved 2017-12-22.
9. Handbook of Plastics, Elastomers, and Composites, Fourth Edition, 2002 by the McGraw-Hill, Charles A. Harper Editor-in-Chief. ISBN 0-07-138476-6.
10. "Universal motor", Construction and working characteristics, Retrieved on 27 April 2015.
11. Battery Types and Characteristics for HEV Archived 20 May 2015 at the Wayback Machine Thermo Analytics, Inc., 2007. Retrieved 11 June 2010.
12. Davis Jr., Robert D.; et al. (July 8, 1997). "Steering control for zero turn radius mower - Robert D. Davis et al - Google Patent Search". USPTO via Google. Retrieved 2010-07-17.