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Design and Implementation of Arduino Based Automatic Grass Cutting Using Robot

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Abstract: The present technology commonly uses manually operated devices to cut the grass, creating pollution and energy loss. In this paper, To cut grass, we present the automatic grass cutter. The workload associated with cutting grass in the field can be reduced by using an automatic grass cutter. This device operates on a rechargeable battery that is fixed to the cutter, and sensors and a crane mechanism can identify and avoid unwanted objects. The Arduino Mega2560 will control every aspect of the motors in the vehicle, including the grass cutter. To identify the object, the vehicle will be in close proximity to the ultrasonic sensor. The ultrasonic sensor detects obstacles and relays that information to the Arduino, which then stops the grass cutter motor to prevent damage to the object, person, or animal, whichever it may be. It includes an Android application, an adjustable grass-cutter level, a gear-wire blade, and obstacle avoidance. This paper also discusses the design parameters. The goal of this project is to create an autonomous grass-cutting robot with built-in obstacle avoidance and grass-level adjustment capabilities.

Keywords: Arduino, Ultrasonic sensor, Motor, Gross cutter

1.INTRODUCTION:

Today people are too busy from day to day to cut the grasses on the house lawn. A tool designed to streamline operations and make them more convenient for quick, hassle-free grass-cutting tasks has been developed. The machine has benefits like being quick without needing to stand in the sun, environmentally friendly, and simple to operate [4]. The gardens are incomplete because there isn't a grass field. The land is made more beautiful by the grass in the field, which also enhances the beauty of the industries, kitchen gardens, and playgrounds [3]. An intelligent cutter machine that doubles as a lawnmower is developed as a solution to this issue. Additionally, this lawnmower can keep harmful animals out of a house, like centipedes and snakes [2].

An automatic lawn mower is a device that mows grass for you. It can be described as a device or robot that assists people with tasks like mowing the lawn. With a user-specified setting, the automatic lawn mower will cut the grass. This design eliminates the need for perimeter wires to keep the robot inside the lawn, in contrast to other robotic lawn mowers available on the market. This robot uses a variety of sensors to avoid and detect objects and people in addition to staying on the lawn.

Additionally, the intelligent cutter machine has been altered to provide users with even more benefits. It's simpler to operate this lawnmower. An Android application is used to control the movement [6]. Similar to growing, the grass needs to be appropriately retained on a regular basis. One of two options is available: manually or automatically using a "lawnmower" type device. It's also crucial to note that skilled labor is a prerequisite for supervision in this situation [5]. Similar to lawnmower solutions, the system interfaces with various sensors and is dependent on the microcontroller. Regular monitoring necessitates skilled labor [7], since manually controlling the response will take longer. These lawnmower-based power electronic devices primarily used internal combustion engines. The primary disadvantages of this mechanization are its high splendor and air and noise pollution. The mower's cutter height can be manually changed by using the IR sensor [10]. The machine is directed by the system in a predetermined direction based on the data generated. The system's flexibility is the only reason manual operation is possible. With the aid of an Arduino Mega2560, the android application in this machine can control the motor's speed [11]. The motor wheel can be programmed to run at a different speed, which can be altered by simply altering the programme. Our device, which consists of a sensor and a rack and pinion mechanism to adjust the level, is useful only for detecting grass, which may be green grass. It is more efficient when it detects grass only [12-13]. The machine will stop rotating the grass cutter motor if there is an obstruction in front of it. The robot then makes left and right turns to detect the presence of any obstacles. Nothing stands in the way. To cut the grass, the robot pivots to the right and advances.

2.LITERATURE SURVEY:

The first issue with grass maintenance is that all grass heights should be the same. The current approach will call for laborers skilled in this field who are familiar with operating a manually operated mower. Because there is a larger area to cover, there will be a greater workload and a greater need for workers. And after research, it is determined that the automatic lawnmower is the only way to solve the issues. Important components like the system's power wire and initial cost are also included with this system. The battery life in the event that the mower runs on batteries. A robot that uses solar power to cut grass while also being able to avoid obstacles. The ARM 7 controller is interfaced with color and ultrasonic sensors in this system [1]. After verifying the mower on various characters, the system will operate on the level grass field surface. This essay offers an environmentally responsible way to mow your lawn. Since this mower runs on a battery, it produces no pollution and is automatic, meaning it doesn't require labor, which makes it more efficient than the original designs.

The main goal of this is to design an automated lawn mower controller that can be used to mow grass on playgrounds and lawns. It made use of the sense-act concept, which means that it is not entirely dependent on the workspace. Detecting grass is one of the features of the automated lawnmower. In addition, a GPS system is included, which determines the robot's movement path. In addition, some sensors like an encoder that uses

GPS to determine the lawn mower's travel distance and a sonar sensor that detects obstacles are used. The system will function flawlessly on the flat surface in contrast to the uncomfortable surface. When an object is placed or occurs close to the system, the sensor will not be able to detect it [13]. Additionally, this requires manual control on the surface that consists of the patch that has some areas devoid of grass. One potential solution to these issues is image processing, which can be applied in the ongoing research and development that needs to concentrate on the reliable answers [12].

3.HARDWARE DISCRIPTION:

3.1 ARDUINO MEGA328:

As seen in Figure 1, the Arduino Mega 328 microcontroller is primarily based on the ATmega328 (datasheet). In more detail, the PWM outputs are supported by 14 pins. It has four hardware serial ports, sixteen analog inputs, sixteen 16 MHz oscillators, an ICSP header, a USB port, a reset button, and a power jack. Did this microcontroller come with all the components it needed built in? It can be easily connected to the computer to get started using the USB cable, the AC to DC adapter, or a battery source.

Microcontroller	ATmega 328
Operating Voltage	5V
Input Voltage	7-12V
Input Voltage(limits)	6-20V
Digital I/O Pins	54 (14 provide PWM output)
Analog Input pins	16
DC Current per I/O Pin	40mA
DC Current for3.3VPin	50mA
SRAM	8KB
EEPROM	4KB
Clock Speed	16MHz
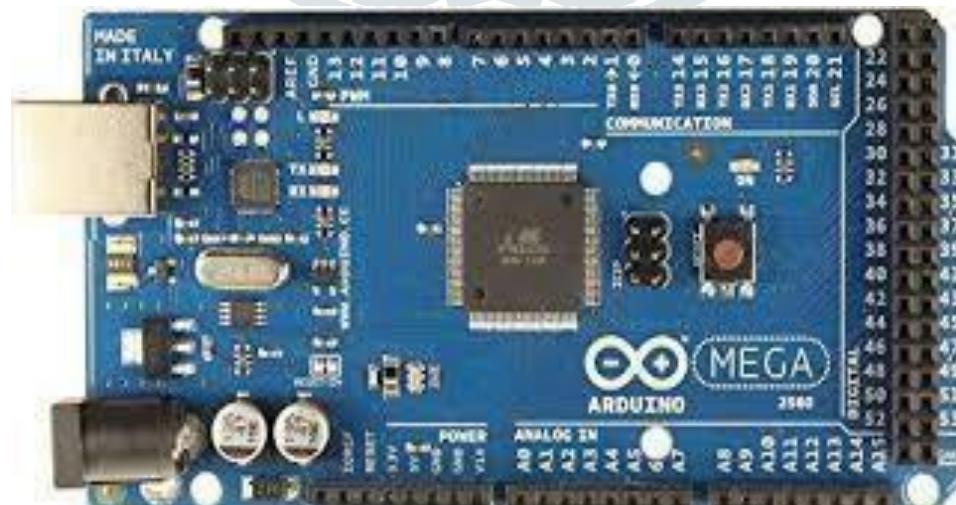
Fig 1:Arduino mega328

3.2 D C MOTOR:

Fig .2 shows the motor that will be used in constructing automated lawn mower. It can operate at a range of 12V to 24V. It has higher torque which made it easier. DC motor is a device that converts electrical form into mechanical form of energy. There are many kind of DC motor such as DC motor, separately excited DC motor and self-excited DC motor. DC motor will be powered by DC current.

Fig 2:Motor

The 300 RPM side shaft compact DC gear motor is designed for use in automation systems or mini-robots.In order to withstand the torque that the motor produces, it has a gearbox that was added following construction study. In this case, the driveshaft will be supported by the metal bushing on both sides. Here, the 300 RPM is generated at 12 volts, allowing it to operate smoothly between 4 and 12 volts. When used in applications requiring dynamic torque greater than 3 kg/cm, this motor is strongly discouraged. The motor will be able to last longer as a result.

3.3 ULTRASONIC SENSOR:

Where sonar is used, as it is by bats, the HC-SR04 ultrasonic sensor is used to determine an object's distance. It can provide non-contact range identification due to its high accuracy and stable reading. These are simple to utilize. The operations are not being hampered by the sun or by dark objects like keen range finders. The complete module can detect between 01" and 13" feet, or 2cm and 400cm, thanks to the ultrasonic transmitter and receiver module, as seen in Fig 3.
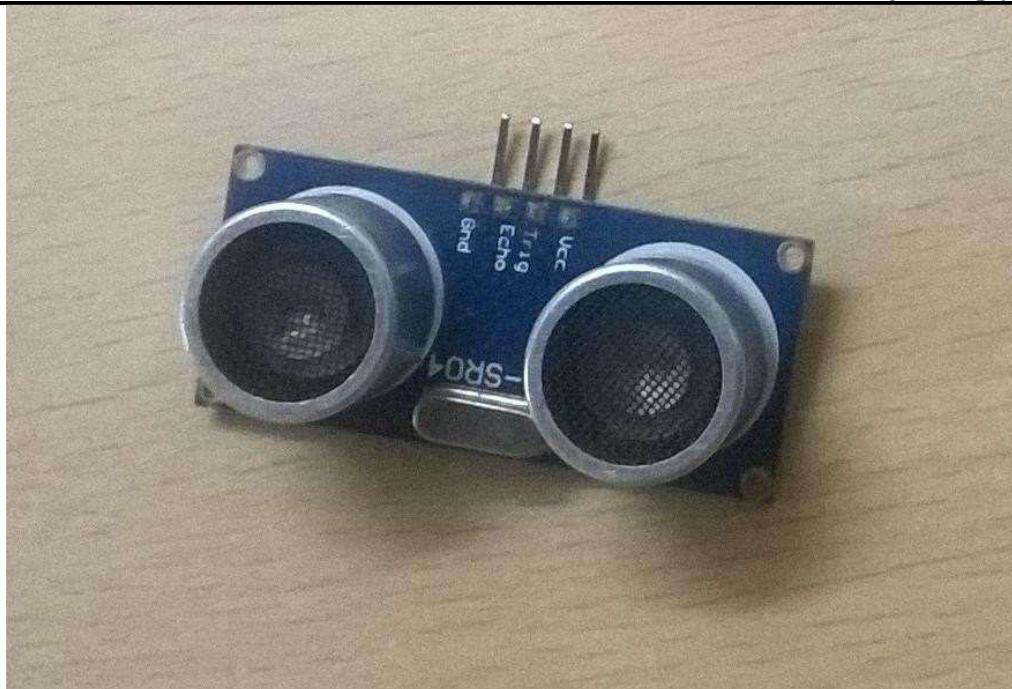
Fig 3:Ultrasonic sensor

3.4 CUTTER:

This will be used for the primary function of the mower i.e. to cut the grass. Depending on the design, more than one cutter can be used in synchronization as well. Also cutters with different shape or number of blades can be used for the purpose of getting the required cutting speed.

Fig 4:Cutters

4.SOFTWARE IMPLEMENTATION:

The software that will be used in this project are CATIA and Arduino 1.0.5 IDE. CATIA will be used for designing the 3D model of the lawn mower. The Arduino 1.0.5 IDE will be used to program the microcontroller.

4.1 Modeling Design in CATIA

CATIA is a tool to design any 3D model electronically. In designing, it will need two segments when drawing. The first is the CATIA parts and the CATIA assembly. At first several part of the lawn mower was drawn. After that, all the part will be combine or assemble together to form a full lawn mower. In CATIA, several techniques will be used such as pad, shell, pocket, fillet, mirror pattern. A rectangular base forms the basis of the drawing. From this several parts will be cut to form the desire pattern. Several hole also made to indicate the screw position. There are three part will be drawn which are two back wheel the body and two front wheel. After finished drawing, the part will combine together using CATIA assembly feature to assemble the parts drawn. Tuning and refinement will be made at the end of drawing to prevent any error occur. Refining such as increase or decrease the dimension of the part due to some obstacle.

4.2 Arduino 1.0.5 IDE

Arduino 1.0.5 IDE is a software to program the Arduino UNO. This software is an open source and can download from the web for free. Arduino 1.0.5 IDE have their own programming library which is simple and user-friendly. All the coding is given as well as example. With the existing of library, the user does not need to have a great knowledge on c programming to write Arduino program. Table 1 shows the sample of Arduino library code which used for programming microcontroller.

| setup()	loop()	pinMode()	digitalWrite()
digitalRead()	analogRead()	analogWrite()	Serial
#define	#include	logic HIGH	logic LOW

Table 1: Arduino sample library code
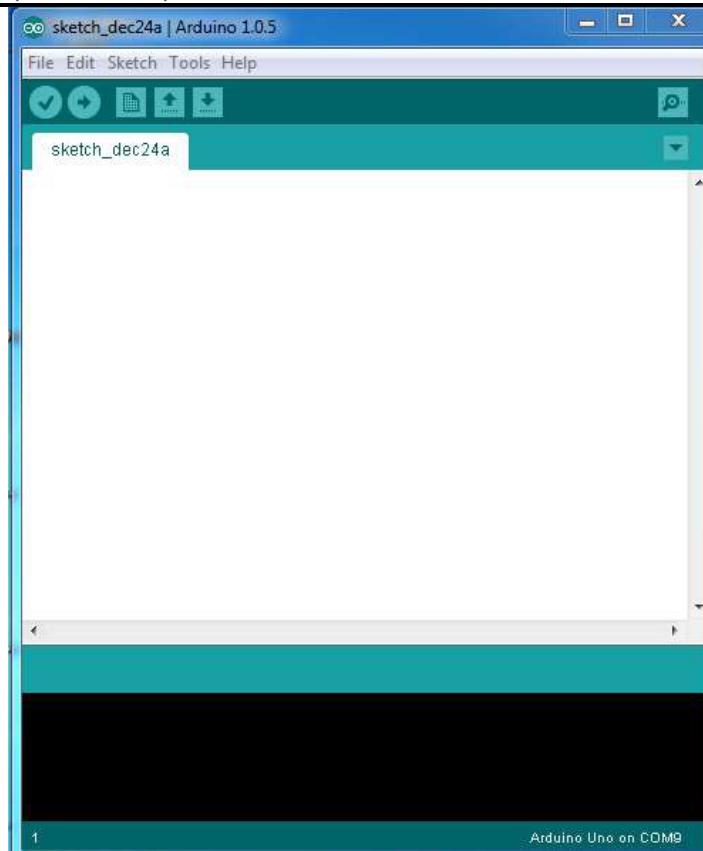
Fig 5: User Interface of Arduino 1.0.5 IDE

5.WORKING PRINCIPLE:

By means of the Bluetooth module process, this robot is controlled. The Arduino controller, which is linked to the Android application, powers the robot. The precise servo value should be stated in accordance with the user's requirements prior to the robot commencing. Two methods were available to the grass cutting robot for operation through manual robot controlling. The primary goal of our project is to create an automatic robot that cuts grass; "automatic" is one of the options. When operating in automatic mode, the robot adheres to the previously provided instructions on the flowchart. The robot will operate in this mode from the beginning to the end of the designated time. Stop the robot's operation once it locates the block in front of it. It is equipped with an ultrasonic HC-SR05 sensor to determine its left and right directions. The robot will turn and proceed in the opposite direction of the obstacle based on its direction of intersection. The robot will proceed in the correct direction if it detects barriers in both directions. Additionally, we have an additional "manual" method of controlling the robot. The servo's value can be controlled in that application because it has left, right, forward, and backward direction keys.
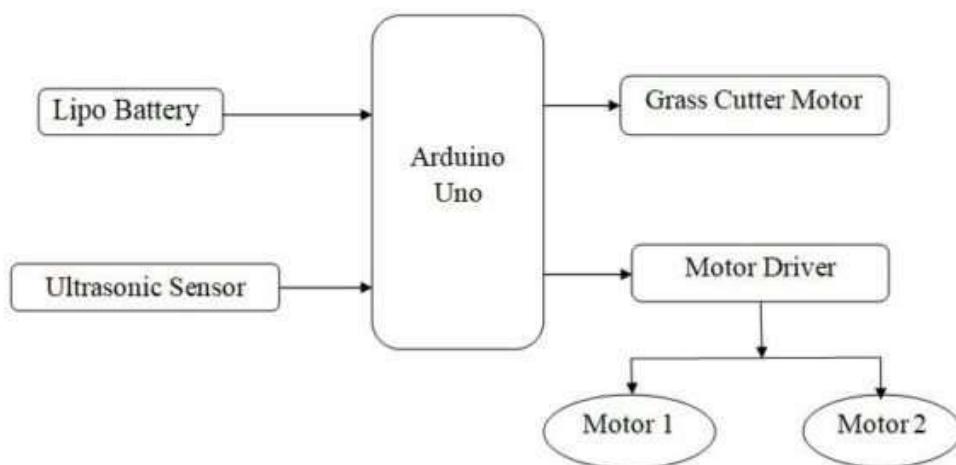
Fig 6: Block diagram

6.RESULT:

The environmental production challenge will be met by this grass cutter. Commercial, industrial, and residential settings can all use this grass cutter. We have lawns, and since their diesel combustion engine is used frequently these days, it produces pollution such as dust and carbon monoxide, which we eliminate with our machine. It is powered by solar energy. The machine is easy to maneuver, has adjustable speed, can identify obstacles in its path and signal them, requires no fuel, and experiences minimal wear and tear. Overall, it performs well. Therefore, it is suitable for grass cutting. As there is no need for the cutter's fuelling, the operation's cost is low. In the places like the residences where a yard is available, the tractor

cannot be driven as in alternative to the tractor the lawnmower is being developed. For this purpose, this machine's capacity is more sufficient. And this machine is verified as this can be used in alternative of the fuel powered lawnmowers is indicated in Figure 7.
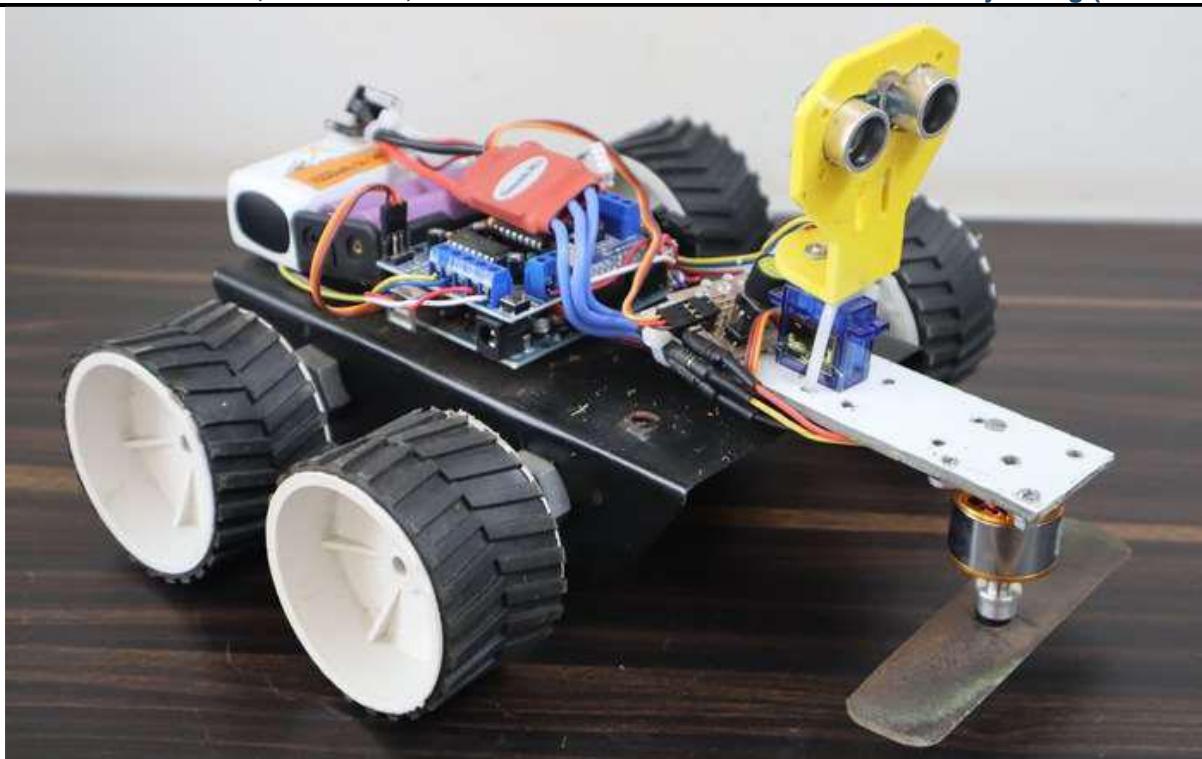
Fig 7: Lawn Mower

7. CONCLUSION:

An automatic lawn mower with several features has been proposed. Several related works has been studied in order to gain idea on how to build an automatic lawn mower. Most research is on the robot path planning using variety technique. All the technique used are mainly aim for the shortest path, consume less energy. Safety is taken into account first when using the manually operated grass cutter. By keeping the operator out of the dangerous area, this system helps to avoid accidents. Controlled lawn mowing operations make sense in less hazardous environments. According to a poll, lawnmowers have caused injuries to almost 50,000 people in the US. These injuries are brought on by careless human error, improper use of the machine's cutting blade, or objects thrown by the mower. It also takes into account accidents caused by improper mower use. The primary objective of the current research is to bring the rate of human accidents down to zero. By adding sensors to identify impediments in front of it, we have automated it. This makes it extremely accurate and efficient because, in accordance with the instructions, it will turn and move in any other direction or cease operating if it detects an obstacle. As a result, equipment needs to be safeguarded against harm and should put humans at less risk.

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