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Research Article

Autonomous Landmine Detection Rover

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I N F O

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A B S T R A C T

The landmine detecting robots are made to cover as much of the landmine field as they can in order to find landmines. A visual map is used to display the discovered landmines, as well as the scanned and unexplored area, with millimetre-level accuracy. To determine the precise location of the robot, an image processing technique is used, providing live reckoning feedback to the robot's dead reckoning servo control. The sensor that is used to find landmines is a metal detector. The remote terminal computer's graphical user interface gives the robot effective control. The approach is straightforward but effective and understandable to produce the desired results.

Keywords: Robot, Landmine Detection Rover, Design, Manufacture

Introduction

All across the world, there are still many landmines buried in the earth. Both people and other living things suffer permanent and temporary disabilities as well as loss of life. It has an impact on both the global economy and international peace. Landmines have become a big global concern as a result of international conflicts, clearing them up will cost a sizable sum of money. To make this goal successful, many land mine-affected developing nations invested a significant amount of their gross national product and labour. Even though technology kept on developing, the manual landmine clearance is still highly preferred because of its consistency, predictability and reliability.[1] However, the process is sluggish and dangerous for the employees, which are the disadvantages of the traditional method. This study developed a landmine detection rover-robot to help in the field that is more rapid, secure, accurate than the conventional approach. Metal detecting sensors are typically used for mine detection. The critical factor that affects a metal detector's ability to identify landmines is the separation between the sensor head and the mine that is being searched for. The performance of the metal detector can be enhanced by altering the distance and elevation between the sensor head and the landmine. If the sensor heads maintain a consistent gap with ground level, the function of robot assisted land mine detection can be carried out conveniently. The safety of people is given more importance in this project. The robot can be controlled from a more secure distance or from an area that has already been cleared of landmines. The risk of an explosion is eliminated since the landmine detector head is projected in front of the rover. This method protects both the rover and the person using the remote to control it.[2]

Mines are laid as a safety measure to ward off invaders or foes in a conflict zone. Its goal is straightforward: use it as a shield to temporarily halt an invasion, steer attackers onto kill zones, or otherwise keep foes out of vulnerable places.

Mines have detonating devices that can be activated by pressure, movement, sound, magnetism, vibration. They are sensitive explosives. When approaching or striking the target, a bomb or artillery shell detonates, whereas a landmine is concealed and waits to be detonated by the presence of a person, an animal, or a vehicle. With the inclusion of anti-handling technology built into those mines, they have been classified as anti-personnel and anti-tank mines.

Figure 1.Landmine used

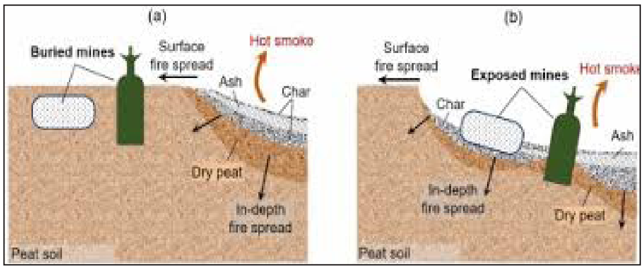

Figure 2.Landmine Penetrating

Anti-tank mines were designed specifically to damage military tanks, as their name implies. They are therefore only set off by tremendous pressure, preventing tiny vehicles or pedestrians from setting them off. Anti-personnel mines were/ are intended to kill or hurt soldiers in order to strengthen the logistical base of the resistance. But even after the battle is finished, these mines can still maim and kill. It is a little explosive device that is either on the ground or underground and is ready to go off when a person steps on it, handles it, or trips one of its trip wires.

Seeing the misery that anti-personnel mines cause is horrifying. The International Committee of the Red Cross identified them as the most serious wounds to be treated. When stepping on an anti-personnel mine, the blast can frequently pull off the legs or else cause severe injuries to the body through the piercing of metal, plastic, grass, shoe fragments, broken bones. In a similar vein, if the explosion occurs during handling, the sufferer may lose vision in addition to having fingers, hands, the abdomen, the spine, the face impacted by the explosion. The three different types of anti-personnel mines are blast, fragmentation, bounding fragmentation. Metal shards are thrown by fragmentation mines, but bounding fragmentation mines are more dangerous because they bounce to waist height before detonating.[3]

When deploying armed vehicles into enemy territory, mine detection Rovers are extremely important. The autonomous mine detection rover project is focused on designing and developing a mine detection rover that can quickly identify its existence by using thermography or X-ray sensors, marking on tracks, detecting areas, sending a signal to the operator. Utilizing a continuous track-structured Rover, which helps control explosive accidents even on rough terrain. The design of this mine Rover will be based on the concept of digital radiography, which will be used to detect the presence of landmines. This technique uses x-ray sensitive plates to capture data during object examination, which is immediately transferred to a computer without the use of an intermediary cassette. While a Rover detecting circuit is being built, topological sites must be taken into consideration. The Mine Rover has a tool or gadget made to achieve the goal of having a less expensive Mine detecting Rover.[4]

Effects of Landmine Explosion

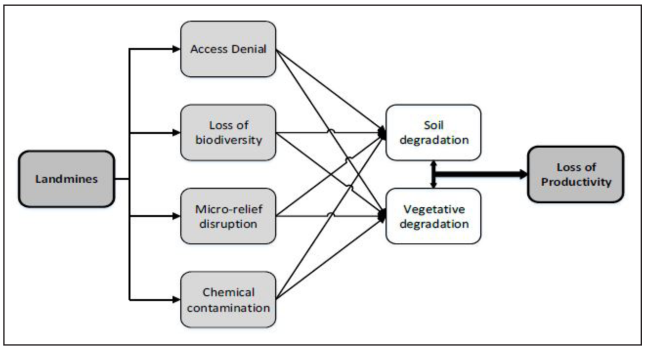

Figure 3.Effects of Landmine Explosion

The following definitions apply to the categories shown in Figure:

Access denial: A lack of access to available resources has been caused by fear of the presence of landmines. A total of 900 000 km2 of land are unusable because of access restrictions.

Loss of Biodiversity: Mines have put a number of species in danger of going extinct.

Micro-relief disruption: Mines disturb the soil's structure, making it more prone to erosion and causing soil instability.

Chemical contamination: The majority of the materials used in the devices are organic, such as carbon, nitrogen, hydrogen, oxygen, etc. Combinations of TNT (2, 4, 6

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trinitrotoluene), RDX (hexogen), PETN (nitro penta), HMX (octogen), as well as additional substances like waxes, plasticizers, stabilisers, oil, etc., are used to make military explosives. When the mines collapse, these substances seep into the land and groundwater. These toxins have an impact on air, plants, microbes, soil with drinking water, food products, water bodies directly or indirectly. The organs of fish, animals, plants, people can be affected by these contaminants, which can function as a poison for their development.

It goes without saying that landmines cause productivity losses, which have a negative impact on social and economic instability. The main issue is that landmines obstruct routine activity by calmly remaining in the ground. According to the United Nations Mine Action Services, more than 110 million mines have been dispersed over the world since the 1960s and are a hazard in more than 78 nations. A landmine's impact results in roughly 15,000 to 20,000 fatalities and numerous injuries. Anti-personnel landmines typically target children, women, elderly people who are unarmed.

The only way to get rid of mines without causing any damage is to remove each one one at a time. Anti-personnel mines cost between $3 and $30 each, but depending on the mine-infected area, neutralising them can cost between $300 and $1000 each mine. And even with professionals disposing of the mines, it has been noted that for every 5000 mines removed, an accident results in the deaths of one person and the injuries of another two.

Accordingly, experts estimate that, at the current rate, it would take more than 1000 years to remove all of the mines, even if none were added. These wounded have a larger requirement than the other combat casualties for blood transfusions, surgical treatment, the fitting of orthopaedic appliances.[4]

Research

The autonomous land mining rover will be used to find mine detecting rovers in battle zones and prevent casualties to both troops and tanks. The radiography (Digital Radiography (DR) is an enhanced form of x-ray inspection that provides a digital radiographic image instantly on a computer.) idea will underpin how the Mine Detecting Rover functions. The Rover is controlled by computers utilising a ZigBee module for the operator's safety. The Rover is equipped with an ultrasonic sensor that it may use to find and avoid obstacles. The GPS sensor's latitude and longitude can be used to find the mine. A material that can withstand blasts up to a particular threshold was used to construct the Rover. Using a buzzer attached on the robot, the Rover generates a warning alarm for nearby people. High-powered DC motors are used to actuate the Rover, which is supported by a bridge circuit and may travel in any direction.

Working Methodology

With a review of the literature, we got to work. In addition, we searched numerous study papers from numerous articles and previously published journal papers. Then, we focused on various Mechanisms that could help with our project. Then, in accordance with the requirements, we created a rough 2D design of the model in Auto-CAD and solid works. After receiving a basic model, we began creating a robot motion software that would meet our needs. We chose commonplace parts. actual project preparation the computations for the remaining components are finished. We have bought market-standard components. A crude 3D model of our project will be developed. We completed the report work for semester I simultaneously. A crude 3D model of our project will be created. Production will take place. It will be assembled. The setup will be tested. Actual theoretical report representation.

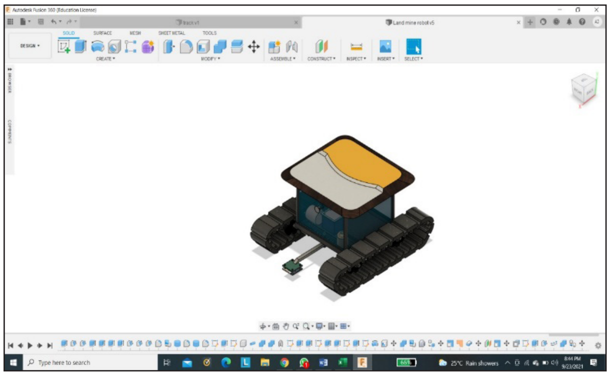

Figure 4.Detector Rover (Designed in Autodesk Fusion 360)

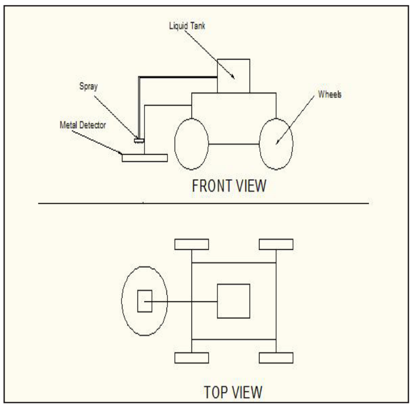

Figure 5.Basic Prototype Design

The Mining Rover is an unmanned robot designed to find land mines in mine fields as well as in conflict zones to prevent casualties among army personnel, workers, miners. The Mine Detection Rover works by using the digital radiography technique to attain improved accuracy of 95–98%. The Rover is propelled by a DC motor that is supplied by a battery or a DC supply and equipped with a number of sensors, including an ultrasonic sensor, a GPS

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sensor, a warning signal. Path after path, the Rover scans the surroundings. The Rover is equipped with a night vision camera to help detect landmines at night, the sprayer will mark the track with fluorescent-coloured paint. Additionally, a distance sensing technique for terrain adaption is created in order to maintain the effective distance between the landmine sensors and the ground surface. The switches on the inductive proximity sensors may identify non-metallic items with a different dielectric constant from air. They are therefore perfect for a variety of materials, including liquid, plastic, paper, wood, cloth.

Figure 6.Prototype Working in 120 Degree

Components

DC Motor

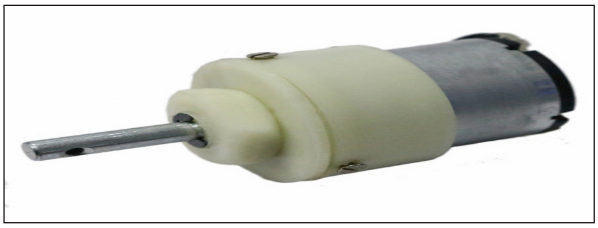

Figure 7.DC Motor

Here, a high-quality and reasonably priced DC geared motor with a 30 rotations per minute (RPM) centre shaft is used. The motor runs at 30 rotations per minute in 12 volts and is a DC type 4-12 Volt motor.

Wheels

Figure 8.Wheels

The wheels will be 109 mm in diameter, 21 mm thick, 6 mm in bore.

Metal Detector

A metal detector is a piece of electronic equipment that looks for surrounding metal. Metal inclusions concealed inside of items or metal objects buried underground can both be found with metal detectors. They frequently consist of a handheld device with a sensor probe that may be moved across the surface of an object or the ground. A shifting tone in headphones or a moving needle on an indicator are indicators that the sensor is getting close to a piece of metal. The equipment typically provides some indicator of distance; the higher the tone in the earphone or the higher the needle goes, the closer the metal is. Detecting concealed metal weapons on a person's body is another prominent usage for stationary "walk through" metal detectors, which are used for security screening at entry points to jails, courts, airports.

Figure 8.Metal Detector

Arduino Nano

The open-source Arduino Nano is a compact, compatible electronic development board built around an 8-bit AVR microprocessor. There are two versions of this board, one based on the ATmega328p and the other on the Atmega168.

The Arduino Nano can perform some tasks that other boards on the market can, but it is smaller and better suited for applications that call for less memory and GPIO pins to connect with. This device has 14 digital pins for connecting to external components, while the board also includes 6 analogue pins with 10-bit resolution each, 2 reset pins, 6 power pins.

The operational voltage of this device, like other Arduino boards, is 5V. The input voltage spans from 6V to 20V, with a recommended input voltage of 7V to 12V. This device's 16 MHz clock frequency is used to create a clock with a specific frequency using constant voltage. In contrast to other Arduino boards, which use conventional USB connections, the board supports a USB interface and uses a mini-USB port. Furthermore, this unit does not include a DC power connection, so an external power source cannot be used to power the board. Additionally, because of this device's bread-board friendliness, you may use it to create a variety of electronic projects by connecting it to breadboards. The software is stored in flash memory, which is 16KB for the

Atmega168 (of which 2KB is utilised for the Bootloader) and 32KB for the Atmega328.

Similarly, the EEPROM and SRAM for the Atmega168 and Atmega328 are 512KB and 1KB, respectively, 1KB and 2KB, respectively. The Nano board and the UNO board are essentially identical, with the former being smaller and lacking a DC power connector.

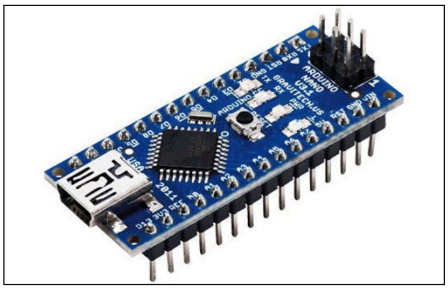

Figure 9.Arduino Nano

Arduino UNO

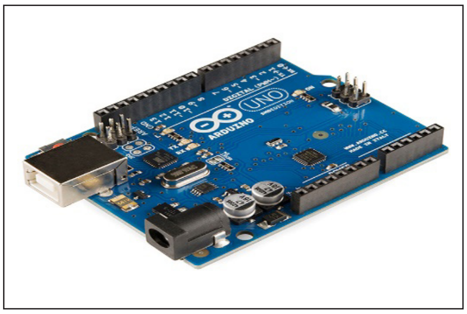

Figure 10.Arduino UNO

A low-cost, adaptable, simple-to-use programmable microcontroller board called Arduino UNO is available for use in a range of electronic applications. Relays, LEDs, servos, motors can be controlled by this board as output devices, it can communicate with other Arduino boards, Arduino shields, Raspberry Pi boards.

AVR microcontroller Atmega328, six analogue input pins, 14 digital I/O pins, six of which are used for PWM output, are all included in the Arduino UNO. This board has a USB interface, which means that a USB cable is needed to connect it to a computer and that the Arduino IDE (Integrated Development Environment) programme is used to programme the board. While the SRAM is 2KB and the EEPROM is 1KB, the device has 32KB flash memory, which is utilised to store the number of instructions. The device's operational voltage is 5V, which makes the microcontroller on the board and its related circuitry visible.

works at 5V, whereas the input voltage spans from 6V to 20V, with 7V to 12V being the ideal range.

Arduino UNO Components

The following features and parts are found on the Arduino UNO board:

ATmega328: This is the board's "brain," where the programme is kept.

Ground Pin: The board includes a number of ground pins.

PWM: There are six PWM pins on the PCB. Pulse width modulation, or PWM, is a technique that allows us to regulate the speed of servo and DC motors as well as the LED's brightness.

Digital I/O Pins: The board has 14 digital (0–13) I/O pins that can be connected to outside electronic devices.

Analogue Pins: Six analogue pins have been integrated onto the PCB. The analogue sensor can be read by these pins and converted into a digital signal.

AREF: It is an Analog Reference Pin used to set an external reference voltage.

Reset Button: This button will reset the code loaded into the board. This button is useful when the board hangs up, pressing this button will take the entire board into an initial state.

USB Interface: This interface is used to connect the board with the computer and to upload the Arduino sketches (Arduino Program is called a Sketch)

DC Power Jack: This is used to power up the board with a power supply.

Power LED: This is a power LED that lights up when the board is connected with the power source.

Micro SD Card: The UNO board supports a micro-SD card that allows the board to store more information.

3.3V: This pin is used to supply 3.3V power to your projects.

5V: This pin is used to supply 5V power to your projects.

VIN: It is the input voltage applied to the UNO board.

Voltage Regulator: The voltage regulator controls the voltage that goes into the board.

SPI: The SPI stands for Serial Peripheral Interface. Four Pins 10(SS), 11 (MOSI), 12(MISO), 13(SCK) are used for this communication.

TX/RX: Pins TX and RX are used for serial communication. The TX is a transmit pin used to transmit the serial data while RX is a receive pin used to receive serial data.

Motor Driver

A high-power motor driver ideal for operating DC Motors and Stepper Motors is the L298 Based Motor Driver Module. It makes use of the well-known L298 motor driver IC and includes an internal 5V regulator that it can utilise to power an external circuit. It has the ability to direct and speed-control up to 4 DC motors or 2 DC motors. For robotics

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and mechatronics projects, this motor driver is ideal for controlling motors with microcontrollers, switches, relays, etc. Perfect for powering DC and Stepper motors used in robot arms, line-following robots, micro mice, other applications.

A circuit known as an H-Bridge may drive current in either direction and is pulse width modulated (PWM). Using pulse width modulation, you can adjust how long an electronic pulse lasts. Try to visualise the brush as a water wheel in a motor and the electrons as the water droplets flowing through it. The continual flow of water over the wheel would represent the voltage; the greater the flow, the higher the voltage. Motors are designed to operate at a specific voltage, if that voltage is exceeded or decreased abruptly to slow the motor down, harm may result. hence PWM. Using the water wheel as an example, see the water flowing steadily yet in pulses.

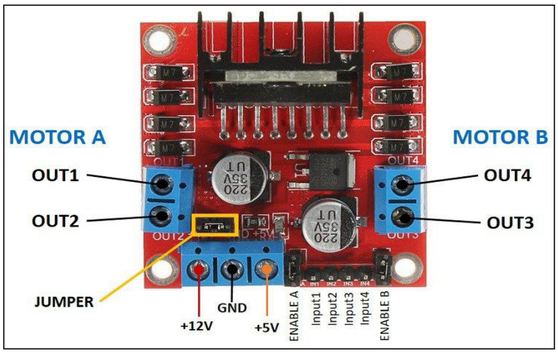

Figure 11.Motor Driver

Features

- L298 dual H-bridge driver chip is the driver chip
- Works with up to 35V DC
- Drive portion of Io: 2A/Bridge peak current
- Appropriate portion of the terminal power supply spectrum Vss:4.5V-5.5V
- The operating current range is logically 0 to 36 mA
- 20W is the maximum power usage

Pins

- Out 1: Motor A lead out
- Out 2: Motor A lead out
- Out 3: Motor B lead out
- Out 4: Mo (Can actually be from 5v-35v, just marked as 12v)
- GND: Ground
- 5v: 5v input (unnecessary if your power source is 7v-35v, if the power source is 7v-35v then it can act as a 5v out) En A: Enables PWM signal for Motor A (Please see the "Arduino Sketch Considerations" section) In1: Enable Motor AI
- In2: Enable Motor A
- In3: Enable Motor B
- In4: Enable Motor B
- En B: Enables PWM signal for Motor B

Usage

H-bridges are often used to control the speed and direction of motors, but they can also be used for other purposes, such as increasing the brightness of some lighting systems like high-powered LED arrays.

NRF

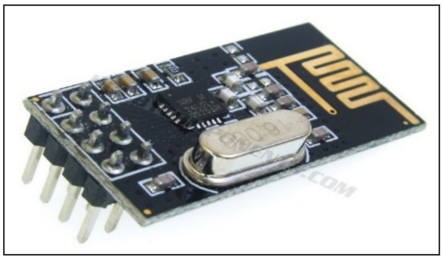

Figure 12.NRF

Model: NRF24L01

A single chip radio transceiver for the 2.4 to 2.5 GHz ISM band is called the NRF24L01.

The transceiver is made up of an enhanced shock burst protocol engine, a fully integrated frequency synthesiser, a power amplifier, a crystal oscillator, a demodulator, a modulator. Setting up the protocol, frequency channels, output power is simple. through an SPI interface, programmable Only 9.0mA at an output power of -6dBm and 12.3mA in RX mode, respectively, of current are used.

Power conservation is made simple to implement by built-in Standby and Power Down modes.

Maximum operating speeds of up to 2 Mbps, effective use of GFSK modulation, anti-interference capabilities make it especially appropriate for industrial control.

GSM

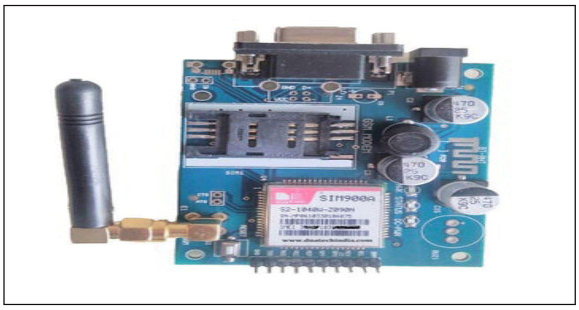

Figure 13.GSM

Global System for Mobile Communications, or GSM. Mobile voice and data services are transmitted using this digital cellular technology. The following list of GSM-related key facts.

- Early in the 1970s, Bell Laboratories developed a mobile radio system based on cells that gave rise to the GSM concept

- The GSM standardisation group was founded in 1982 with the goal of developing a uniform mobile phone standard for Europe
- GSM is the most extensively used telecommunications standard, it is used all over the world
- Each 200 kHz channel in the circuit-switched GSM system is divided into eight 25 kHz time slots
- In the majority of the world, GSM uses the 900 MHz and 1800 MHz mobile communication bands
- GSM uses the frequencies 850 MHz and 1900 MHz in the US
- More than 70% of digital cellular subscribers worldwide are GSM subscribers
- The Time Division Multiple Access (TDMA) technology is used by GSM to deliver signals in a narrowband
- Digital technology was used in the development of GSM
- It can transport data rates ranging from 64 kbps to 120 Mbps
- In more than 210 countries throughout the world, GSM currently supports more than one billion mobile subscribers and offers basic to advanced voice and data services, including roaming service
- You can use your GSM phone number while roaming in other GSM networks. Data is digitalized and compressed before being sent down a channel alongside two other streams of user data, each in its own time slot

Features of GSM

- Improved spectrum efficiency
- International roaming
- Low-cost mobile sets and base stations (BSs)
- High-quality speech
- Compatibility with Integrated Services Digital Network (ISDN) and other telephone company services
- Support for new services

Joystick Module

Figure 13.Joystick Module

This dual-axis joystick module is of the highest quality. It can be utilised to detect motion in two directions (axes). Additionally, it features a built-in switch that is turned on by pressing the stick. Two potentiometers, one for each axis, are all that are needed to move in one direction. Pots cost 10,000 each.

By moving the “hat,” you may use this Joystick Module to measure position coordinates on the X and Y axes. Additionally, it has a switch that may be operated by pushing the “hat. Additionally, it has a switch that may be activated by lowering the “hat.” like the Xbox controller in style.

Two 10k potentiometers on the X and Y axes produce analogue signals to regulate 2D movement. Two analogue values that represent two directions will be output by the module when it is in operating mode. The value that can be read from the analogue input of this module, which operates on a 5V power supply, is approximately 2.5V. As the joystick is moved, the value rises to a maximum of 5V; otherwise, it falls to 0V.

Specifications and Features: -

- Dimensions: 40 x 27 x 15 (L x w x H) mm
- Weight: 10gm (without Hat)
- 2.54mm pin interface leads
- Operating Voltage: 5V
- Long service life and stable performance
- Standard interface and electronic building blocks
- Widely use in Arduino DIY projects
- Cross rocker as a two-way 10K resistor, with the rocker in a different direction

Battery

Figure 14.Battery

Figure 23: The battery 18650 has a 2000 mAh capacity and is a Li-ion rechargeable battery. Although it is not a regular AA or AAA battery, this one is highly helpful for devices like cameras, DVD players, iPods, others that need high current either continuously or briefly. Without significantly losing battery capacity, an 18650 cell can undergo up to 1000 cycles of charging and discharging. They have a long battery life, are safe to use, are environmentally friendly. It has a high energy density and offers your device great continuous power sources. It should be used in conjunction with a protection circuit board that safeguards the battery from overcharging, overdischarging, avoiding drawing too much current.

Simply glue the wires to the terminals to use the cell in

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any circuit, you can quickly swap out spent cells by using 18650 battery holders. Li-ion batteries must be handled carefully because they are flammable and volatile and shouldn't be handled roughly or punctured. Additionally, avoid overcharging and discharge past a certain point since gases buildup inside could cause an explosion and fire. So whenever utilising Li-Ion batteries, always use the protection board. View additional cells here. 3.7V Rechargeable Li-Po Battery, 9V Hi-Top Battery, 9V High-Watt Battery

Specifications

- Voltage: 3.7 Volts
- Capacity: 2000 mAh
- Rechargeable: Yes
- Battery Size: Diameter- 18mm x Length- 67mm
- Charging Method CC-CV

Battery Holder

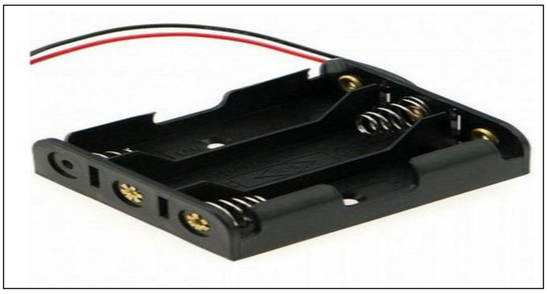

Figure 15.Battery Holder

An integrated or separate chamber used to retain cells is known as a battery holder or battery mount. If it has its own compartment, it can be connected to a mobile device. It is utilised to hold the cells firmly in place and supply power to the attached gadget. A battery holder's main purpose is to make it easier for the device it is attached to to get electricity. Through lugs soldered to the cell-powered device, wire leads, snap terminals, or it can be installed on PCBs through pins, external connections to the batteries in the battery holder can be formed.

Surveillance Camera

Figure 15.Surveillance Camera

Security cameras, often known as surveillance cameras, are video cameras used to observe a space. They are frequently connected to a recording device or IP network, a security guard or law enforcement official may be watching them.

Electronic Circuit

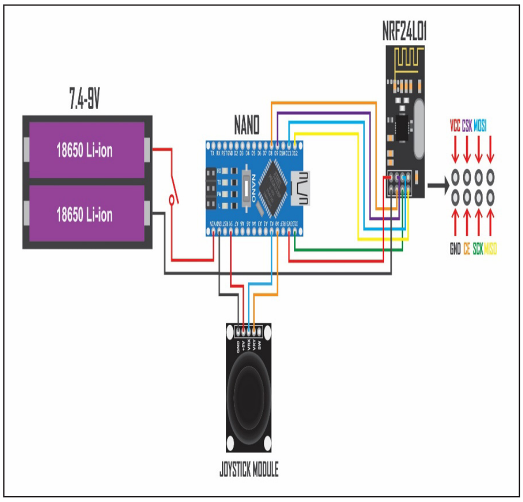

Figure 16.Circuit Diagram Of Motor

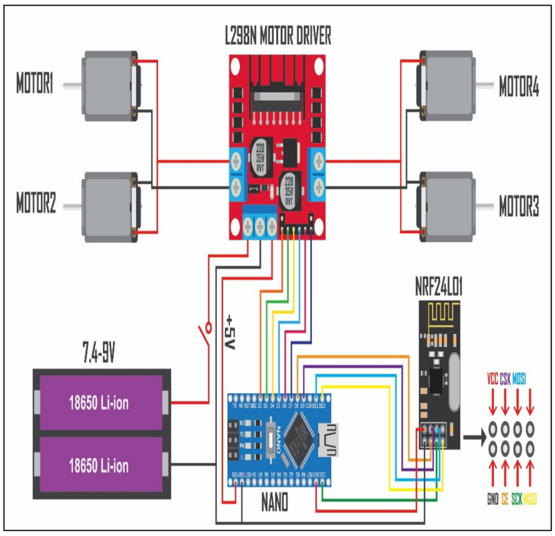

Figure 17.Circuit Diagram of Arduino NANO

Calculation

Motor Torque Calculations:

Vehicle Design Criteria:

Gross vehicle weight (GVW): 3 kg

Weight on each drive wheel (Ww): 1.5 kg

Radius of wheel/tire (Rw): 32.5 mm

Desired top speed (Vmax): 0.3 m/s

Desired acceleration time (ta): 0.3 sec

Maximum incline angle (α): 20o

Worst working surface: Sand(dune)

Total Tractive Effort, TTE= RR + GR + FA

Where,

RR = force necessary to overcome rolling resistance

GR = force required to climb a grade

FA = force required to accelerate to final velocity

Step One: Determine Rolling Resistance

Rolling Resistance (RR) is the force necessary to propel a vehicle over a particular surface. The worst possible

surface type to be encountered by the vehicle should be factored into the equation.

RR = GVW x Crr

= 3 x 0.15

= 0.45 kg

Crr = surface friction (value from Table)

Step Two: Determine Grade Resistance

Grade Resistance (GR) is the amount of force necessary to move a vehicle up a slope or "grade". This calculation

must be made using the maximum angle or grade the vehicle will be expected to climb in normal operation.

To convert incline angle, α, to grade resistance:

GR = GVW x sin(α)

= 3 sin(20o)

= 1.026 kg

where:

GR = grade resistance

α = maximum incline angle [degrees]

Step Three: Determine Acceleration Force

Acceleration Force (FA) is the force necessary to accelerate from a stop to maximum speed in a desired time.

FA = GVW x Vmax / (9.81 x ta)

= 3 x 0.3/(9.81 x 0.3)

= 0.3058 kg

Step Four: Determine Total Tractive Effort

The Total Tractive Effort (TTE) is the sum of the forces calculated in steps 1, 2, 3. (On higher speed vehicles

friction in drive components may warrant the addition of 10%-15% to the total tractive effort to ensure acceptable

vehicle performance.)

TTE = RR + GR + FA

= 0.45 + 1.026 + 0.3058

= 1.7818 kg

Step Five: Determine Wheel Motor Torque

To verify the vehicle will perform as designed in regards to tractive effort and acceleration, it is necessary to

calculate the required wheel torque (Tw) based on the tractive effort.

Tw = TTE x Rw x RF

= 1.7818 x 32.5 x 1.1

= 63.7 kg-mm

where:

RF = "resistance" factor

The "resistance factor" accounts for the frictional losses between the caster wheels and their axles and the drag on

the motor bearings. Typical values range between 1.1 and 1.15 (or 10 to 15%).

Step Six: Reality Check

The final step is to verify the vehicle can transmit the required torque from the drive wheel(s) to the ground. The

maximum tractive torque (MTT) a wheel can transmit is equal to the normal load times the friction coefficient between

the wheel and the ground time the radius of the drive wheel.

MTT = Ww x μ x Rw

= 1.5 x 0.8 x 32.5

= 39 kg-mm

where:

μ = friction coefficient between the wheel and the ground

The total wheel torque calculated in Step Five must be less than the sum of the Maximum Tractive Torques for all

drive wheels or slipping will occur.

For two wheel drive, Tw< (MTTx2)

i.e., 63.7 kg-mm < 78 kg-mm

Therefore, our design assumptions are within safe limits.

Motor Torque Calculations:

Wheel Circumference = π x D = π x 65 = 204.2035 mm

Velocity = 0.3 m/s

Velocity = RPS x Wheel Circumference

RPS = 0.3/0.2042035

= 1.469 rev/sec

RPM = RPS x 60

= 88.147 rpm

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Therefore, we will be using a motor with speed of more than 88.147 rpm.

Standard motors, which are available with speed of more than above, are of 100 rpm

Results

The goal of this research was accomplished by precisely identifying and mapping the land mines and the region that the robot travelled so that the demining team could quickly find and disarm the landmines. Being invisible to the landmine is key to this robot's success in finding mines.

This is made only by its light weight. This robot is inexpensive. This robot includes a straightforward mapping system and graphical user interface. The robot is simple to operate even for beginners. The local market has a wide variety of robot parts. All three modes of operation—automatic, semiautomatic, manual—were effective. One graphical user interface with all three control modes offers the user a very potent system. Landmines may be precisely plotted thanks to image processing's use of dead reckoning error compensation.

The user of this research needs this vital feature to account for the sandy places where robot wheels are prone to skidding. The landmines on the graphic map are off by only a few millimetres. Landmines were successfully located using the balancing beat metal detector. The landmines can be easily located with the use of a visual map. Using a PIC microprocessor and servomotors, PID was successfully implemented. A visual environment is used to tune the servomotor. The visual environments for the PID tuning saved time. The response of control shown in visual environment quickly enables the user to change the value of any parameter to get the desired response. The visual environment program for cameras alignment helped in quick setup of system in any remote area. To test the intelligibility of the robot, novice users operated the robot and found the controls very easy to use and learn. Wireless serial interface handshaking was successfully implemented between the PIC microcontroller and remote terminal computer. This communication remained secure and reliable at all times

Conclusion

The research will demonstrate that an autonomous landmine detector can detect landmines automatically, which has been a very difficult task to far. From low-level positioning of a mobile landmine detecting platform in an unstructured environment, all phases of the development of such a system will have significant unresolved issues.

A few of the most important issues will be developed in this work, along with potential answers. This project's goal is to locate and mark a landmine so that it can be detonated by the mining mine detection Rover project's next-generation autonomous mine detection rover. When a landmine is discovered, our Rover will autonomously search a given minefield, support any suitable landmine detection software, spray the paint there. The presence of the Mine Detection Rover will be detected and scanned using a camera and sensor for thermography.

Our system will demonstrate the viability of this technique for landmine detection and labelling, our study will lay the groundwork for further advancement of this system. This research will demonstrate that a robotic solution to the issue of landmine detection and removal is a useful alternate to the current approach and will be beneficial to society.

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