

LANDMINE DETECTION ROBOT USING ARM CORTEX

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ABSTRACT

Landmines are basically explosive devices which will explode when triggered by pressure. This is used as a weapon in order to shatter the enemies, but it is reframed to be seen as environmental contaminants or toxic pollutants. When it explodes, it causes severe damage to the civilians and the economy. Hence, in order to prevent these consequences, lines has to be detected even before they explode into fragments as these are released at high speeds. Thus, this paper provides the solution for the effects caused by the landmines in defense field by introducing a landmine detection robot which uses the ARM microcontroller. The robot detects the buried mines using a GPS technology (wireless communication) to avoid human interference with the landmines.

Key Words:

Landmines, ARM Cortex, Metal Detector, GPS/GSM module, Power supply, LCD.

INTRODUCTION

As we know now, landmine is an explosive device disguised under or on the ground to annihilate enemy targets, but it also harms the existence of the people. When it detonates, these fragments can kill up to 35 meters or more from the landmine and harsh injuries at more than 100 meters. After outburst, landmine can last active for up to 50 years. Landmines are inexpensive and effective when deployed, but are expensive and perilous to remove. It is approximated that there are 110 million landmines in the ground right now. In order to avert these up-shot, noticing these landmines is an interesting intention of this paper. This purpose is pleased by employing a robot. This robot possess metal detector which will spot the line, GPS (Global positioning system) to pursue the location of the mine which is shrouded and then sends SMS message and ARM microcontroller used to process the data sent by metal detector and stops whenever it is detected. ARM cortex board is employed as controller that handles the motorized vehicle so that robotic vehicle scrutinize the whole area.



HISTORY

This gives an overview on the past inventions of the various parts related to design of landmine detection.

In the ancient world, buried spikes provided many of the same function as modern mines. Firstly gunpowder was used as an explosive.

Before explosives some fortification in the Roman Empire were surrounded by a series hazards buried in the ground. It includes goads, foot long-pieces with iron hooks on their ends, so that it form a zone that are wide enough that enemy could not much harm from outside but were under fire if they attempted to remove the obstacles.

More easily deployed defense used by Romans was caltrop, a weapon about 12-15cm across with four sharp spikes that are oriented so that it was thrown on the ground.



In 19th century, the Chinese began the experiment in gunpowder it is mixture of sulphur, charcoal, and potassium nitrate. In 13th century, it was difficult to use mines because it is hygroscopic, easily absorbing water from atmosphere and when wet is no longer explosive. After this another method will be used i.e. cast iron cannon ball shells filled with gunpowder. It was made by hardwoods carry three different fuses connect with touch hole.



The hat dogs can smell a landmine was first demonstrated in the 1970s. They are up to a million times more sensitive to chemicals than humans, but their true capability is unknown because they can sense explosives at lower concentrations than the best chemical detectors. Well-trained mine-detection dogs can sniff out explosive chemicals like TNT, monofilament lines used in tripwires, and metallic wire used in booby traps and mines. The area they can clear ranges from a few hundred to a thousand meters per day, depending on several factors. Rats have the advantage of being far lower mass than the human or dogs, so they are less likely to set off mines. They are just smart enough to learn repetitive tasks but not smart enough to get bored they do not bond with their trainers, so they are easier to transfer between handlers. They have far fewer false positives than metal detectors, which detect any form of metal, so in a day they can cover an area that would take a metal detector two weeks.



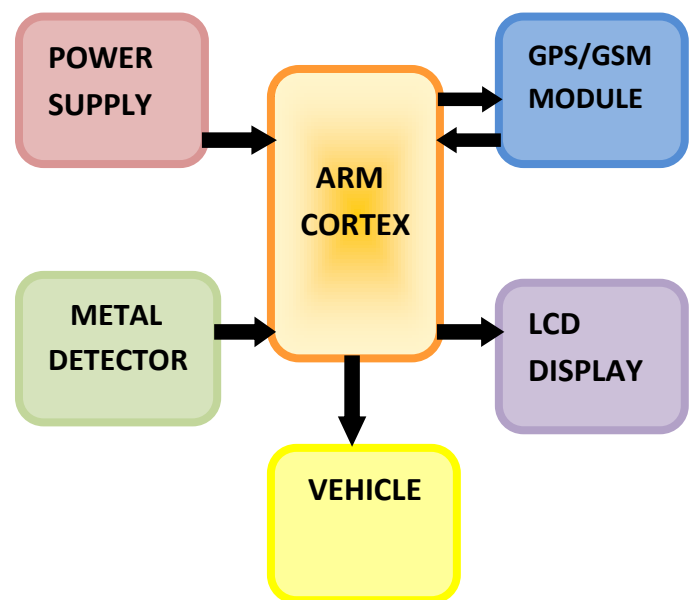
The Sri Lankan Army Corps of Engineers has been conducting research on the use of the mongoose for mine detection, Sri Lanka have been developing a method where a mongoose is guided by a remote-controlled robot.

Honey bees can be used to locate mines in two ways: passive sampling and active detection. In passive sampling, their mop-like hairs, which are electrostatically charged, collect a variety of particles including chemicals leaking from explosives.

As part of the "Dog's nose" program run by the Defense Advanced Research Projects Agency (DARPA), several kinds of non-biological detectors were developed in an attempt to find a cheap alternative to dogs. These include spectroscopic, piezoelectric, electrochemical and fluorescent detectors.

In these drone will be used as robotic attachments in a three-step process. First, a map is generated using a 3-D camera and GPS. Next, a metal detector pinpoints the location of mines. Finally, a robotic gripping arm places a detonator above each mine and the drone triggers it from a distance.

HARDWARE IMPLEMENTATION



These are main components present in designing landmine detection robot:

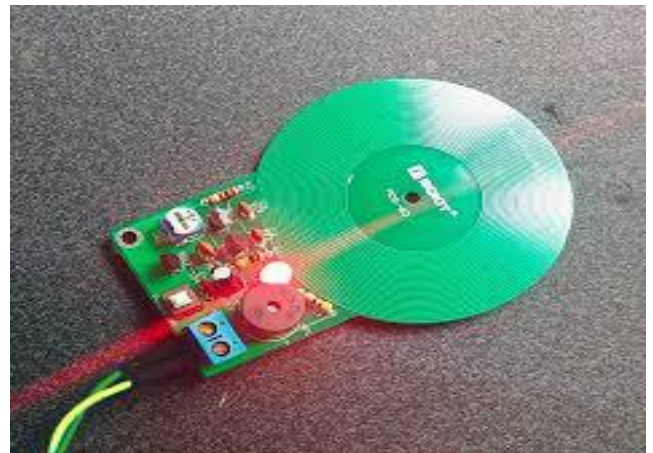
1) ARM Cortex

ARM cortex-M3 is a group of 32-bit RISC ARM processor cores licensed by Arm Holdings. ARM architecture is a 'Harvard architecture' which propounds particular data and instruction buses for communicating with ROM and RAM memories.

It has higher speed which assures effective response even in simple applications. The most prime factor is that, it has largest memory capacity. We have ARM Cortex Board as controller that drives the motorized vehicle accordingly so that the robotic vehicle scans the entire rectangular area.

Basically, microcontroller is embedded inside a system to command a singular function in a device. It does this by comprehending data it receives from its I/O peripherals using its central processor.

The impermanent information that the microcontroller receives is stored in its data memory, where the processor accesses it and uses instructions stored in its program memory to decrypt and apply the incoming data. It then uses its I/O peripherals to communicate and validate the appropriate action.



3) GPS/GSM MODULE

GPS (Global positioning system) is capable of showing the exact position on the earth anytime, anywhere in any weather conditions. The GPS has three parts i.e. satellite, receiver, software. The GPS receiver should know two things about the satellite i.e. location and the distance. GPS tracking system uses Global Navigation Satellite system (GNSS) network. This network engulfs a range of satellites that use microwave signals that are transmitted to GPS devices to indicate information on location. It can potentially give both real-time and historic navigation data. It can record the data of the device which has travelled for past 12 hours. The data saved on GOS tracking system is customarily stored in internal memory or on a memory card which is then downloaded to a computer for later analysis. In some instances, the data is sent for wireless download or can be applied at specific points during the journey.



2) Metal Detectors

Metal detector is an electronic device that detects the presence of metal nearby. They are commonly used for finding metal inclusions hidden or for landmine detection. They consist of a handheld sensor (proximity sensor) probe which can be swept over the ground to detect metal elements buried underground. If the sensor senses any metal nearby, it is indicated by a buzzer or through needle movement. It also gives information about the distance i.e. how close the metal is present by increase or decrease in the volume of buzzer. Typically a well equipped device can detect metal elements buried underground up-to 6 to 10 inches deep.



4) POWER SUPPLY

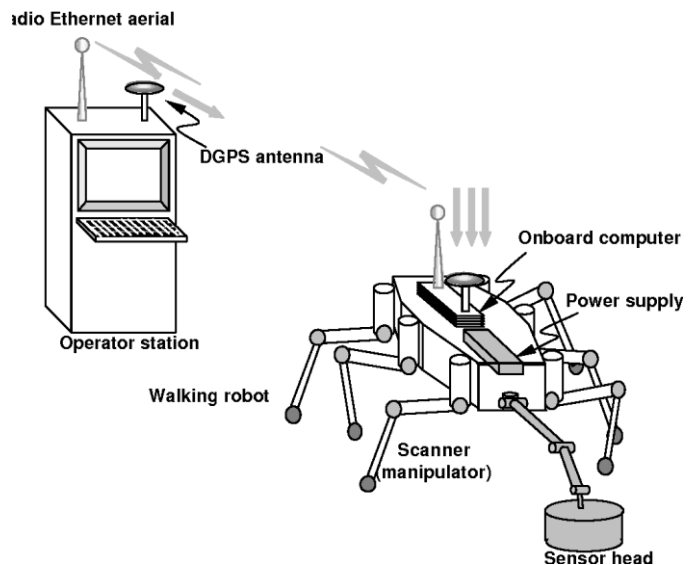
Acceptable power has to be supplied or needed to run the motors and the accompanied circuitry. Standard power supply which is necessary varies from 3V to 24V DC. 220V AC supply must be reformed to match the desire of our machine. Batteries can also be used to run the robots. DC motor, Stepper motor, Servo motors can be used to guide the robots



5) LCD DISPLAY

Liquid crystal display is a flat panel display or other electronically modulated device. LCD's are used to check the output of the different modules interfaced with the microcontroller. It can also be used to debug and rectify the problem when system module fails to work. Liquid crystals do not emit light directly instead using a reflector to produce images in monochrome. It has arbitrary images or fixed images with low information content. This can also be displayed as seven segment display. These images are made in form of matrix of small pixels. LCD screens have replaced bulky CRT display nearly all applications. LCD screen available in size ranging from tiny digital watches to very large television receivers. It has lower weight for a given display size and a slimmer profile and low power consumption. Most color LCD systems use the same technique, with color filters used to generate red, green, and blue pixels. The color filters are made with a photolithography process.

WORKING OF LANDMINE DETECTION ROBOT



Landmine detection robot basically consists of the metal detector which is used to sense the metal inclusions buried underground. The system is put down on a field to detect the landmine. The system starts moving on the field. Simultaneously, metal detector starts its operation. If it senses the presence of any metal elements nearby, it automatically sends the message signal to the controller i.e. ARM cortex and with help of GPS module it locates the exact position and also informs about how far the metal element is located.

GSM through Attention Command sends the SMS to the user. Once the landmine is detected and the process is completed, the system stops at specific location. The landmine deceased completely thereby saving many lives.

THE OVERALL LOOK OF THE LANDMINE DETECTION ROBOT



ADVANTAGES

- Totally remote controlled.
- With the help of GPS, location can be mapped accurately.
- Avoids the human interference in detecting landmines which may put their lives into danger.
- Locations of detected landmines can also be accessed via mobile phone through GPRS and SMS.
- It provides robust control.
- Enables smoother detection policy with no human efforts.
- Reduces death rates.
- It provides working range as large as the coverage area of the service provider.
- It enables time saving.
- It provides comfortable, fearless and secure landmine detection through robots.
- It enables the operation of the robot from the safer distance.
- These advanced technologies plays important role to save soldiers lives and the mankind from such a big disaster.
- Its one of the Nations life savior system.

CONCLUSION

The landmine is the most dangerous weapon that is invented when the World War happened. It plays a very important role in the period of war and most of the soldiers have lost their life or body parts due to their inability to detect them. In order to prevent this, a robot can be used to find the landmine in the critical areas and also the robot can be

controlled by the advanced technologies like ARM cortex, Metal detectors, GPS and so on. The metal detector is used to find the landmine in the land and map them or mark in the field exactly. Then they can be easily defused with the help of robot. You need the controller as ARM microcontroller, metal detector, motor drive, transmitter and receiver to control the robot direction. This is been discovered in order to save the lives of soldiers, peoples present nearby landmines and the economy of our country. It is a national project which acts as a life savior by avoiding the human interference with the landmines and allowing only robots to detect and dissolve the dangerous landmines and it helps to save lives. Finally it is one of the greatest inventions as a tribute to our armed forces and their services to our Nation.

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