

MINE EXPLORATION, RECOVERY AND SECURING INSTRUMENT (MERSI)

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Introduction:

Mine Exploration, Recovery and Securing Instrument(MERSI) is a semi-automated device that can be used by the Indian army or any mine retrieval organization in retrieving mines in desert terrain The Indian army and most of its combatants use only a select few types of mines due to their effectiveness in the field. The two most used mines are NMM14s and M16s.

NMM14 is an anti-personnel mine which consists of a small charge which ignites when the firing pin engages on the depression of the plate on top. The triggering weight of this particular mine is about 1.5 kg. The charge is not of lethal quantities, but is big enough to blow a foot clean off. M16, fragmentation mines, consists of one metal canister containing the main charge and pellets encased inside a second metal canister. This consist of a special dual charge system which activates when a person steps off of it. The first charge is small lying between the first and the second canister which makes the mine jumps up to about 3 feet and then detonates creating a kill radius of 27m. For several reasons, the top soil shifts in desert terrain. This project can help Soldiers posted in this type of region with the retrieval of land mines without the heightened threat to their lives. This project could also potentially travel through trenches clearing the path for our soldiers.

Objective:

The recovery of landmines is a completely human endeavor in today's date. It is a dangerous and important feat that is performed by brave soldiers who are trained for this.

This project is primarily for the mitigation of the amount of lives lost due to these mines.

The objective is two part:

1. The detection and mapping of the land mines.
2. Recovery and securing of the land mines.

MERSI is a specialized equipment that will help soldiers recover mines without getting too close to them themselves. MERSI will be able to detect possible mine locations and then send a prodding tool into the ground to propel out the mine from the ground. Then an arm placed on the rover will pick up the mine and place it on the Rover where it can be disarmed safely.

Methodology:

We came up with conceptual drawing we essentially divided the machine into following sub parts

1. Arm
2. Needle

3. Metal detector
 4. Rotating disc
 5. Rover
- The arm is made of links made up of pvc pipes it has 4 rotating joints with three links and one clipper the base of the arm will also rotate and all the joints are powered by dc motors
 - This is the part of machinery which breaks in the ground to lever out the mine it consists of two pneumatic cylinder in which one is hinged to the edge of the rover and the second is hinged on body of first to angle it above the ground
 - The metal detector which we are using can detect up to 5cm it has three links which folds itself after detecting
 - Now the rotating base is fixed onto a spindle resting on the rover. It carries the arm, needle, and metal detector.
 - The rover consists of a cuboidal frame with 2 worm gear motors driving the continuous track wheels with rubber pads.
 - All of these parts are controlled by individual Arduino boards, and all of these boards are connected to a master raspberry pi board which will also controls the camera on top of the clippers of the arm.

Result:

The result of all the work done by our team over the past semester is a fully functional rover equipped with all the tools for the detection and retrieval of M16 and NMM14 land mines in desert terrain. It can be controlled by a panel of switches and joysticks interfaced through Arduino. The pneumatic supply is given by a storage cylinder connected through a long pipe to the piston arrangement on the rover.

Conclusion:

We have successfully developed a working prototype of a mine detection and retrieval robot. Given enough time and resources I believe that this project has a lot of room to grow. For example, accessibility to all kinds of terrains.

Scope for advancement:

- The individual parts along with the rover can be made smaller once the excess area is recognizable.
- The pneumatic supply can be given by smaller storage cylinders or portable pneumatic compressor placed on the rover itself.
- The metal detector can be replaced by a stronger and more sensitive one so as to make detection more accurate
- Provide the capability to place a detonator on top of the mine if the retrieval is very risky.
- Get the arm and the metal detector links 3-D printed to reduce the weight.