**Name:** Mine Shell  
**University/School:** Arab academy for science and technology and maritime transport **Supervisor/Mentor:** N/A  
**Competition Category:** Minesweeper –Academia   
**Country:** Egypt

**Abstract [Overview about robot/system]**

The Mine Shell robot is designed to detect mines quickly and efficiently in a manner that prevents missing any target. It is also made to be durable and resistant to damage.

**Describe your mechanical design and locomotion system**

Some aspects were taken into consideration while designing and building the body, the robot had to:

* Be made of non-metallic material so that the metal sensors are not affected
* Be light-weighted so that it doesn't sink in the sand
* Have a small size to be able to control with ease
* Be high above the ground to decrease the possibility of touching a mine simply by passing over it

The chassis of the body is made of artelon plastic which is very durable and can support a lot of weight, the wheels are made of rubber, and the control boxes are made of acrylic.

The robot is using a 4-motor driving force with a fifth motor that is attached to its front which moves an arm in a 180 degree circular motion with the metal detector at the end of the arm.

**Describe sensors and how can it detect landmines?**

Since there are two types of mines in the field: surface mines and buried mines, two types of sensors were used to differentiate between them. Because the mine is a metallic cube of 10 cubic centimeters, a magnetic field is used to detect it. The metal sensor board used depends on pulse induction where an opposite magnetic field caused by a metal can be sensed. The second type of sensor used is the ultrasonic sensor which is used in determining the type of the mine.

**Describe your electronic circuit/control system/platform used [Tele-operated/Autonomous]**

The robot was chosen to be tele-operated to be more accurate and to minimize errors.   
The control board used is an Arduino Mega.  
The Arduino is connected to six boards/modules:

* Two motor-driver boards to control motors which is using relays, and the arm motor driver which is controlled by a PWM signal through a power transistor
* The SD card module to store a map of the field
* The serial UART wireless module chip for wireless communication
* The ultrasonic sensor module
* The electric shaft encoder attached to the motors
* The IMU sensor
* The metal detector board

An Arduino Uno is connected to the Mega for interrupt pins and to move the metal detector arm.  
Localization is achieved using sensor fusion between the IMU sensor and the magnetic shaft encoders.  
Two encoders are attached to the front wheels to minimize errors.

**Put your plan to navigate the whole arena [250 words] (10 Points)**

In order to navigate the arena in a systematic manner that reduces error and saves time, a pattern was created:

* The robot will start scanning from the block in the lower left corner (A1) one block at a time
* The robot will walk 19m in one direction scanning these blocks then rotates to walk 19m in the opposite direction scanning the blocks next to those already scanned
* This operation is repeated till the arena is wholly scanned

**Describe how to provide the map of detected mines?**

To document the position of the mines, the Arduino is programmed to store the number of the block and the type of the mine then sending them to a text file in the SD card.

The SD card will be taken from the control box after finishing the scanning of the arena and will be presented to the judges.

**How to face the rough environment and the high heat?**

The weather and the nature of the land were put into consideration while designing the body, so that the robot will not fail in doing the mission midways. The body of the robot has a cover to provide protection to the boards from the heat and sun, and the acrylic boxes used to hold the battery and boards are well-closed to insulate them from the sand.

**Put your Video YouTube link here:** https://goo.gl/BEO6z0