Arab Academy for Science & Technology and Maritime Transport

Collage of Engineering and Technology

2011 Mate ROV competition

AAST Team

ROV “TAHREER”

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**Abstract**

ROV Tahrir was designed and manipulated by Arab Academy For science, Technology and Maritime Transport Students and its aim is to complete the MATE 2011 Competition, knowing that it's our first time to join this competition so we faced a lot of challenges which firstly designing it's body and reach to it’s wanted stability in water (i.e. Body surface in contact with water surface) , Secondly which kind of motors should we use , with suitable propellers , and to isolate every single part in it ,In addition to safety which is our highest priority, also how to isolate the electric power cables ,how to collect all the cables . But with learning and searching, we knew our faults and worked on fixing them, we reach to suitable solutions through which we achieved our aims, All these solutions were reached by co-operation between team members, so there is a future plan to improve our ideas, to make everyone in each certain field know about ROV technology and improvements in software knowledge and a more efficient electrical system.
1. **FINANCIAL STATEMENT**

<table>
<thead>
<tr>
<th>Purchases</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2*(1/4) PVC plastic cement</td>
<td>22 EGP</td>
</tr>
<tr>
<td>Battery 12 volt, 55 amp</td>
<td>440 EGP</td>
</tr>
<tr>
<td>15 * T-Section 1 inch</td>
<td>30 EGP</td>
</tr>
<tr>
<td>9 * Tie Belt</td>
<td>20 EGP</td>
</tr>
<tr>
<td>3 * PVC pipe 1 inch</td>
<td>54 EGP</td>
</tr>
<tr>
<td>2 * PVC pipes 1.5 inch</td>
<td>36 EGP</td>
</tr>
<tr>
<td>20 * (90 degree Section ) 1 inch</td>
<td>35 EGP</td>
</tr>
<tr>
<td>20 * T-Section 1 inch</td>
<td>40 EGP</td>
</tr>
<tr>
<td>8 * PVC Cap 1.5 inch</td>
<td>16 EGP</td>
</tr>
<tr>
<td>3 * (1/8) PVC Plastic cement</td>
<td>24 EGP</td>
</tr>
<tr>
<td>26 * Foxconn Processor Fan</td>
<td>540 EGP</td>
</tr>
<tr>
<td>6 * Glue</td>
<td>6 EGP</td>
</tr>
<tr>
<td>2 * Tools Bag</td>
<td>280 EGP</td>
</tr>
<tr>
<td>2 * LCD screen</td>
<td>400 EGP</td>
</tr>
<tr>
<td>Electric Wire</td>
<td>2000 EGP</td>
</tr>
<tr>
<td>5 meters Water Pipe</td>
<td>20 EGP</td>
</tr>
<tr>
<td>10 * Tie Belt</td>
<td>20 EGP</td>
</tr>
<tr>
<td>4 * (90 degree) PVC Section 1 inch</td>
<td>12 EGP</td>
</tr>
<tr>
<td>2 * PVC T-Section</td>
<td>7 EGP</td>
</tr>
<tr>
<td>9 * Rule Bilge Pump 1100 GPH 12V</td>
<td>3000 EGP</td>
</tr>
<tr>
<td>Fish finder</td>
<td>1100 EGP</td>
</tr>
<tr>
<td>2 * Camera</td>
<td>1000 EGP</td>
</tr>
<tr>
<td>Extra tools</td>
<td>1200 EGP</td>
</tr>
<tr>
<td>ARM</td>
<td>530 EGP</td>
</tr>
<tr>
<td>Electrical Control</td>
<td>210 EGP</td>
</tr>
</tbody>
</table>
2. Body:

We made our “TAHRIR " Body from PVC tubes which have density 1.41 gm/cm³ and diameter 1 inch, its symmetrical and uniformly shape is to grante an equally distributed hydrostatic force and its stability in water, also to make it easy in installing our equipments.
2.1-Body Calculations:-

2.1.1 Dimensions:-

Length = 64.2*4 cm

Width= 37*6 cm

Height = 33*6 cm

2.1.2 Mass of the PVC

Volume of PVC = (3.14/4)*(((3.3)^2)*((2.5)^2))*678 = 2470.79 cm³

Density = mass/volume

Mass = 1.41*2470.79 = 3483.3 gm

The mass of PVC = 3.483 kg

Mass of air

Volume of air = (3.14/4)*((2.5)^2)*678 = 3328.12 cm³

Density of air = 0.0013

Mass of air = 0.0012*3328.12 = 4.32 gm
Total mass of body = 3.48823 kg

Up thrust force

Total volume of the body = \((3.14/4)\times(3.3)^2\times 678\) = 5798.9245 cm³

Bouncy force = the density of fluid \(\times\) the total volume of body \(\times\) gravity force

= 1000 \(\times\) 5798.9245 \(\times\) 9.81

Bouncy force = 56.887 N

The weight of the body

\(W = M \times g\) = 3.48823 \(\times\) 9.81

\(W = 34.210\) N
3. Thrusters:

We had bought a dc bilge pump with a rate of flow 1100 GPH with 12 v DC at 3.3 Amps and power 50.4 watt, which is suitable for propulsion system.

We sow its casing and slip off the impeller and took the motor only from the pump.

We had bought a fan processor, we know it work on air dynamic but we didn’t find a propeller work on water dynamic with the dimension that we need,

We made a coupling to couple the shaft of motor with the fan processor,

We used the kort nozzle of the fan processor and put it as safety for the fan,

We fixed the thruster system as shown.
It was a challenge to us to drilling the cover of this fan at the center to rotate accurately and fixing this fan processor on it with the motor (pump) Covering it again with another one to guarantee its safety

- Installation:-

We install 8 motors with uni-direction motion only.

2 for ahead motion

2 for astern motion

2 for right and left

2 for vertical motion
-4. Manipulator:-

-Details: -

The arm made of Artinol it has light density the arm has two functions that move up and down and has a grip

-Specifications:-

Two couple power cables Car Central Lock and Auto Glass Lift Motor.

-Moves up word and down word.

-Opening and closing clamps for grappling.

-Weight:- 1.6 kg
- 4.1 Design & Dimensions:

- **Additional:**
  
  - **Car Central Lock:**
    
    For opening and closing the ARM, two motions only, it fixed inside the arm.

    - **Details:**
      
      - Made: in Taiwan.
      - Type: DC motor
      - Voltage: 12 V
      - Material: Shell material ABC.
      - Use: moving the clamps.
-Specifications:

- Single gun type
- Actuator with 2 wires.
- Double track
- Jam-Prevention design.
- High torque.
- Strong electromotor.

-Auto Glass Lift Motor:

To move the ARM up and down (bi-direction motor)

- Details:
  - Type: DC motor
  - Voltage: 12 V
  - Use: vertical movement of the manipulator.
  - Weight.

- Specifications:
  - Worm and Worm wheel drive mechanism.
  - Helical gear contracture.
-5. Depth measuring system (Fish Finder)

-Definition:-

The Fish finder 140 combines a 4" (10.16 cm) grayscale display and Garmin’s exclusive fish finder technology into entry-level sonar that's perfect for any vessel where space is at a premium.

Pinpoint Your Next Catch

Fish finder 140's included dual-beam transducer provides excellent shallow-water performance, and the wide viewing angle lets you see fish even off the sides of the boat. With an easy-to-ready grayscale display and backlight, the Fish finder 140 has one of the sharpest screens for the money.

We fixed it at the bottom rear of the “TAHRIR”.

To help the pilot knows about robot position which can do the mission easier.
Specifications:

Depth: 2.6 in
Height: 4.9 in
Product Type: Fishfinder - included transducer
Width: 6.1 in

BUILT-IN DISPLAY:
Color Depth: 4-level grayscale
Color Support: Monochrome
Display Diagonal: 4"

MISCELLANEOUS:
Included Accessories: Mounting bracket, power cable

POWER:
Low Voltage Power: DC 10 - 18 V

SONAR:
Alarms: Deep water, fish size, low battery, shallow water
Features: See-Thru technology, AutoGain Technology, automatic settings backup, Ultrascroll, Fish Symbol ID, Whiteline
-6. Challenges:-

All of you know well that we are an Arabic team from the Arab Academy for Science and Technology in Egypt, and we started our term at too late due to our great revolution, so we want to tell u that our robot was built at a too short time which was less than three months.

This is in addition to that this is the first time to us to share in this great competition, so we have no experience about it before, which provides more great effort to built a robot, find a materials and test (all of these is the first time)

And finally choose the students, knowing also that we have no regional competition.

So we have great challenges for the time, experience, budgets, technical supports, and convince our collage by the competition.
-7. Camera:-

-Description:-
- CCD Underwater camera with LED light
- B/W or color image
- Color CCD underwater camera with 20m cable
- 3.6mm M12 Lens
- viewing distance in the water: 3-5M.DC12V
  (the cable can be 20M)
- Color Sony CCD underwater camera with 20m cable

-Specification:-
Image Sensor  1/3 COLOR CCD
SYSTEM: PAL/NTSC
MODEL: SONY
PIXEL: NTSC:510*492/PAL:500*582
VIEWING ANGLE : 92 degree
LENS DIMENSION: 3.6MM

MINIMAL ILLUMINATION: 1.0LUX 0.05LUX

VIDEO OUTPUT: 1.0VP-P 75

POWER SUPPLY: DC 12V

POWER CONSUMPTION: 1.4W 120mA

HORIZONTAL RESOLUTION: 420 TV LINES

WORKING TEMPERATURE: -10 to +50 degree

S/N RATIO: >48dB 50dB

MEAS (cm): 175*67*95MM

-8. Electrical control:-
8.1 For 8 motors

- We talk 48 Volt/40Amp from the source on a DC – DC converter (48v to 12v)

Then it goes on two paths:

First: on a regulator (7805) to down the volt to 5 volts to get the power of the drive board.

Second: on the 8 uni-direction motors with the transistors.

-we get the control from the pilot indirect to the drive board, which consists of 8 opt couplers for isolation and safety

From proteus.
8.2 For 2 motors:-(to control the ARM)

We get its power from the DC – DC converter (out 12 volts)

Then it goes on 2 paths:

First: on 2 relays direct to control the bi-direction center lock motor.

Second: variable resistance to control the speed then on the 2 relays to control the bi-direction motor for moving the ARM up and down.
8.3 Control overview:

9. References:
