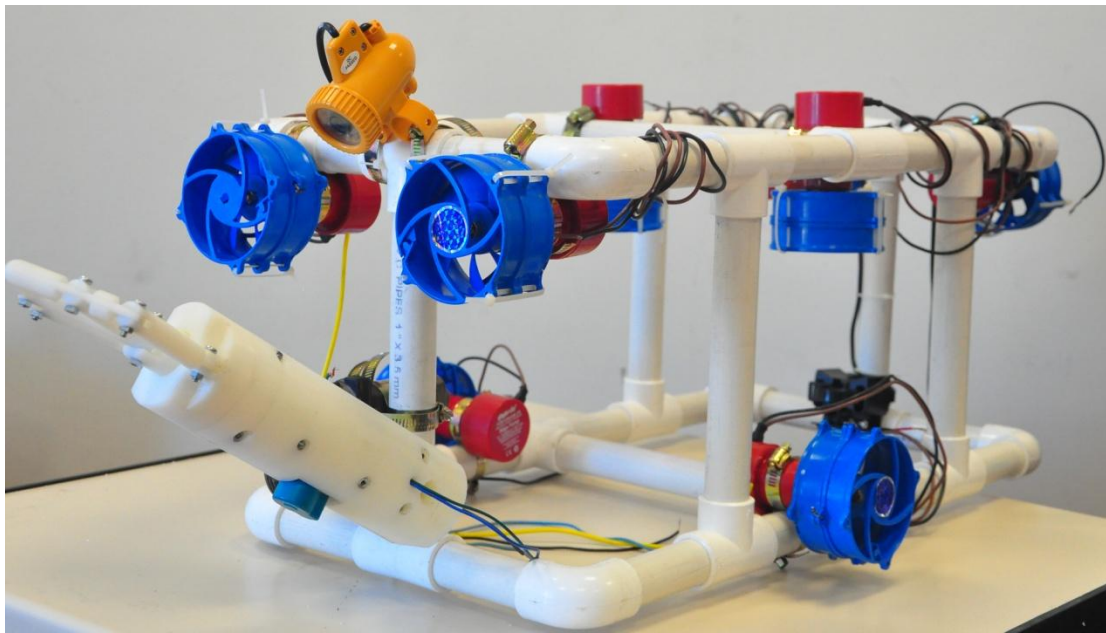




*Arab Academy for Science &  
Technology and Maritime Transport  
Collage of Engineering and Technology*

2011 Mate ROV competition



AAST Team

ROV "TAHREER"

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## -Abstract-

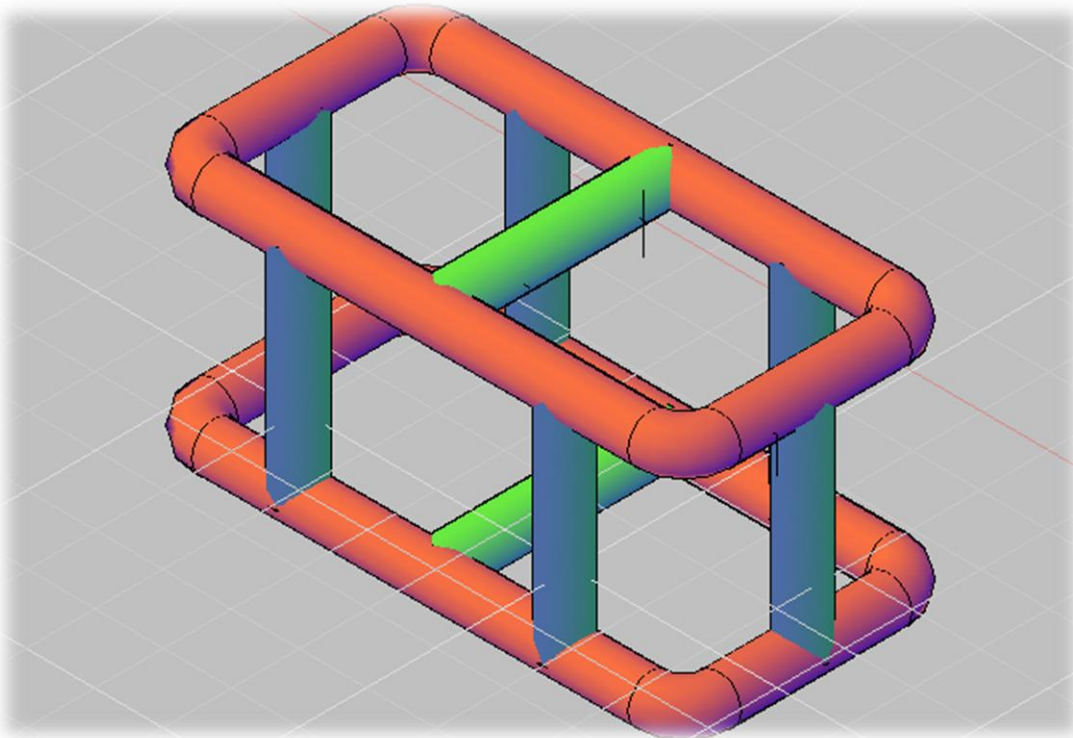
ROV Tahrir was designed and manipulated by Arab Academy For science, Technology and Maritime Transport Students and its aim is to complete the MATE 2011 Competition, knowing that it's our first time to join this competition so we faced a lot of challenges which firstly designing it's body and reach to 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

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

## 2. Body:-

We made our "TAHRIR " Body from PVC tubes which have density 1.41 gm/cm<sup>3</sup> and diameter 1 inch, its symmetrical and uniformly shape is to grantee an equally distributed hydrostatic force and d its stability in water, also to make it easy in installing our equipments.



## 2.1-Body Calculations:-

### 2.1.1 Dimensions:-

Length =  $64.2 \times 4$  cm

Width=  $37 \times 6$  cm

Height =  $33 \times 6$  cm

### 2.1.2 Mass of the PVC

Volume of PVC =  $(3.14/4) \times ((3.3)^2) \times ((2.5)^2) \times 678 = 2470.79 \text{ cm}^3$

Density= mass/volume

Mass=  $1.41 \times 2470.79 = 3483.3$  gm

The mass of PVC = 3.483 kg

### Mass of air

Volume of air=  $(3.14/4) \times ((2.5)^2) \times 678 = 3328.12 \text{ cm}^3$

Density of air= 0.0013

Mass of air=  $0.0012 \times 3328.12 = 4.32$  gm

**Total mass of body = 3.48823 kg**

**Up thrust force**

Total volume of the body =  $(3.14/4) * ((3.3)^2) * 678 = 5798.9245 \text{ cm}^3$

Bouncy force = the density of fluid \* the total volume of body \* gravity force

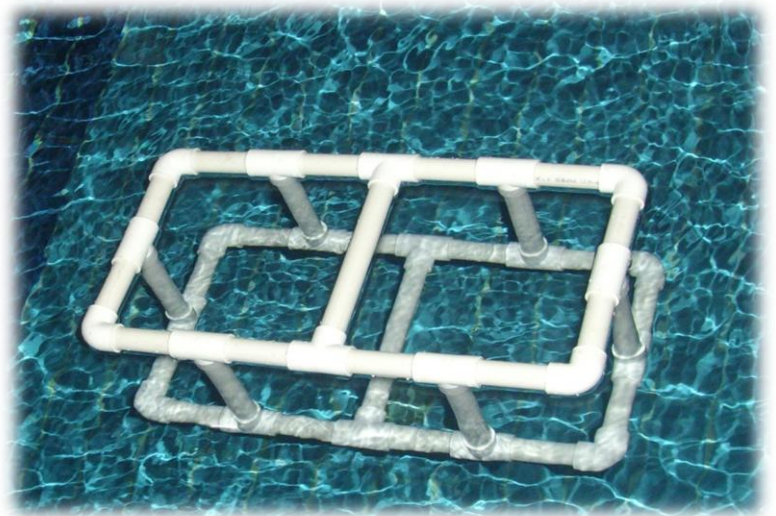
$$= 1000 \quad * \quad 5798.9245 \quad * \quad 9.81$$

Bouncy force = 56.887 N

**The weight of the body**

$$W = M * g = 3.48823 * 9.81$$

$$W = 34.210 \text{ N}$$



### -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.

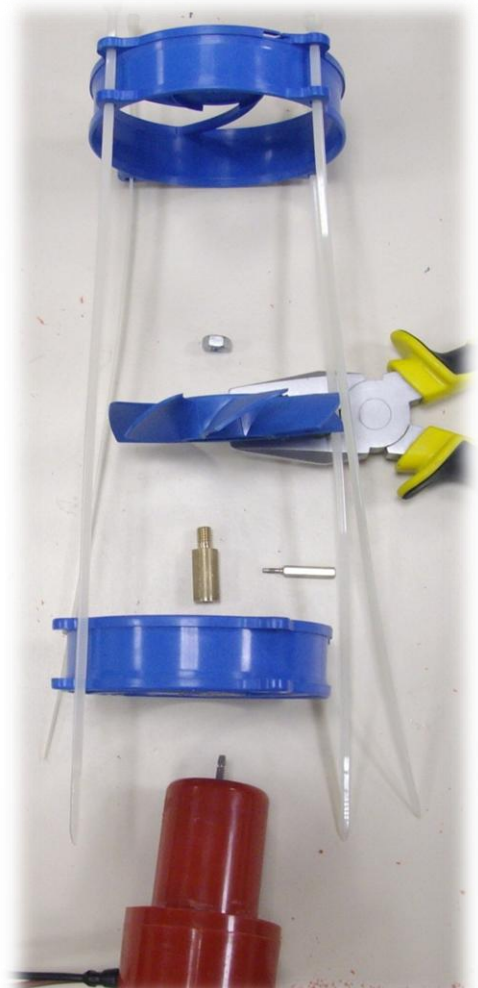
We saw its casing and slip off the impeller and took the motor only from the pump.

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 grantee its safety

### - Installation:-

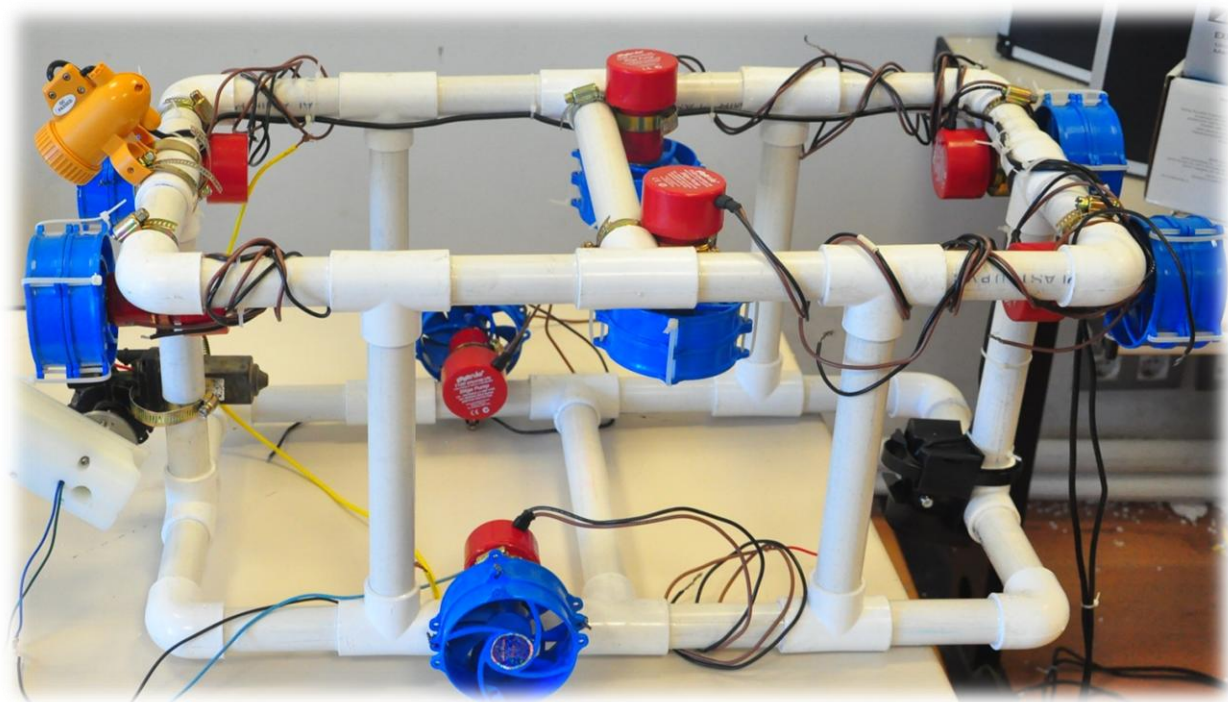
We install 8 motors with uni-direction motion only.

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

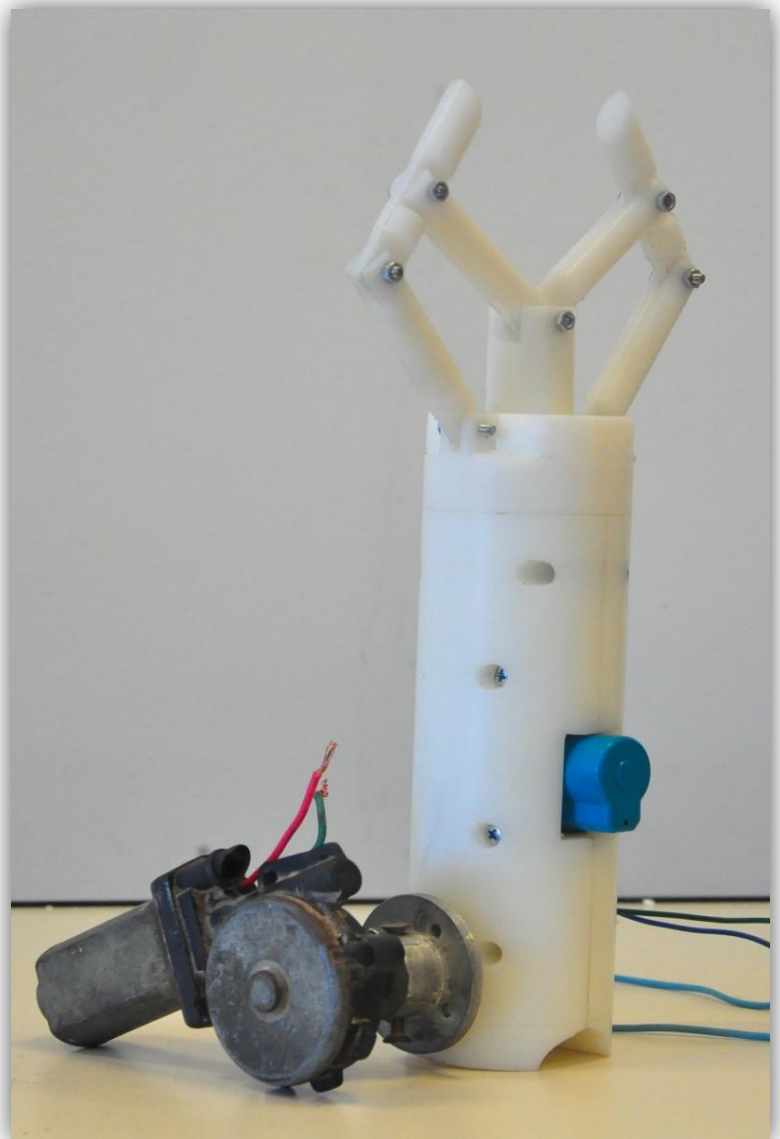
### -Specifications:-

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

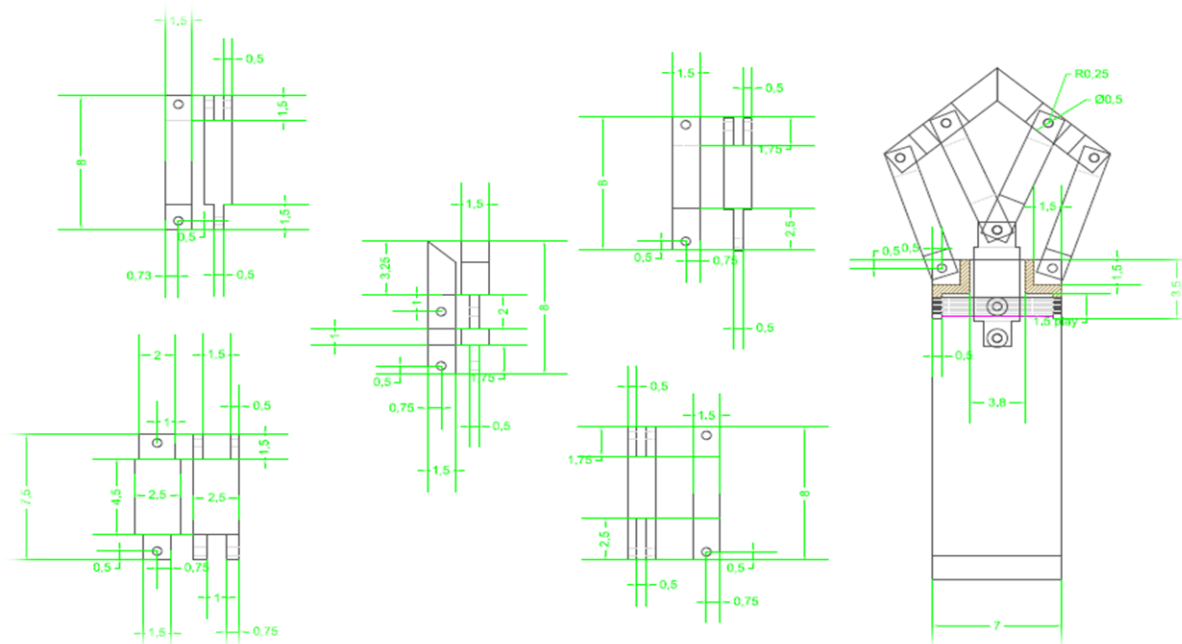
-Moves up word and down word.

-Opening and closing clamps for grapping.

-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.

- o 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
- Material: Iron and Plastic.
- Use: vertical movement of the manipulator.
- Weight.

### ○ Specifications:

- Worm and Worm wheel drive mechanism.
- Helical gear contracture.
- Good Vibration Stability. Output Shaft.



## -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.

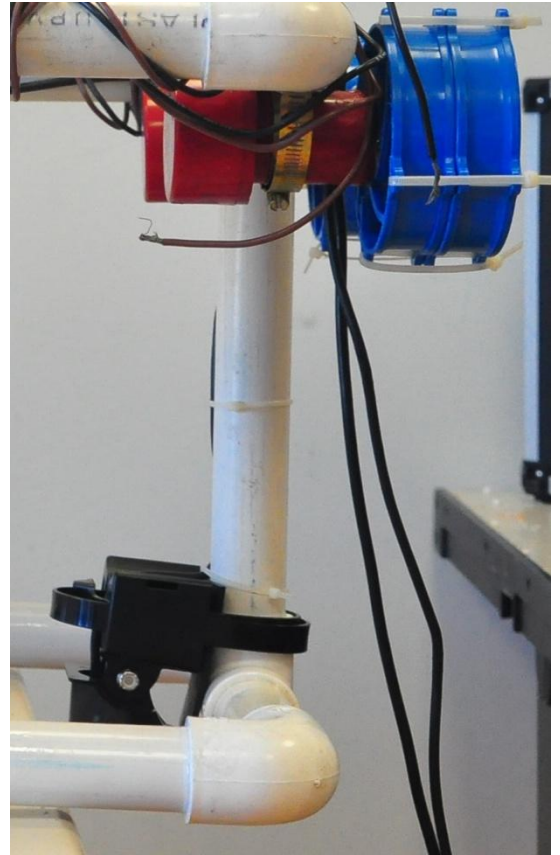
### Pinpoint Your Next Catch

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-read 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

TRANSDUCER:

Beamwidth: 14/45 degrees

Maximum Depth: 600 ft

Operating Frequency: 80/200 kHz

Power Output (Peak to Peak): 800 W

Power Output (RMS): 100 W

Transducer Mount: Transom

Transducer Type: Dual-beam

## -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 grate 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 )

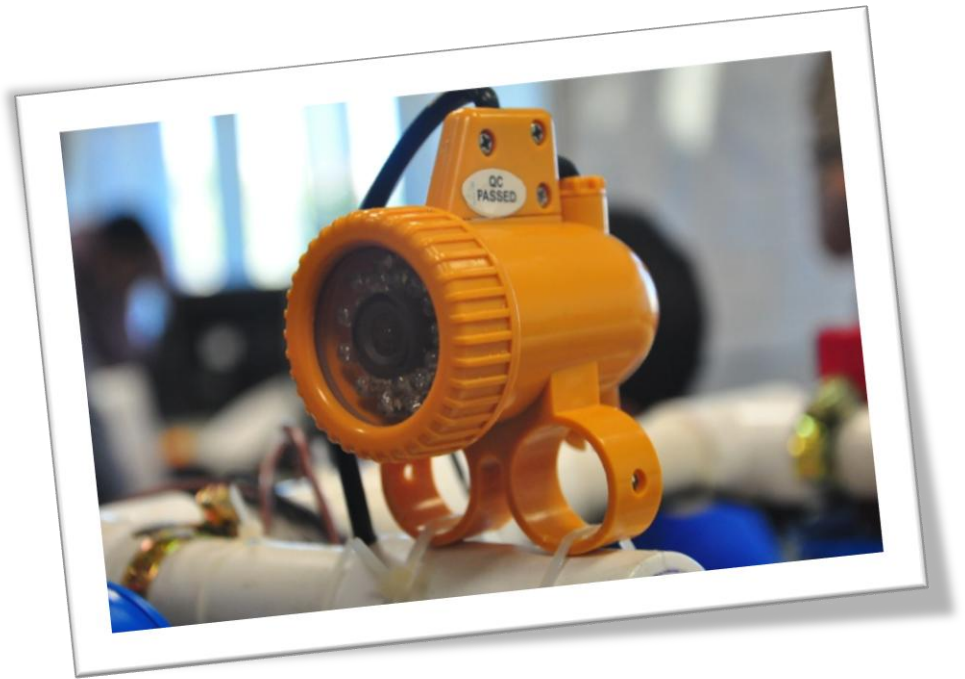
And finally choose the students, knowing also that we have no regional competition.

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

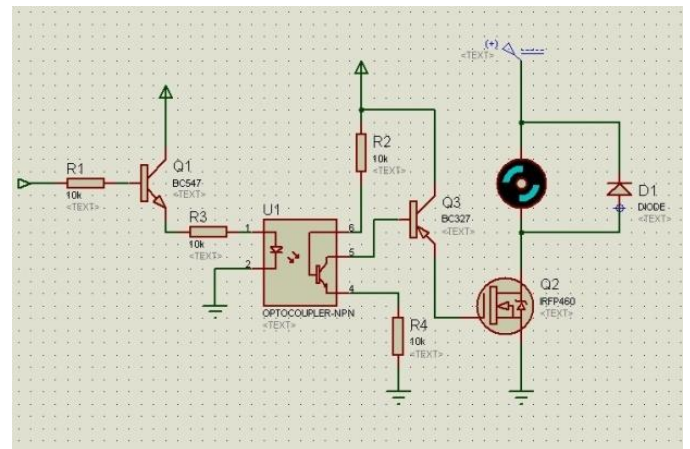
-We talk 48 Volt/40Amp from the source on a DC – DC converter (48v to 12v)

Then it goes on two paths:

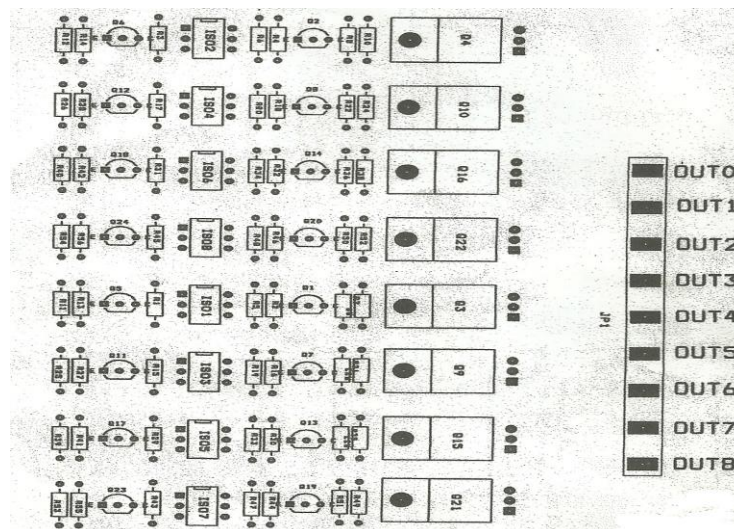
First: on a regulator (7805) to down the volt to 5 volts to get the power of the drive board.

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.



Scanned top layer picture for the drive board for the 8 opt couplers and transistors.

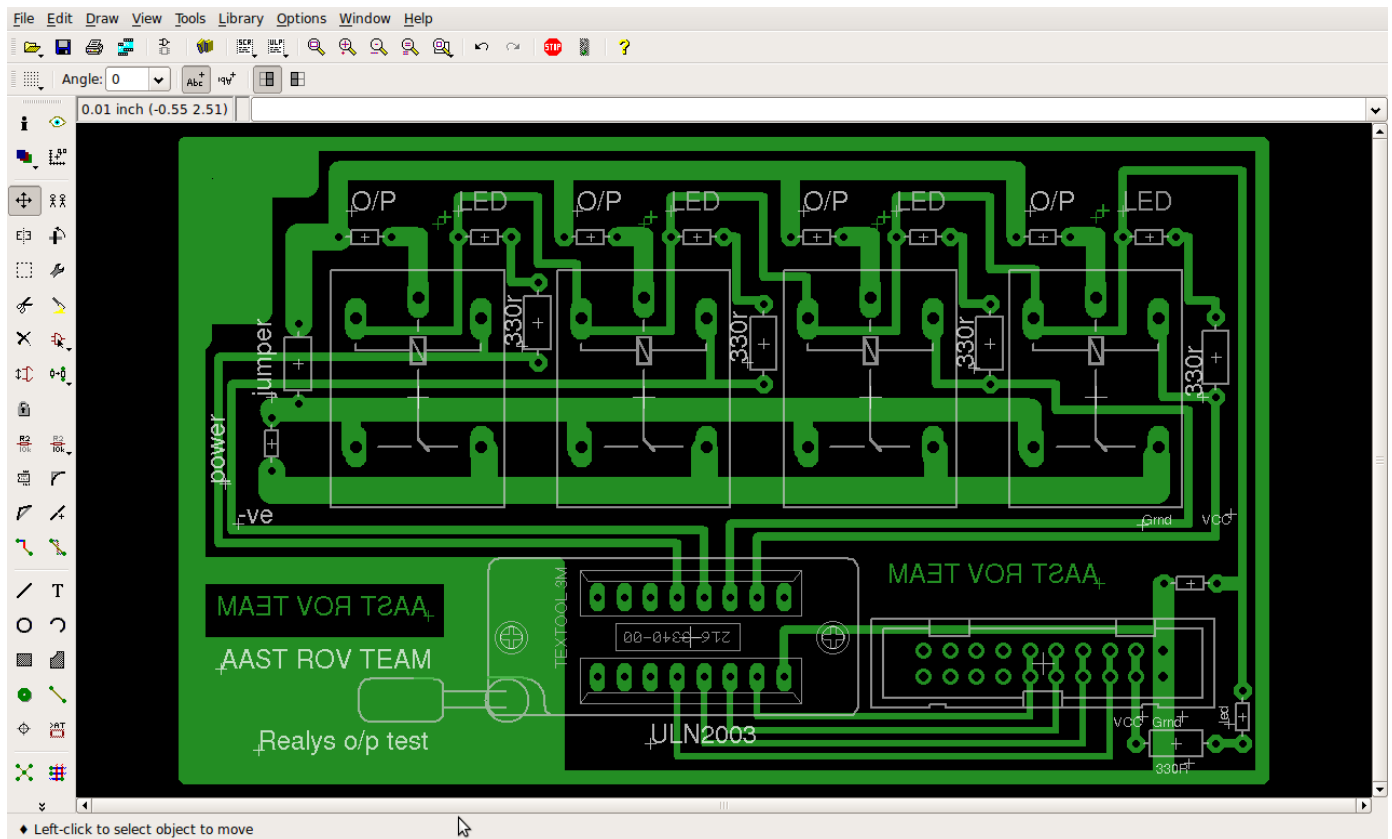
## -8.2 For 2 motors:- (to control the ARM)

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

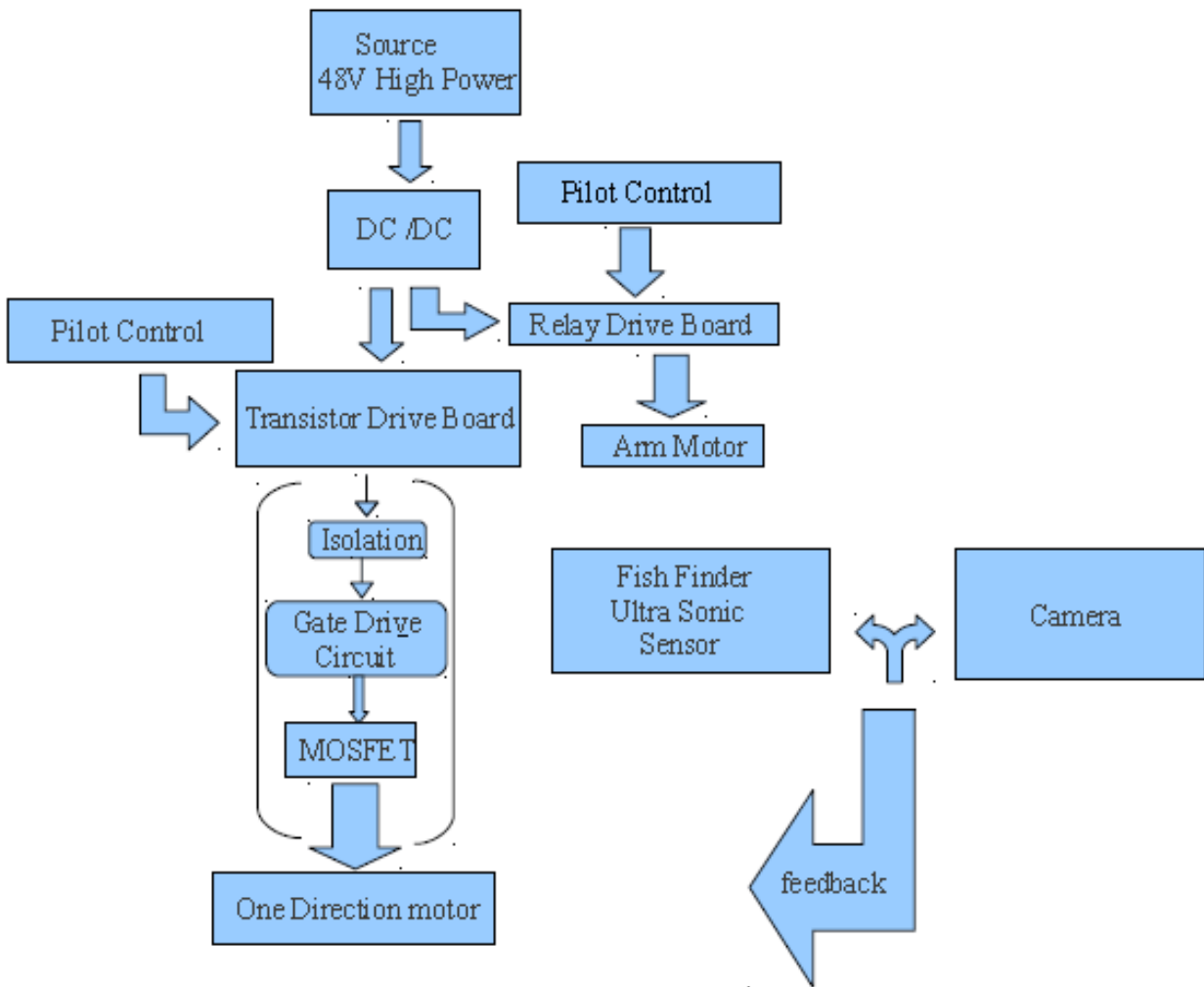
Then it goes on 2 paths:

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 over view :



### 9. Refrences:-

[http://www.sears.com/shc/s/p\\_10153\\_12605\\_05711585000P?sid=IDx20070921x00003h&srccode=cii\\_5784816&cpncode=00-1550535-2](http://www.sears.com/shc/s/p_10153_12605_05711585000P?sid=IDx20070921x00003h&srccode=cii_5784816&cpncode=00-1550535-2) .

<https://buy.garmin.com/shop/shop.do?piD=344#> .