BADAN PENGELOLA DAN PELAKSANA HARIAN
**SMP ISLAM AL AZHAR 26 YOGYAKARTA**
DIBAWAH BIMBINGAN YAYASAN PESANTREN ISLAM AL AZHAR JAKARTA
TERAKREDITASI A

بسم الله الرحمن الرحيم

# SURAT KETERANGAN

No : 0162/SKET/SMPIA26/IX/1440.2018

Yang bertanda tangan dibawah ini :

Nama : Agung Widiyantoro M.Pd

Jabatan : Kepala SMP Islam Al Azhar 26 Yogyakarta

Alamat : Jl Ring Road Utara ( Depan Asrama Haji ) Yogyakarta

Menerangkan dengan sesungguhnya bahwa :

Nama : **Dr. phil. Mashoedah. S.Pd., M.T**

NIP : 197011082002121003

Instansi : Pendidikan Teknik Elektronika FT UNY

Telah melaksanakan kegiatan **Pelatihan dan Konselor** dalam rangka lomba Robot ROV (*Remotely Operated Vehicle*) tingkat ASEAN 28-29 April 2018 sebagai bentuk kegiatan Pengabdian Pada Masyarakat.

Dengan hasil : **Juara 3 Kategori RANGER**

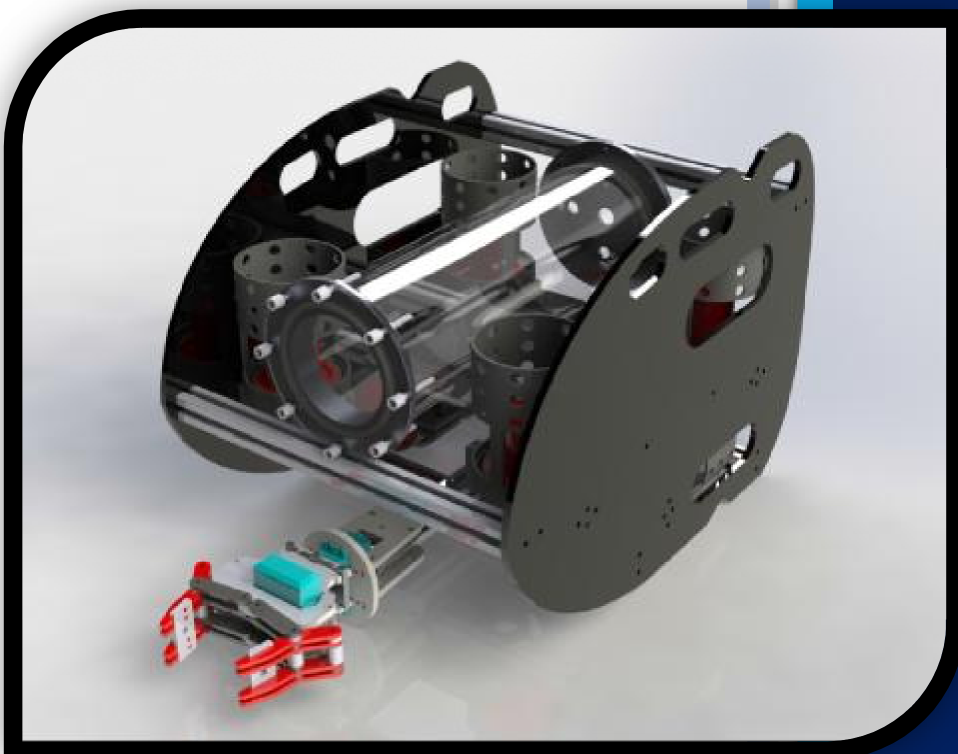
Demikian Surat Keterangan ini dibuat, agar dipergunakan sebagaimana mestinya

Dikeluarkan di : Yogyakarta
Tanggal : 09 November 2018
Kepala SMP Islam Al Azhar 26 YK

Agung Widiyantoro, M.Pd
NIY.8712.021406.6.007

2018

# Spilar Robo



## TEAM MEMBER

- *ROMDLON MUSYAFFA AKBAR* (8th Grade) **: Chief Executive Officer**
- *FAIZ ATTAQI* (8th Grade) **: Chief Financial Officer**
- *BAGINDA BINTANG S FAIZ ATTAQI* (8th Grade) **: Chief Financial Office**
- *MUHAMMAD REFQY MAWARDI WARIS* (8th Grade) : **Designer**
- *MUHAMMAD GHIFARY NUR SYA'BANI* (8th Grade) : **Designer**
- *BINTANG MAHARDIKA SHANDY* (7th Grade) : **Designer**
- RAKA ARGHA (7th Grade) : **Designer**
- ALIFIO (7th Grade) : **Designer**
- IMAM (7th Grade) : **Designer**
- *MUHAMMAD WAHID AKMAL LATIEF SHOBIR* (8th Grade) : **Tether**
- *TEUKU RADJA SYAHPUTRA* (8th Grade) : **Mechanical Engineer**
- *FILBERT* (7th Grade) : **Mechanical Engineer**
- DIAR (7th Grade) : **Mechanical Engineer**
- *ARDIAN* (7th Grade) : **Mechanical Engineer**
- *ALHADIAN AKBAR* (7th Grade) : **Mechanical Engineer**
- RANGGANI FANTONI (8th Grade) : **Mechanical Engineer**
- *AHMAD ROIHAN AL MUTTAQI* (7th Grade) : **Programer**

**MENTORS :**
Mashoedah, Ferry Kurniawan

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# 1. Abstract

Our robotics team, SPILAR ROBO was established in December 2015 in order to join this MATE competition. This team was established because in our school we have a robotics extracurricular from the year of 2011. From 2011 until 2018 we have already won several robotics competitions at regional, national, or international levels. As for this MATE competition, this is'nt the first time for us. With a lot of experiences from 2011 in robotics, however, we hope we are able to do the best for our beloved country, Indonesia.

Our motivation to join the MATE competition is to improve the technology in robotics in order to solve the problems in the ocean as our country Indonesian ,is well-known as a marine country. We realize there will be some potential problems or natural potentials in the ocean we can explore. Therefore, by understanding the underwater ROV technology we expect we can contribute something useful for our beloved country.

# 2. Design Rationale and Vehicle Systems

## 2.1. Frame

Spilar Robo decided to build a perfection from our previous ROV. This year we make a more hydrodinamic and attractive model with minimized size to make maneuvers easier. We name our robot “AURO 4”.

In designing “AURO 4”, we have to considerthe potential benefits will be contributed by the ROV.In defining the potential benefits, we refer to the missions given by MATE.

“AURO 4” needs a unit of gripper in order to move horizontally and vertically. Additionally, we need thrusters. We have to consider where to install the thrusters with a total of 6 units (four horizontal, two vertical). We also need 2 water-tight enclosures to house the electronics and for the buoyancy.Finally, we need 3 units of camera, 2 cameras for wide view, and 1camera to focus on objects in front of the ROV.

### Frame materials

We made the frame from aluminium. We choose aluminium because this material is easy to use, particularly to build a ROV, and also because we need a sturdy but lightweightmaterial. Additionally, it is easy to disassemble when we need to change the design or the components immediately because we use screws to connect the frame.


Fig 1. Aluminium Profile (Credit : )

Fig2. Angle Bracket Diecast and T-nut (Credit : )

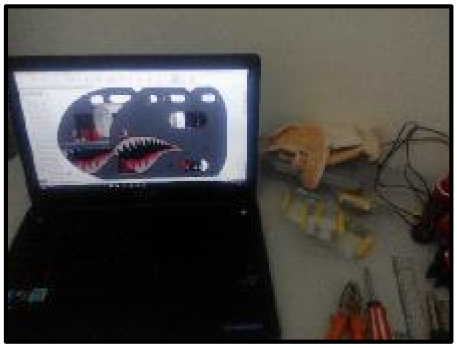

Fig3.”AURO 4”design with Solidworks (Credit : )

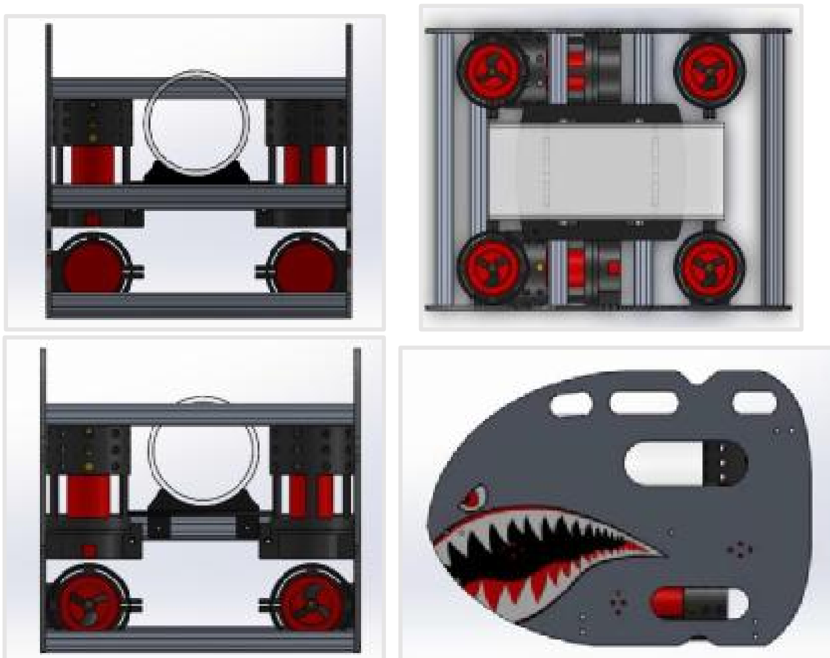

Fig 4.”AURO 4” design with Solidworks (Credit : )

Besides the aluminium frame, we also use an acrylic frame. We need cutting laser acrylic to make some parts in our ROV.

Fig 5. Making the acrylic frame  (credit : )

## 2.2. Buoyancy

Buoyancy is a crucial factor in “AURO 4” design process. ROVs require steadiness at various depths and perform substantially better when their floatation is tuned correctly. We use 2 water-tight enclosures to house the electronics and for the buoyancy. Our engineer made those tubes by cutting an acrylic tube and sealing it using acrylic with an O-ring installed.

Fig 6.Buoyancy tube design with Solidworks(Credit : Musyaffa Akbar )

Fig 7. The design of tube after laser cutting (Credit : )

## 2.3. Propulsion System

On building the propulsion system of the ROV, we need to consider 4 things :

### 1. Choosing The Right Motor or Thruster

The motor we use is a waterproof motor and it has to be capable of working nicely on extreme conditions. For "AURO 4", our engineer uses the same type of motor we used on the previous ROV, the Johnson Pump Thrust but with a different Speed and Torque .We choose this type of motor because of its excellent price to performance ratio. With this motor, we can get a better thrust for the ROV and it has worked greatly on our previous ROV.

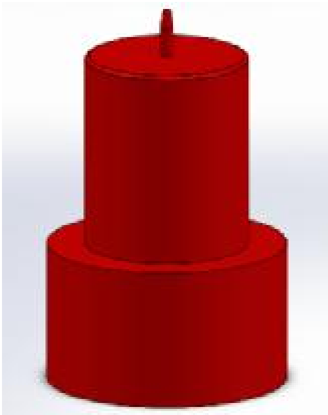

Fig 8. Bilge Pump with 1100 GPh , designed using Solidworks (Credit : )

### 2. Choosing The Perfect Propeller For The ROV

Our engineer decides to install new propeller and is different from our previous ROV. Previously we used 4 blade propeller (478B Prop.Alu-Alloy ) and now we use 6 blade propeller (6 Blades 67mm CNC Alu-Alloy Positive Propeller ). Our engineer chooses this type of propeller because it helps the ROV moves smoothly and the motor does not need to work heavily.

Fig 9. Propeller (Credit : )

### 3. Making a Propeller-to-Motor Connector

To connect the propeller to the motor we use, our engineer has to build a connector that fits the hole on the motor and the propeller.

Fig 10. Propeller shaft (Credit : )

### 4. Configuring The Thruster's Position

We install 6 units of thrusters on our ROV, 2 units of thrusters are installed horizontally (to move forward and backward and to turn (left and right) and 4 units of thrusters are installed vertically ( to pull the ROV up and to push it down to the water)

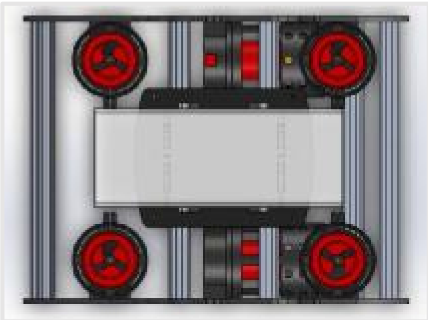

Fig 11. Configuring the thrusters position (Credit : )

## 2.4. Gripper

Main Gripper

We use an acrylic-based gripper, which is easy to design and to cut it with the laser cutting machine.

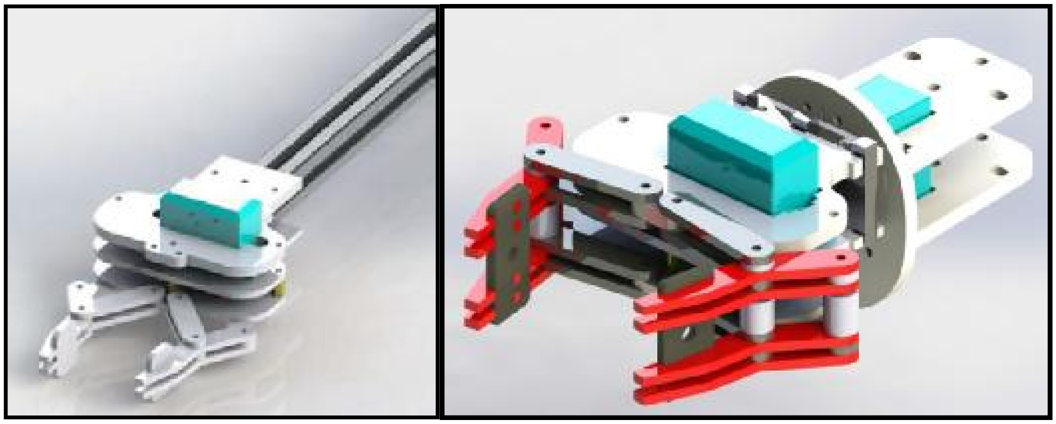

Fig 12. Last and New of "AURO 4" gripper design (Credit : Musyaffa Akbar)

Our team uses the paralellogram principle for the gripper to maximize the gripping force so it helps the ROV to do the task given effectively. This gripper has two joints and is moved by 2 waterproof servo motors.

## 2.5. Camera

Fig 13. Custom cameras (Credit : )

For the camera, we use the same type of camera with our previous ROV and consists of 2 units of custom waterproof cameras . The wirings that inside the acrylic box is sealed o-ring to prevent water from going inside to the tube. We installed a unit of camera for the gripper view, and a unit of camera to see the situation around the water.

## 2.6. Tether

Our cables is designed to be lightweight and flexible to make the ROV easier to maneuver. We use a pair of AWM e316944 12 AWG cables for the power supply. We use this type of cable because of its low resistivity. A AWM e166211 24AWG cable is also used for serial communication and camera video. 12 m long tether is responsible for successfully transporting all of the signals that are necessary for such a complex control system.

Fig 14. Tether (Credit : )

## 2.7. Control System

Electric Block Diagram System of "AURO 4"

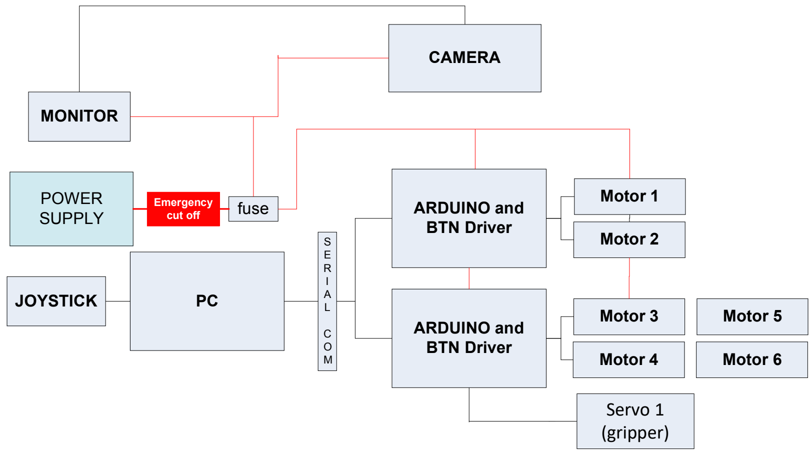


Fig 15. Diagram System (Credit : )

### Control

Our team use a Logitec game pad and connect it to a PC to drive the ROV, with serial RS232 Communication.a

Fig 16. Joystick (Credit : )

### Electronic

For the ROV we made driver high current with Arduino. Event 3 channel driver module we use 1 Arduino controller. This part to part design was based on the simplicity and the possibility of troubleshooting in the event of a failure during the competition.We use BTN7970 High Current PN Half Bridge and for 1 channel driver we need 3 BTN7970. To drive 1 motor we need 1 channel driver. The process of making the ROV thruster driver, first we draw the scheme in eagle software to get a board drawing, then print it in transfer paper to PCB, and finally soldering component and test drive.

Fig 17. Electronic Control process (Credit : )


Fig 18. Power Supply monitoring (Credit : )

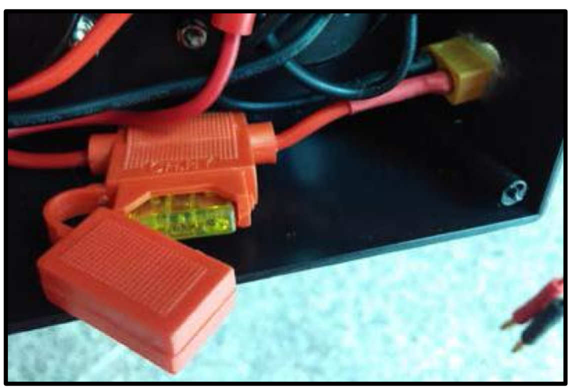

Fig 19. 25A Fuse  (Credit : )

A Voltmeter was placed across the power terminals to read the voltage and an Ampere meter was added to monitor the amount of current used by system.

For power supply connections we use the standard banana plugs.

We use 25A fuse or circuit breaker in the positive power supply line within 30 cm of the power supply attachment point.

An additionalswitch was added to shut down power immediately in case of emergency.

# 3. Vehicle System

- All ROV works were done in the Workshop of Sekolah Robot Indonesia, except for 3D printing and laser cutting. Our team must order in some places. In preparing ROV, firstly we designed with Solidwork for real ROV and after that we made a real ROV.
- For the Thruster we use bilge pump. We use propeller with 4 blade. For safety, we use propeller guard.
- For the Buoyancy we use a 10 cm Diameter acrylic tube.
- For the Electric driver and controller, we use high current driver. This is a new work for this team and for the controller we use Arduino.

# 4. Safety

For SPILAR ROBO, safety is number one priority both while working for the ROV and for the ROV it self. So we make sure that our personnels have been trained to operate the electrical and power tools before they are allowed to operate them. When we were at work, we had to wear protection gears including eye goggle, gloves and face masks.

We have three safety regulations when we were working, those are :

## THE TEAM

- Always wear eye protection and gloves when doing mechanical works
- Always use face mask when doing electrical works

Fig 20. Goggle and face mask (Credit : )

Fig 21. Gloves (Credit : )

# THE ROV

- No sharp or pointed edges

Fig 22. ROV without sharp edges (Credit : )

- Caution stickers are placed on any possible hazard (thrusters, grippers, etc.)
- Every propeller contains its own cover to protect the propeller itself and the user

Fig 23. Last and New of “AURO 4” Propeller Guard Design (Credit : )

- Tether is properly secured at surface and in ROV

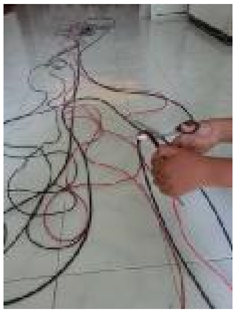

Fig 24. Tether (Credit : )

- All items are connected securely to the ROV to avoid fall off

ELECTRICAL

- 25  Amp fuse on the positive side of the main power source
- All electronic parts are placed inside the water-tight enclosure.
- Check all connections before turning on power
- All wiring and electrical parts are properly sealed
- Emergency Cut Off switch
- Ampere meter and volt meter display

# 5. Challenge

When working for “AURO 4”,not all things worked as we expected.There are some problems we encountere during the work. On the technical aspect, when we were designing and trying to make it real, it did notwork as expected. For example, the ROV did not move nicely in the water. So we had to rethink about the design due to the weaknesses we observed in the first test. For the non-technical side, there are so many activities at school that we have to do. Consequently, we only have time in the afternoon until midnight to work on the ROV and it reduces our sleeping time. Additionally we did not have any pools to test our ROV. Therefore we haveto rent swimming pools of some hotels the test our ROV.

# 6. Lesson Learned

### 6.1. Technical

Mastering the programming language for Arduinos was possibly the most helpful and useful skills learned by our programmers this year. Even during the development phase, we already know that we wanted to use Arduino for “AURO 4”.This meant that our programmer and electrical engineers had to get started right away on learning the new language we use and understanding the new microcontrollers. We have learned many skills, including how to use basic if statements, arrays, and serial commands. Probably, the most important skill of all is knowing how to troubleshoot. The many important lessons learned during that process are what allow “AURO 4” to dive today.

### 6.2. Interpersonal

This year, SPILAR ROBO learned how to work efficiently. This happens because of our member’s school activities making them spend their nights on working for the ROV and reducing their sleeping time. One example was working on the ROV mechanics. Due to the limited amount of time our member had, we have to work on it on holidays, or even stay up late at night building the acrylic tube and building the frame. Through this opportunity to work, we all learned to appreciate our time, and our fellow member’s time because we want to finish this ROV as expected and efficiently.

# 7. Future Improvement

For SPILAR ROBO, we were always looking for new technologies to implement in our products. Even if we thought that “AURO 4” is great enough, there will always be rooms for revisions and improvements. For the next year we want to develop our ROV by adding depth sensor, an accelerometer, and also installing a gyroscope to our ROV. We will use the sensor to monitor how deep our ROV goes. An accelerometer will allow us to measure the different accelerations our ROV is producing and experiencing, while a gyroscope will give us information as to how much the ROV is tilting. By adding those materials, we can improve our ROV’s qualities even better. For example, depth sensors will give us information on what we can see and do in that depth. By combining the depth sensor, the accelerometer, and the gyroscope we can maintain our ROV’s position even better. For example, if we want the ROV to remain stationary when there was a slight current, those three sensors will help us. We are also in the progress of learning the RaspberryPi and Beaglebone so we can install it into our ROV and make it a better ROV.

The particular things we wish to improve from this ROV robot are: 1) how the robot is able to examine the coral reef's problem; 2) how the robot can explore the natural contents of Indonesia; and 3) how the robot is able to investigate the natural habitats almost extinct and give information on how we can reproduce in order to increase the population so that those habitats will not extinct.

# 8. Reflection

We realized that SPILAR ROBO has advanced the the development of ROV. Additionally, our team personnel's ability and our teamwork also improved when we were working on the ROV. As a team, we spent our nights working hard to develop and manufacture the "AURO 4". Through this project our members have gained more confidence in themselves and as a whole team. This year had challenged us altough we had new members but they have the equal skills and abilities as the old team member did. Finally, we believe after we had been through, we were able to overcome our challenges to become a better team.

The advantage of our team is this team consists of students from the same school, which is Al-Azhar 26 Islamic Junior High School Yogyakarta, Indonesia. Therefore, it is easy for us for coordination, team establishment andtask division. ,This leads to the training program runs smoothly and we feel this team is very cohesive and united.

The disadvantage of this team is that our school is very far from the robot instructors' residence as they come from Surabaya (one hour flight from Yogyakarta). It led to less frequent of meeting. However, we had tried to close it by we went to Surabaya or we invite our trainers to come to Yogyakarta for couple of days when we have spare time.

# 9. Financial Report

Income:

| # | From | Income/$ | |
|---|---|---|---|
| 1 | SMP ISLAM ALAZHAR 26 Yogyakarta | | 1305 |
| | | Total/$ | 1305 |

Outcome:

| Item | Unit | price/$ | Reused | Price/$ | Total Price/$ |
|---|---|---|---|---|---|
| MECHANICAL ITEMS | | | | | |
| Motors + Shipping Tax | 6 | 20 | 4 | 20 | 400 |
| Motor Shaft | 6 | 10 | 6 | 10 | 60 |
| Propellers | 6 | 10 | 6 | 10 | 60 |
| Aluminum profile | 7 | 35 | 7 | 35 | 245 |
| Angle Bracket Diecast | 20 | 1 | | | 20 |
| T-nut | 40 | 0.5 | | | 20 |
| Propeller guard | 6 | 10 | | | 60 |
| Acrylic Tube | 1 | 100 | | | 100 |
| Acrylic Body cutting | 1 | 100 | | | 50 |
| ELECTRICAL ITEMS | | | | | |
| Camera wide | 2 | 30 | - | | 60 |
| Camera focus | 1 | 40 | - | | 40 |
| Tether | 1 | 80 | - | | 60 |
| Stick | 1 | 30 | - | | 30 |
| Driver High Current | 2 | 30 | - | | 60 |
| Microcontroller | 2 | 10 | - | | 20 |
| Cable Sheath | 1 | 10 | - | | 10 |
| Magnetics | 2 | 10 | - | | 20 |
| ROV TOTAL/$ | | | | - | 1305 |
| TOTAL EXPENSES/$ | | | | | 1305 |

# 10. System Integration Diagram

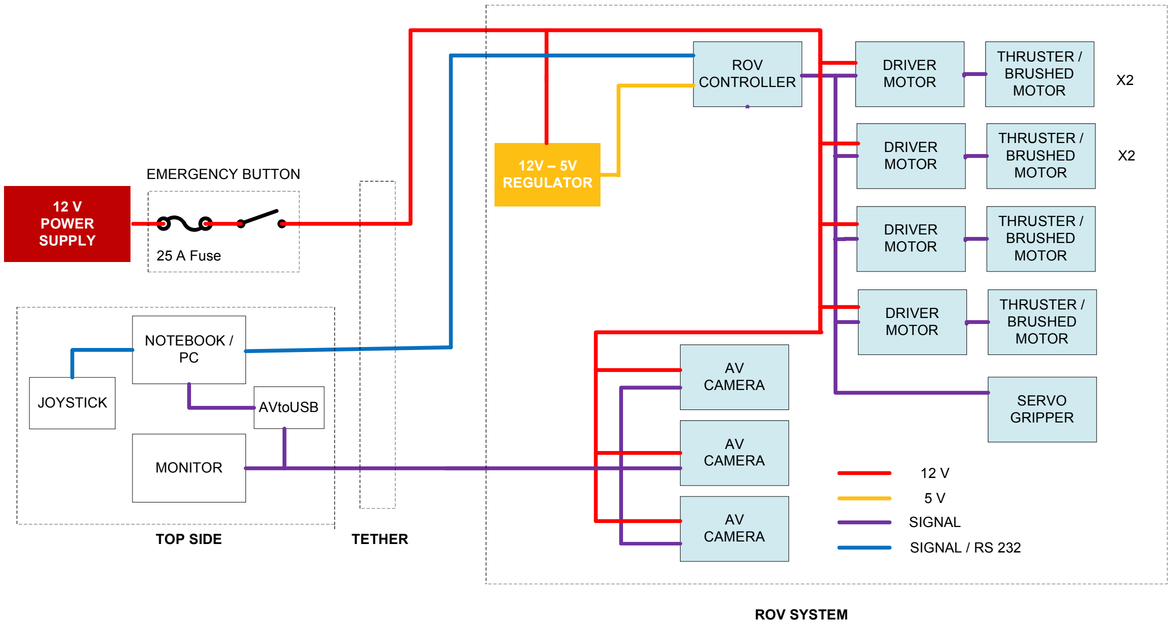


Fig 24 SID (credit : )

# 11. References


1. MATE ROV website, MATE ROV HK website, for scoring information and task information: http://www.rovcontest.hk/ & http://www.marinetech.org/
2. The Arduino Reference Library, which provided software programming details (http://arduino.cc/en/Reference/Libraries)
3. Datasheet BTN7970, http://www.infineon.com/dgdl/Infineon-BTN7970-DS-v01_01-en.pdf?fileId=db3a304316f66ee80117642373746a89&ack=t


# 12. Acknowledgments


Local team supporters

1. Dhadhang SBW, Team Mentor and Instructor
2. Tri, Solid Instructor
3. Mr.Fery Kurniawan , Team Manager 1
4. Mr. Mashoedah, Team Manager 2
5. REAA :
   a. ROMDLON MUSYAFFA AKBAR (8th Grade) : Chief Executive Officer
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   m. DIAR (7th Grade) : Mechanical Engineer
   n. ARDIAN (7th Grade) : Mechanical Engineer
   o. ALHADIAN AKBAR (7th Grade) : Mechanical Engineer
   p. RANGGANI FANTONI (8th Grade) : Mechanical Engineer
   q. AHMAD ROIHAN AL MUTTAQI (7th Grade) : Programer
6. Team Parents
7. Our Teacher in school

# Remotely Operated Vehicle (ROV)


Oleh : Mashoedah, M.T

**Pelatihan Robot ROV (Remotely Operated Vehicle)**
**Persiapan Lomba MATE ROV tingkat ASEAN 28-29 April 2018**

## ROV

- Apa itu ROV?
  - Remotely Operated Vehicle—adalah sebuah robot bawah air
    - Remote: operator atau pilot tidak berada didalam ROV
    - Operated: ROV dikendalikan oleh manusia
    - Vehicle: Suatu kendaraan yang mandiri, dengan sistem yang terintegrasi


ROVs

ROVs dapat diklasifikasikan dari berbagai bentuk dan ukuran.

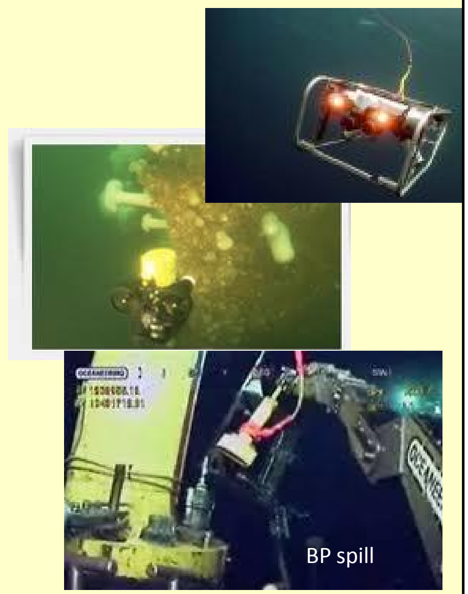
- Micro
- Mini
- General
- Light Work Class
- Heavy Work Class
- Trenching/Burial
- Autonomous underwater vehicle (AUV)

# Tipe-tipe ROV lainnya

- Seagliders
- Buoys
- Wave gliders
- Drifters

## ROV digunakan dalam berbagai bidang

- Scientific research
- Underwater archaeology
- Oil & gas drilling support
- Reconnaissance
- Homeland Security
- CSI
- Telecommunications
- **Student Competitions**
- Spying???




## ROVs are designed with a mission in mind, but sometimes must do other tasks:

- **Rescue a disabled ROV trapped inside *Titanic***
- **Cap an oil well**
- **Install instruments for an ocean observatory**
- **Collect organisms from under the polar ice cap**
- **Catalog data from a deep-sea hydrothermal vent**
- **Rescue trapped submariners**
- **Catalog diversity of a national marine sanctuary**

## Bagian-bagian dari ROV (Anatomi)

- Structure (frame)—what keeps it all together
- Flotation—what allows it to float
- Ballast—what helps it to sink
- Power—what supplies the energy for the vehicle
- Propulsion—devices (motors & propellers) that transform electrical energy into motion
- Control—directing the vehicle—switches, joysticks
- Navigation and sensors—cameras, lights, sonar
- Tools (payload)—manipulators, sampling devices (what you need to complete the task at hand)

## Rangka

- Rangka yang digunakan dalam ROV dapat berasal dari beberapa bahan seperti besi, aluminium, PVC, dan Polimetil Metakrilik. Ukuran rangka ROV sangat bergantung dari beberapa kriteria berikut : (Christ dan Wernli, 2007)
- i. Berat total ROV di udara,
- ii. Volume komponen di dalam ROV,
- iii. Volume sensor dan instrumen,
- iv. Volume daya apung,
- v. Kriteria beban bantalan poros dari rangka.

- Mini ROV yang akan dibuat menggunakan pipa PVC dan pipa besi. Pipa PVC digunakan karena memiliki kelebihan yakni sulit rusak, tahan lama, tidak berkarat, membusuk, dapat digunakan setiap waktu, dan awet (Kietzman, 2011). Pipa besi digunakan karena dapat menambah daya berat ROV yang digunakan untuk mengimbangi daya apung yang dihasilkan oleh pipa PVC.

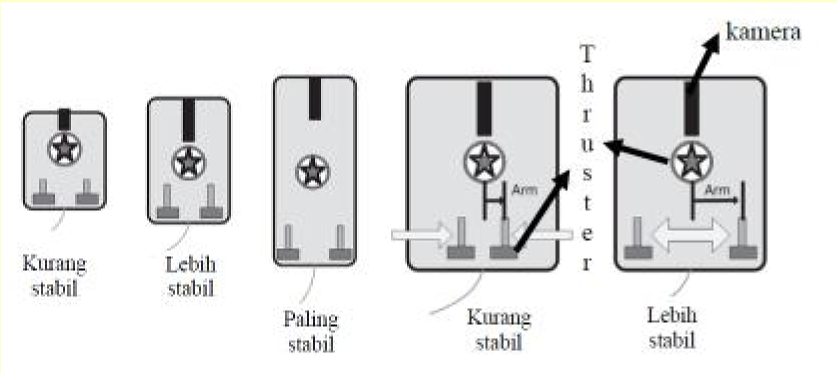
## Motor pendorong/ *thruster*

- Jenis motor dapat dibedakan menjadi dua yakni motor AC dan motor DC. Sejauh ini, ROV menggunakan motor DC karena kekuatan, ketersediaan, keragaman, kehandalan, dan kemudahan antarmuka (*interface).*

## Bilge Pump

- *Bilge pump merupakan salah satu jenis pompa yang menggunakan motor* DC untuk menggerakkan pompa ini. *Bilge pump biasa digunakan di dalam kapal* atau perahu untuk menyedot air yang ada di lambung kapal.

# Penempatan Motor pada ROV




# DC Motor Drive

# DAYA APUNG

- Daya apung suatu benda dirumuskan dalam hukum archimedes. Berdasarkan hukum archimedes, setiap benda yang tercelup sebagian atau seluruhnya dalam fluida akan terangkat ke atas oleh gaya yang sama dengan berat dari fluida yang dipindahkan. **Persamaannya ditulis sebagai berikut:**

$$Fa = V.\rho.g$$

# Daya Apung

$$Fa = V.\rho.g \ldots\ldots\ldots (1)$$

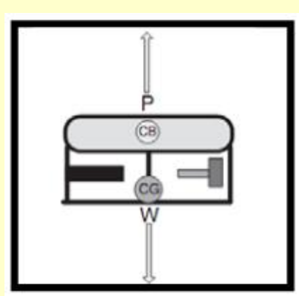
$\rho$ = massa jenis zat cair ($kg/m^3$)

$V$ = volume benda yang tercelup ke dalam air ($m^3$)

$G$ = percepatan gravitasi ($m/detik^2$)

$Fa$ = gaya ke atas (N)

- Resultan semua gaya berat pada fluida yang dipindahkan berada di tengah badan ("*Center of Gravity/CG). CG merupakan* jumlah dari semua gaya berat yang bekerja pada badan akibat gravitasi bumi. Resultan gaya apung berlawanan dengan tarikan gravitasi. Resultan ini mengarah ke atas melalui CG dan dinamakan "*Center of Buoyancy" (CB)*



# Buoyancy Analysis

$$Weight = Volume * Density$$

$$Buoyancy = Weight_{Displaced\ water} - Weight_{Rov}$$

# Camera

- Kamera merupakan bagian yang penting dalam sebuah ROV. Kamera dapat dianggap sebagai "mata" ROV. Setiap ROV menggunakan kamera ataupun video kamera untuk navigasi maupun untuk memotret benda yang ada di dalam air. Saat ini, sebagian besar sistem ROV yang berukuran kecil menggunakan perangkat kamera *charge-coupled device (CCD) yang harganya murah*). **Sistem kamera ini terpasang pada papan sirkuit kecil dan menghasilkan sinyal** video yang ditransmisikan melalui kabel ke piranti penangkap video

## Baling-baling

- Baling-baling berfungsi sebagai penggerak ROV. Putaran baling-baling akan membuat aliran fluida mendorong ROV. Arah putaran baling-baling juga akan mempengaruhi aliran fluida. Baling-baling didesain untuk bergerak dan mengarahkan fluida berlawanan dengan arah gerak

## Catu daya

- ROV membutuhkan energi listrik untuk bekerja.
- Sumber tenaga (Catu daya) ROV dapat menggunakan tegangan AC maupun DC. Tegangan AC memiliki kemampuan mentransmisikan energi lebih jauh dibandingkan DC. Tegangan DC memiliki kelebihan dalam biaya yang murah dan berat komponen kabel, dan keamanan.

## *Tether/ kabel*

- *Tether adalah suatu kumpulan kabel yang dapat mengalirkan dan memuat* daya listrik, video, maupun sinyal data untuk komunikasi antara operator dan wahana bawah air. Biasanya kabel terbuat dari tembaga atau fiber optik

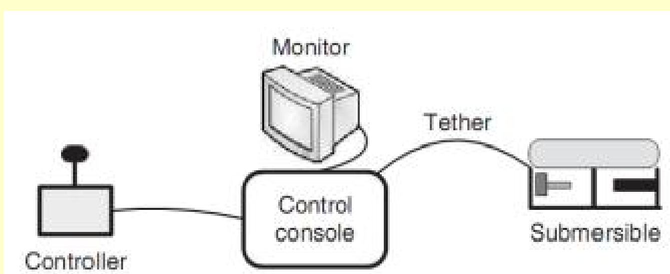
## Pencahayaan

- Pencahayaan sangat diperlukan oleh ROV untuk membantu pengamatan di dalam air. Seperti diketahui bahwa di dalam air cahaya semakin redup karena adanya penghamburan dan penyerapan. Kedua hal ini yang mempengaruhi kejernihan air.

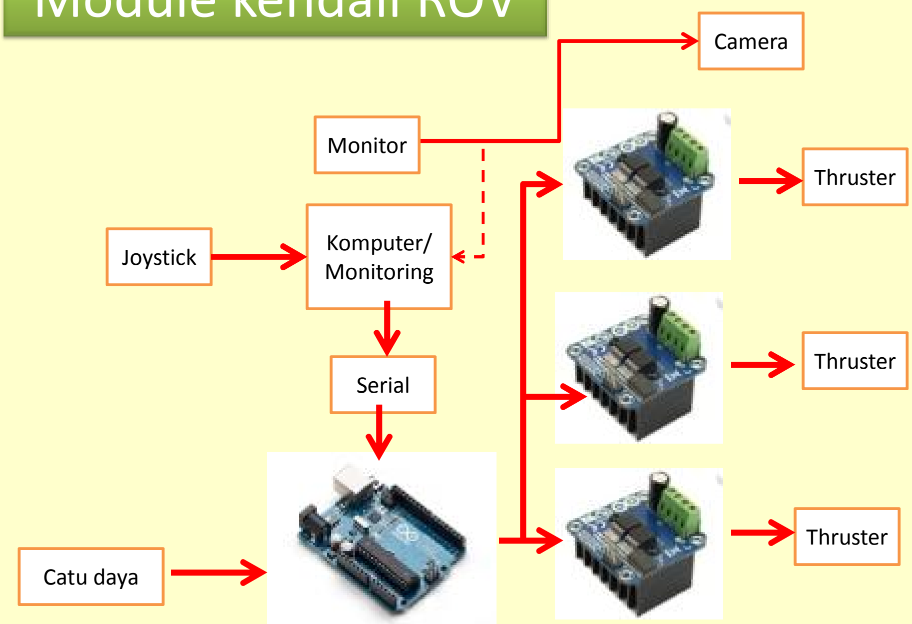
# Kendali ROV

Untuk mengendalikan gerak ROV diperlukan suatu rangkaian kendali yang dapat dioperasikan secara remot.

# Diagram Sistem Kendali ROV



## Module kendali ROV




# TERIMA KASIH

*SELAMAT BEKERJA DAN BERLOMBA*