BANNARI AMMAN INSTITUTE OF TECHNOLOGY

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Stay Ahead

AMUROV 2.0

BY

EVADERS

TEAM MEMBERS:

1. ABINESHWARAN A – ECE
2. THANGADURAI M - EEE
3. RAVEENTHIRAN E – EEE
4. PRANAV SURYA - EEE
5. SAJJID ISMAIL M – MECH
6. MANOJ S - MECH
7. KARTHIKEYAN E – MECH
8. SANJAY KUMAR G - AERO

MENTOR:

Mr. SELVAMUTHUKUMARAN D Asst.Professor II, Dept of Mechanical Engineering.

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CHAPTER 1

ABSTRACT

Remotely Operated Under Water vehicles (ROVs) are minimal lowered robots prepared for swimming lowered on predefined key performing required endeavours with the usage of reasonable sensors and equipment. ROVs are customarily used for oceanographic contemplates bathymetric examinations and military applications. It is an aluminium enclosed hydrodynamic arrangement with a twofold body and involves 8 motors for development control. It has four levels of chance flood, yaw, pitch, roll independently. This paper displays the organizing and collecting water fixing spines and assurance of O rings for water fixing of the vehicle. Its design, plan assessment proliferation, creation is discussed in this endeavour. Coming up next is the issue of recognizing verification that was found after research done on a couple of composing reviews and study cases. In this paper, the significant issue enunciation will be discussed in nuances, for instance, control structure, underactuated condition, present recovery or station keeping, coupling issues and correspondence framework. ROV is one of the Underwater vehicles attached with umbilical connection and distantly worked by a vehicle operator. The control plan of ROV is fairly awesome because of the dark non-straight hydrodynamics impacts, boundaries weaknesses and the shortfall of a careful model of the ROV components and boundaries. Standard regulators can't effectively compensate for modelled vehicle hydrodynamic powers or dark agitating impacts. Underactuated condition is described as one having fewer control commitments than the level of chance, so how does the ROV need to keep up a particular point or significance following vital in any event one of motor's glitch moreover an issue to be highlighted. Stance recovery or station keeping will be one of the issues in the ROV structure. This station keeping approach is used to keep up a circumstance in association with another moving ROV as the ROV endeavours to remain fixed at the ideal significance with present the characteristic disrupting impacts, for instance, wind, waves, current and unexpected biological aggravations. Coupling issue between the tie and connection with the ROV body will be one issue in offsetting the ROV itself as it duplicates the vehicle load.

CHAPTER 2

INTRODUCTION

Understanding the sea is basic. There are about tremendous assets discovered bountiful under the sea, which are till now unidentified and furthermore said to be unseen as well. The assets present in the submerged assets are still puzzler. It is realized that 97% of water present on the planet are seawater and just 5% of the water body are investigated. There are even more assets that are not investigated at this point. With the expansion in interest to contemplate the submerged assets numerous innovations have been created. A portion of the striking innovations was sonar, Doppler sensors, sub-base profilers, observing floats. ROVs and ROVs are a portion of the high-level vehicle frameworks that utilize crude and trend-setting innovations for investigation These vehicles could be a key that could be utilized to reveal the secret by arriving at the far-off profundity which people thinks that it's hard to do.

ROVs are automated robots that work in an independent way and ROVs are worked distantly by the data sources given by the client.

ROVs are fit for arriving at higher profundities and work for quite a while, simple to keep up and savvy when contrasted with customary techniques. These ROVs have been largely utilized for oceanographic investigation, military observation, Oil and Gas investigation also looking through tasks that could exceptionally help in salvage activities. There are various limitations in sx planning the smaller than normal submerged vehicles. The planning could be partitioned into different modules such as casing plan, Electronic walled in area or frame plan, submerged drive, Electronics and instrumentation, power the executives, control frameworks.

For the most part to accomplish high hydrodynamic attributes Cubical shaped frame configuration is picked. The speed of the vehicle is corresponding to the number of engines utilized in the vehicle, similarly the more the electric part is utilized poor people will be forced the board. The quantity of degree opportunities additionally relies upon the number of engines utilized and the viable situating of the engines. Different sensors are utilized to gauge the profundity, height, pressing factor, speed, and situating of the vehicle. The vehicle is planned so that it very well may be utilized deftly to different applications.

The problem statement of the competition is to complete the given tasks and prove our vehicle. The tasks include Navigation, Target Acquisition, Target Reacquisition, and Localization. This paper thoroughly discusses Mechanical and electronic design in the vehicle the way how we are going to take over the tasks.

CHAPTER 3

LITERATURE REVIEW

Because of the execution of keen city plans, there is a need for robotized vehicles to improve the execution. There is a need to track down the option for every single strategy for cycle and machines. Gone are the days that man actually gets into water studying it or taking care of the submerged bodies. Here comes the substitute path for doing such a deal with which is only Remotely Operated Underwater Vehicles(ROVs). The fundamental thought of our undertaking is to lessen the exertion of people in dams studying, bathymetric examinations, and reconnaissance. For this, we have planned and manufactured ROVs which could do such errands in a simpler manner. Those works are done easy route since ROVs are computerized and just keeping up it very well may be our work. Further, it is fixed to a camera which could be utilized for reconnaissance reasons. It utilizes an Arduino microcontroller for controlling the entire framework and engine frameworks would help in its development. One of the principal advantages of this ROV is a short-sighted plan and profoundly minimal design. Showing and control of lowered vehicles have drawn broad thought for quite a while. The most by and large saw defense coherent appearance is the limited dimensional model made at U. S. Navy's David Taylor Model Basin in 1950 [24]. These second sales nonlinear differential conditions, known as standard conditions of improvement, have expected coming about the position being made of appearing and control of brought down vehicles [25]. A settled model for brought-down vehicles is recommended in charge networks at present are depicted in T. I. Fossen [26]. In [27] a nonlinear six degrees of possibility (DOF) model, considering the Euler-Lagrange structure, conditions of advancement are allotted into discrete terms. This makes the construction more understood. It goes presumably too known gadget for nonlinear control and observer structure. The nonlinear and complex issue of following of brought down vehicles is gotten familiar various propensities. A regular way to deal with overseeing linearizing the nonlinear segments about certain working points is by forwarding speed. These outcomes are first shown in [28]. Unequivocally appearing of brought down vehicles consolidates assessment of statics and parts. Statics is worried about the agreeableness of vehicles still or moving at a steady speed. Segments are worried about vehicle bodies having breathed life into improvement. The assessment of segments is segregated into two portions: kinematics, which manages the numerical piece of advancement, and energy, is the appraisal of the powers causing improvement.

The developing essentials for remotely operated Underwater Vehicles raised the taking a gander at sales of distinct control of ROV. As demonstrated by the based control law model was made, which watches out for the issue of the security and improvement control of brought down vehicle. The brought down vehicle hydro parts, powers, and minutes returning again to vehicles are all through examined in [29]. T.I. Fossen portrays appearing of ROV subject to unbendable body segments. Fossen bundles hydrodynamic conditions of advancement into radiation impelled powers and diffraction powers. The conditions of advancement are in nonlinear development. Self-regulating Underwater Vehicle is moving under the liquid instrument for example water, thus powers and minutes returning again to it are reliant upon different hydrodynamic elements. It additionally relies on vehicle length, math, and properties of improvement, for example, straight and precise speeds, thickness, and consistency of the liquid. The hydrodynamic power is the most hazardous part in displaying of Underwater Vehicles. Newman [30] has shown marine hydrodynamics in detail. A large portion of the accessible making manages the showing of surface boats. Yuh [31] had portrayed ROV appearing. In [32] included mass terms are presented in the condition of improvement of ROV. Different terms in appearing of brought down vehicle and terms related with conditions of advancement are clarified in detail in [33]. In the wake of understanding the conditions of improvement utilizing Newton Lagrangian mechanics and the important hydrodynamic powers, Goshen proposed two strategies. One is a test-based technique and the other is a farsighted strategy [34]. Insightful testing techniques endless supply of model ROV in free water. Hydrodynamic tests are done on MARIUS ROV [35]. Prudent strategy is continuously liked as a real model of ROV isn't required during vehicle plan set up. The limits of the ROV dynamic model are settled from assessments, shape, control surfaces, and different parts [36]. Such models may utilize computational liquid mechanics (CFD) or test conditions to show hydrodynamics of vehicles. In [37] a segment make strategy is proposed. It disintegrates the vehicle into key parts, by then drag and lifts power for every key fragment is acquired. By then powers and minutes are enrolled for each part and summation is rarely truly complete model. This strategy is unquestionably not difficult to apply. In [38] Pester got this kind of model at any rate powers and minutes returning again to the vehicle are gotten utilizing various systems. A considered explicit appearance is utilized in some ROVs. It would appear that section makes technique.

CHAPTER 4
PROBLEM STATEMENT

Tragically, a part of the time the people can't explore the dams fittingly. As a result of the nonappearance of help, the split of the dam can't be recognized suitably within a period. During floods, various people get impacted and lost their life. In such cases, the distantly worked vehicle is used to audit the dam for the whole day. We can prepare to see the land and water proficient culture through a blue mechanical self-sufficiency camera. Through this, we can be prepared to defend the people when they are at risk. Be that as it may, little ROVs are sensibly easy to work, the vehicle and related frameworks are tangled and along these lines skewed to mechanical, electrical, and programming issues. This requires the client to be comfortable with the design parts to work them securely and gainfully. Making introducing the results out of little ROV considers just generally joins a point by point talk of specific burdens the author(s) may have experienced. Perhaps, epic amounts of these encounters are related among clients by getting people's conversations or insightful by experimentation. Preparing offered by affiliations that supply little ROVs reliably give a good introduction to lone constructions (ROV, following, sonar, and so on), yet are not unequivocally proposed to address them by and large operational issues attracted with the standard utilization of the vehicle and other stuff (e.g., programming approach, intersystem correspondences, fitting frameworks to communicate applications). In this paper we assess a broad piece of the particular focuses related to masterminding and planning shallow-water (<200 m) visual assessments with a little ROV, considering our assessments of benthic marine fishes in the San Juan archipelago in Washington state. The subjects and models showed subsequently are not novel to our work, at any rate, are illustrative of the difficulties and issues that new clients are likely going to experience while utilizing this progression. Stood apart from enormous work-class ROVs (e.g., ROPOS, VENTANA) that are over the top to contract and require Compared to tremendous work-class ROVs (e.g., ROPOS, VENTANA) that are costly to approve and require explicit get-togethers to work, the more obvious moderateness, lower working expenses, and relative simplicity of little ROVs make them particularly legitimate for use by standard asset affiliations and shrewd establishments working on limited going through plans and with immaterial assets (i.e., vessels, staff). Not at all like gigantic ROVs that reliably require a colossal, gave help vessel, a little ROV can be passed on from a degree of stages that can be custom-fitted to work with the size of activities and anticipated working conditions (e.g., Csepp 2005). Little ROVs are useful for working at profundities past safe scuba limits (~25 m) and in complex areas difficult to reach to fishes and different nets, and can be moved rapidly and sent thinking about outrageous or particularly transient occasions, for example, hypoxic conditions (Grantham et al. 2004). Moreover, the capacity to lead non-hurting testing makes the little ROV an exceptional instrument for mulling over extraordinary or delicate species. express get-togethers to work, the more fundamental moderateness, lower working expenses, and relative straightforwardness of little ROVs makes them particularly reasonable for use by brand name asset affiliations and clever establishments working on restricted going through plans and with irrelevant assets (i.e., vessels, staff). Not in the smallest degree like monster ROVs that commonly require a monstrous, submitted help vessel, a little ROV can be passed on from a degree of stages that can be changed to put together the size of activities and anticipated working conditions. Little ROVs are useful for working at profundities past safe scuba limits (~25 m) and in complex locales cut off to fishes and different nets, and can be moved rapidly and sent because of outstanding or very fluttering occasions, for example, hypoxic conditions (Grantham et al. 2004). In addition, the capacity to facilitate non-dangerous examining makes the little ROV a mind-blowing mechanical get-together for researching astounding or touchy species.

CHAPTER 5

FABRICATION OF ROV

5.1 MECHANICAL DESIGN OF THE VEHICLE

The mechanical section of ROV pivotally aims at the design, prototyping, and manufacturing of the encloser flange(hull), frame, and penetrators. The actuators (thrusters) are mounted on optimized positions of the frame for complete ease in the navigation of the vehicle. The vehicle works on both positive and negative buoyancy in the presence and absence of the buoyancy foam.

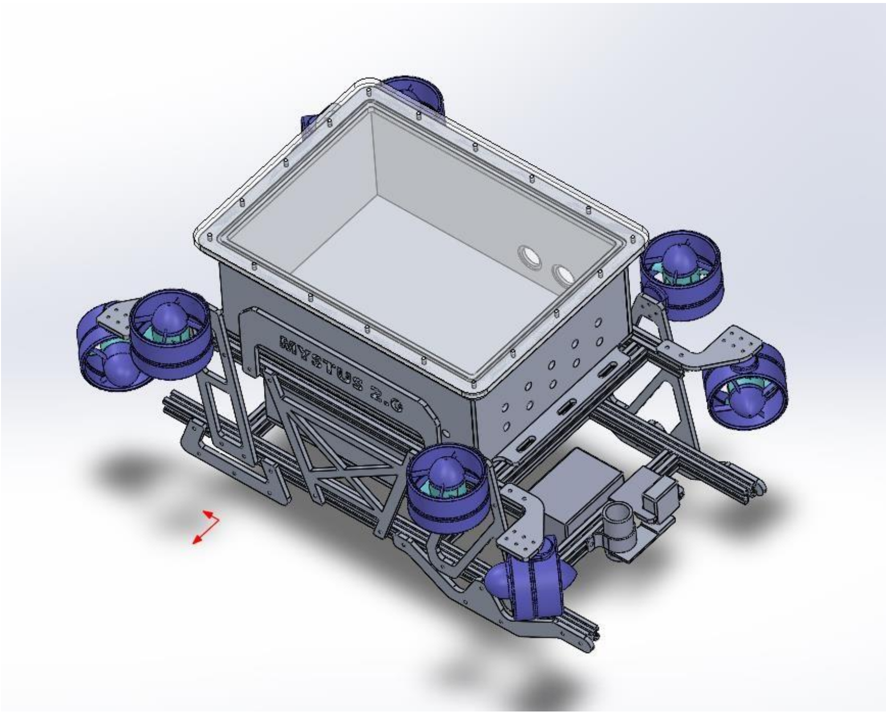


FIGURE 1. COMPLETE DESIGN OF THE ROV

5.1.1 ENCLOSURE OF ROV

The enclosure is the water tight region of the vehicle. The design of the encloser pivotally focusses on,omplete waterproofing 2.Uniform distribution to pressure

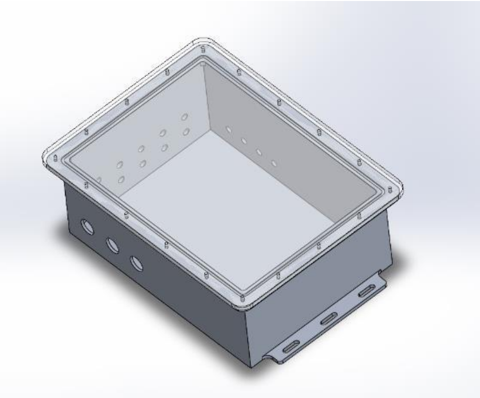
3.Transparency to the electronic components

4.Heat sinking capacity

5.Compact structure

6.stability

The electronics in the hull need an outlet for the continuous dissipation of heat generated by them. The enclosure is the weight bearing region of the vehicle, The entire pressure acts on the enclosure thus deciding the shape of the enclosure should have a vast focus.



HULL

FIGURE 2. SOLIDWORKS CAD MODEL OF HULL

The encloser is designed as cuboid to ease uniform pressure distribution and to minimize the drag force. We have used HULL (encloser), used for storing electronics components and battery. The cuboidal shapes are integrated to withstand high pressure at underwater as well as to get enough space for placing components. The hull is made aluminium and the lid of the hull is acrylic material. These hull are arranged as shown in Figure 1.

The following considerations are made selection of the material for the encloser:

1.Effective cost

2.Light weight

3. Strong and Stability

4. Pressure withstanding capacity

5. Corrosion resistance

6. Availability and machinability

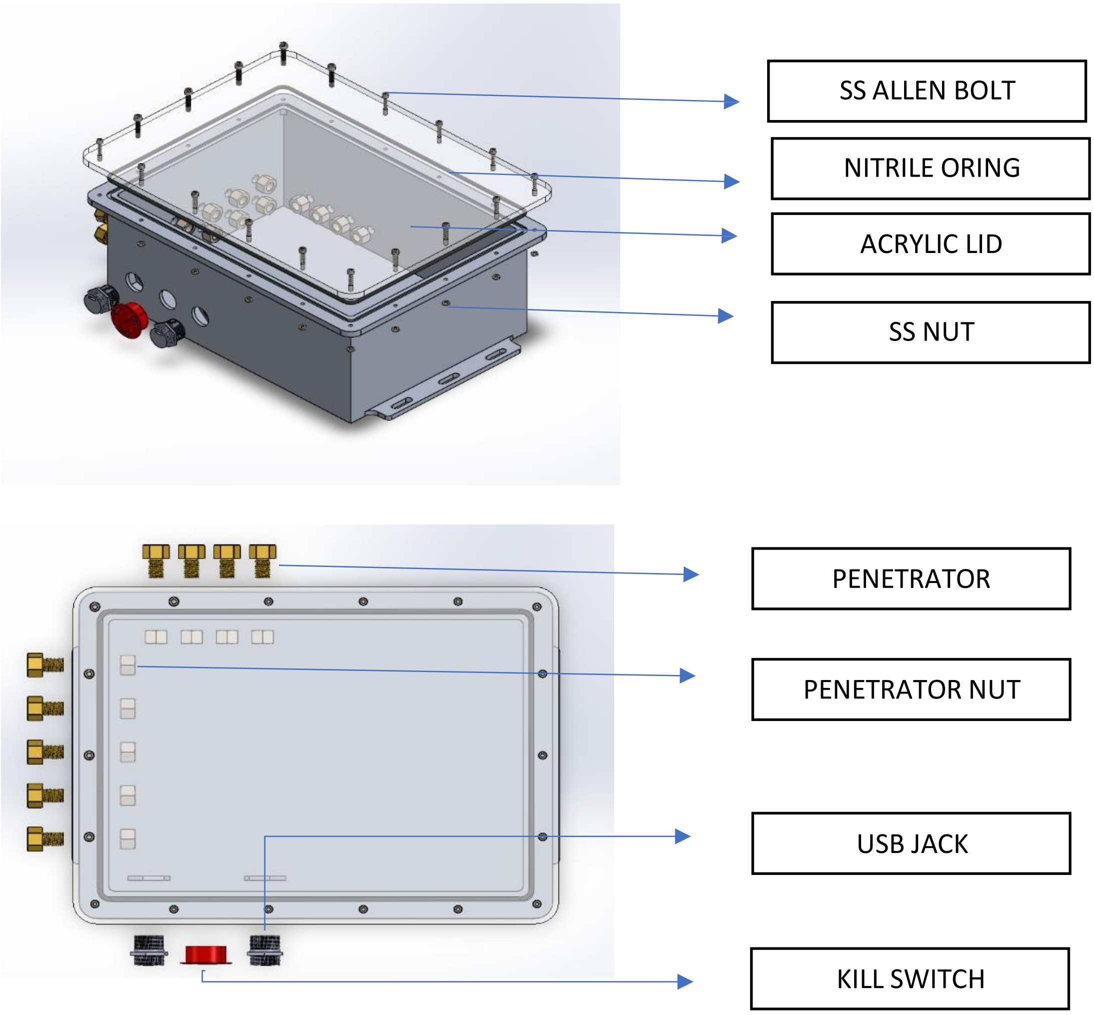


FIGURE 2.1 EXPLODED VIEW OF THE HULL

5.1.2 ACRYLIC LID:

Acrylic is a transparent thermoplastic homopolymer which is similar to polycarbonate and they are mostly used as an alternative to glass since it has high impact strength. This is also a lightweight component that has a density of 1.18 g/cm³ and has good heat dissipation property. This material is transparent and can be used where an imaging device is to be employed in the vehicle.

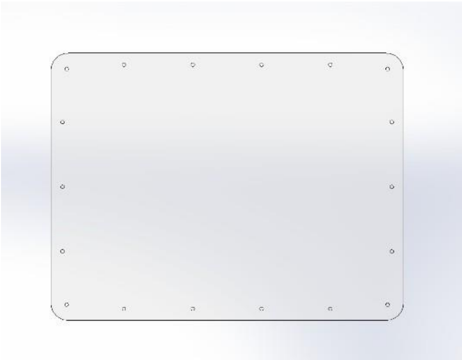


FIGURE 2.2 ACRYLIC LID

5.1.3 PENETRATORS:

The team has designed and manufactured the underwater penetrators mounted on the aluminium hull. The cables for thrusters and batteries are routed out of the hull through these penetrators.

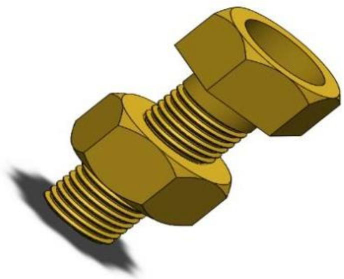
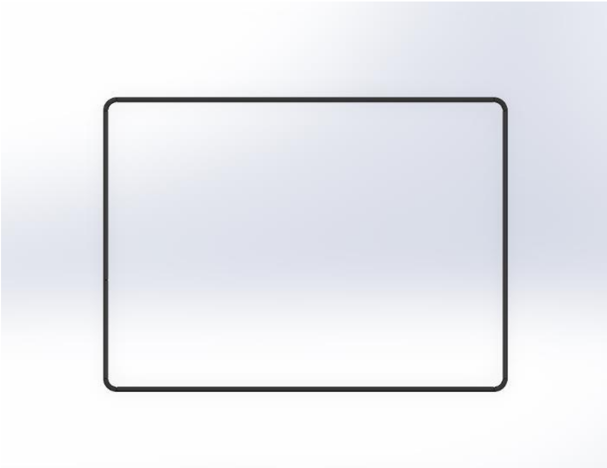


FIGURE 2.3 BRASS PENETRATOR

5.1.4 O RINGS:

The O rings are used for complete sealing at the interface. It also reduces the structural damages. Nitrile O rings are used for their high pressure, heat tolerance and compressible properties.



1260 x 4mm

FIGURE 2.4: DIMENTIONS OF O-RINGS

5.1.5 KILL SWITCH:

We have used water proof kill switch for On and Off purpose. So that we don’t want to open battery hull for each and every time when we want to use.

FIGURE 2.5: KILL SWITCH

5.1.6 ALUMINUM:

Aluminum alloy is one of the most used and lightweight metals in the earth. It is most widely used in aircrafts, automobiles, etc. It has a density of 2.70 g/cm3 and it is a non-ferrous material and also it is corrosion resistant. It is cheap and easily available. It has good heat dissipation property and good weldability, so custom shapes can be easily created.

FIGURE 2.6 ALUMINUM

5.1.7 ACTUATORS

The actuators are the foremost important part for navigation purpose. The actuators areimported from blue robotics. Four actuators are used in this vehicle which provides 4 degrees of freedom. The thruster positioning is a vast part of the vehicle. The thrusters are activated through four different ESI which are controlled using Arduino DUE.

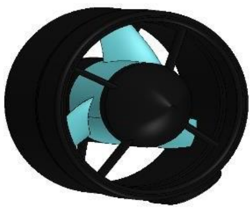


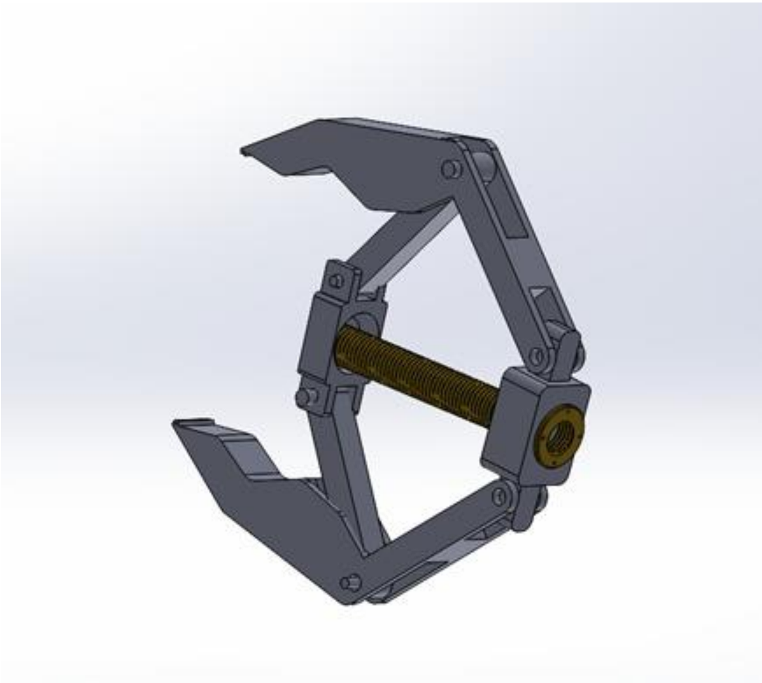
FIGURE 2.7: ACTUATORS

5.2 SPECIFICATIONS:

- **LENGTH:** 65
- **BREADTH:** 50
- **HEIGHT:** 35
- **WEIGHT:** 17.85 kg

5.1.8 GRIPPER HAND

Robots are often fitted with what are called grippers – special devices designed to help robots handle objects in the real world. Grippers are also known as 'end-effectors' or 'manipulators. We opted to make a gripper with only 2 arms but slightly larger and stronger using a 3D printer, Seaflo submersible bilge pump. When motor rotates in circular motion, the thread moves in linear motion. Motor thread rotates in clockwise direction making the gripper hand open and while rotating in anticlockwise direction, it makes the gripper hand close.



CHAPTER 6

STRUCTURAL ANALYSIS

6.1 HULL ANALYSIS

The structural analysis of the Hulls and Enclosure are done using ANSYS software to withstand hydrostatic pressure at the depth of 50 m and the effective thickness of the hull is evaluated and results are obtained. All the hull models are modelled in SOLIDWORKS 2018 and imported into ANSYS WORKBENCH 18.1 as neutral file format - IGES. The imported models are discretized and analysed with appropriate boundary conditions. The finer the mesh the more accurate the results. But fine mesh takes a lot of time to compute the results.

6.1.1 PRESSURE ANALYSIS – HULL

Loads

- External pressure: 5bar @ 50m depth
- Internal pressure: 1bar

Mesh

- Element size: 2.5mm
- Element order: Quadratic
- Element type: Tetrahedron
- Size Function: Adaptive
- Automatic Mesh defeaturing: 0
- No. of. Elements: 136862
- No. of. Nodes: 240408

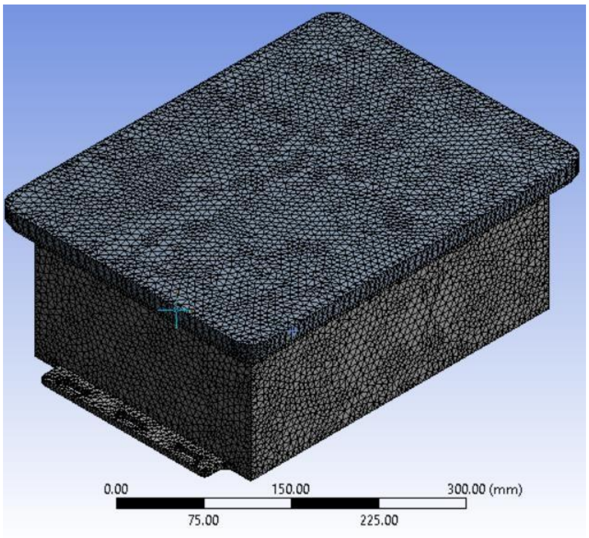


Fig 3.1 Discretization of Hull

Result:

Failure criteria: FOS for Acrylic 1.6

FOS for Aluminum 1.57

Max: 178.26 MPa

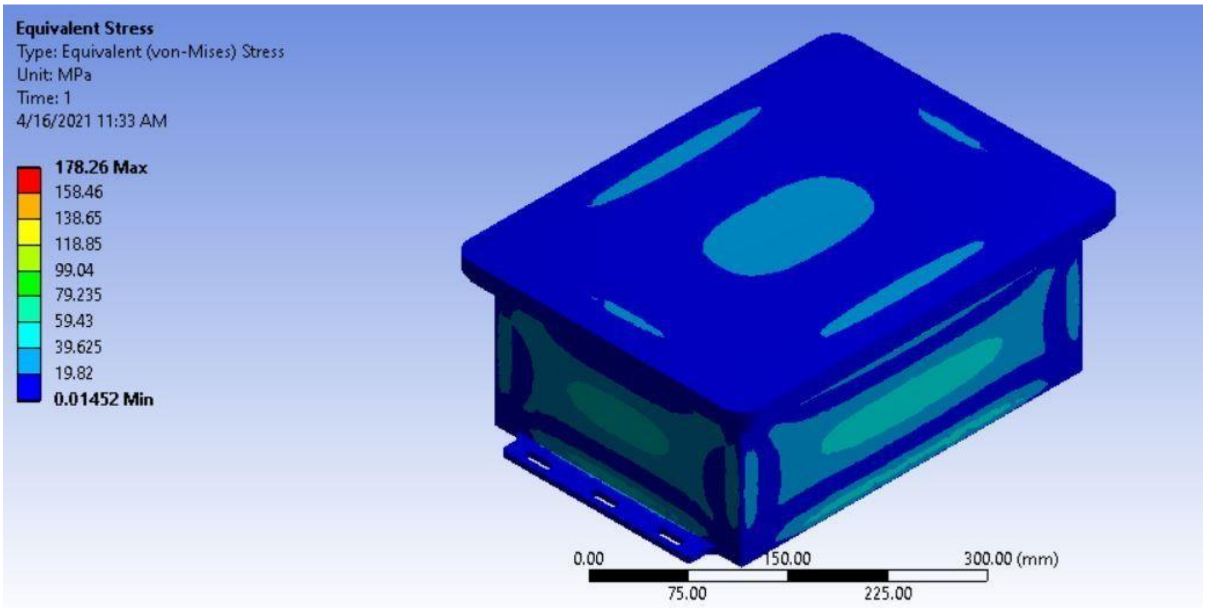


Fig 3.2 Equivalent (Von-Misses) stress Contour of Hull

Max: 4.0895 mm

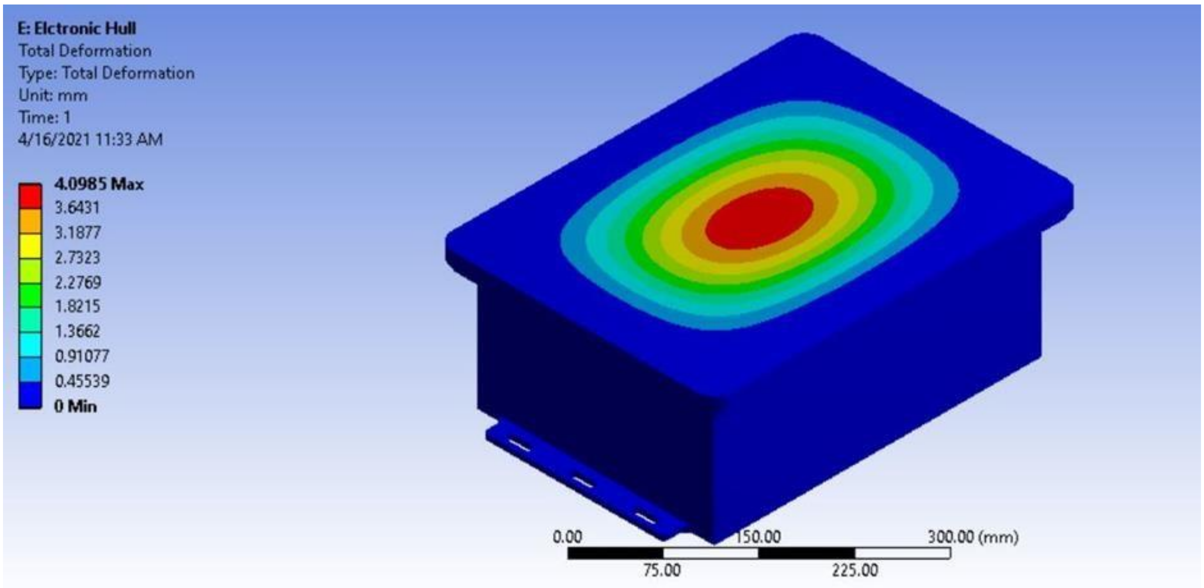


Fig 3.3 Deformation of Hull

6.2 FRAME ANALYSIS

Loads

- Hull: 65.013 N

Mesh

- Element size: 5 mm
- Element order: Quadratic
- Element type: Tetrahedron
- Size Function: Proximity and Curvature
- Automatic Mesh defeaturing: 0

Results (Frame)

Max: 19.803 MPa

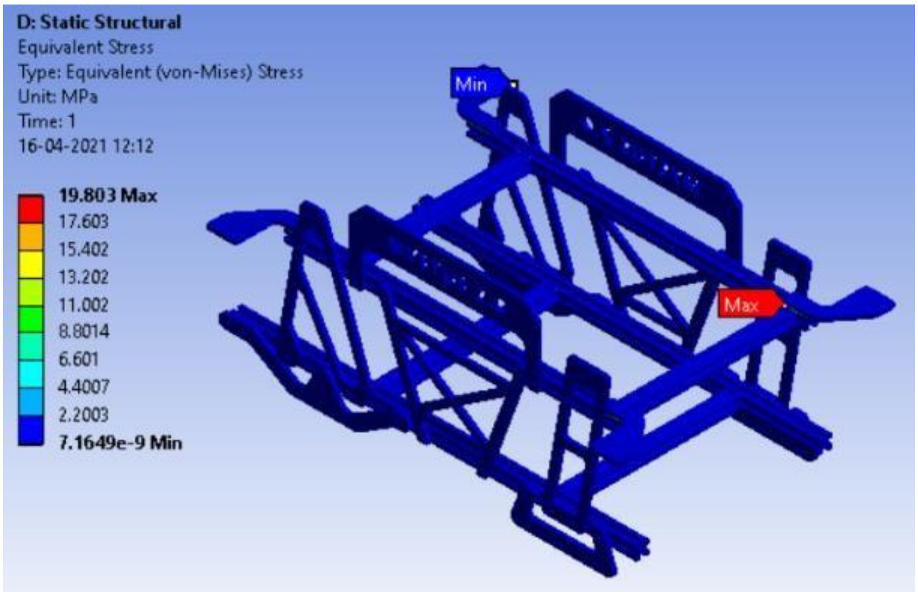


Fig 3.4 Equivalent (Von-Misses) stress Contour of Frame

Max: 0.0211 mm

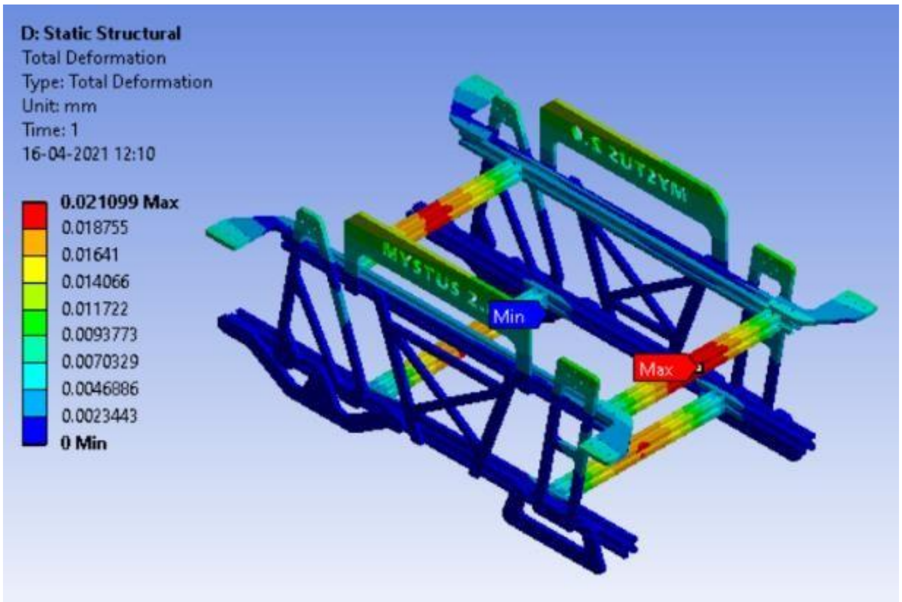
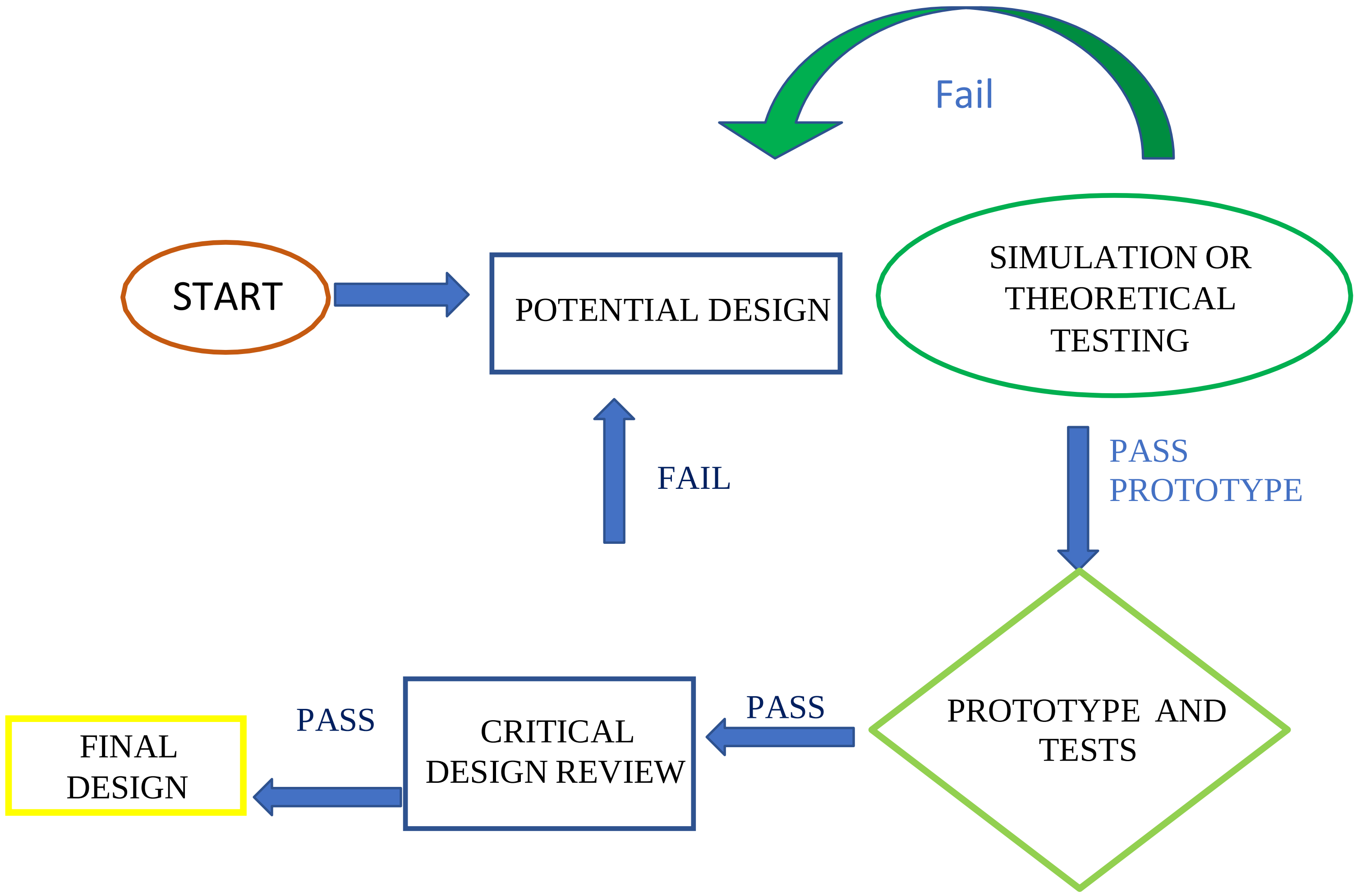


Fig 3.5 Total Deformation of Frame

CHAPTER 7

DESIGN FLOW



CHAPTER 8

ELECTRONIC DESIGN.

8.1 ELECTRONIC FRAMEWORK

The electronic structure is the primary component for the interface among mechanical and programming frameworks. A distantly worked submerged vehicle needs to convey various sensors and electronic gadgets to work with the submerged route, target obtaining, target re-acquisition, limitation, information assortment, correspondence, and well-being purposes. The precision and unwavering quality of the situating of the electronic gadgets limit the level of execution and security that can be accomplished. The electronic structure additionally serves for better perseverance and well-being tasks of the vehicle in the continuous. The electrical prerequisites can be assembled in a few classes.

- Navigation aids used in ROV is the Inertia measurement unit which is used to measure the absolute as well as electric heating, orientation.
- Depth is measured using 30 bar pressure sensor which aids in relatively temperature measuring temperature as well as pressure.
- ROV’s propulsion system requires precise speed control and quick response to closed-loop feedback achieved using a better motor controller.
- The Low Light HD cam provides High vision capability underwater.
- A Central processing unit (CPU) is used to process mission algorithms and data.
- Kill switches, leak sensors, and other peripherals are used to ensure the safety of electronic components enclosed inside the hull.
- Sensors are used to sample valuable oceanographic data like dissolved oxygen, CTD data. ROVs are battery-powered.
- To survive long underwater missions, minimal power usage is desired as the battery loading capacity of the ROV is very limited.

The System Flowchart for an electronic design in fig:5.1

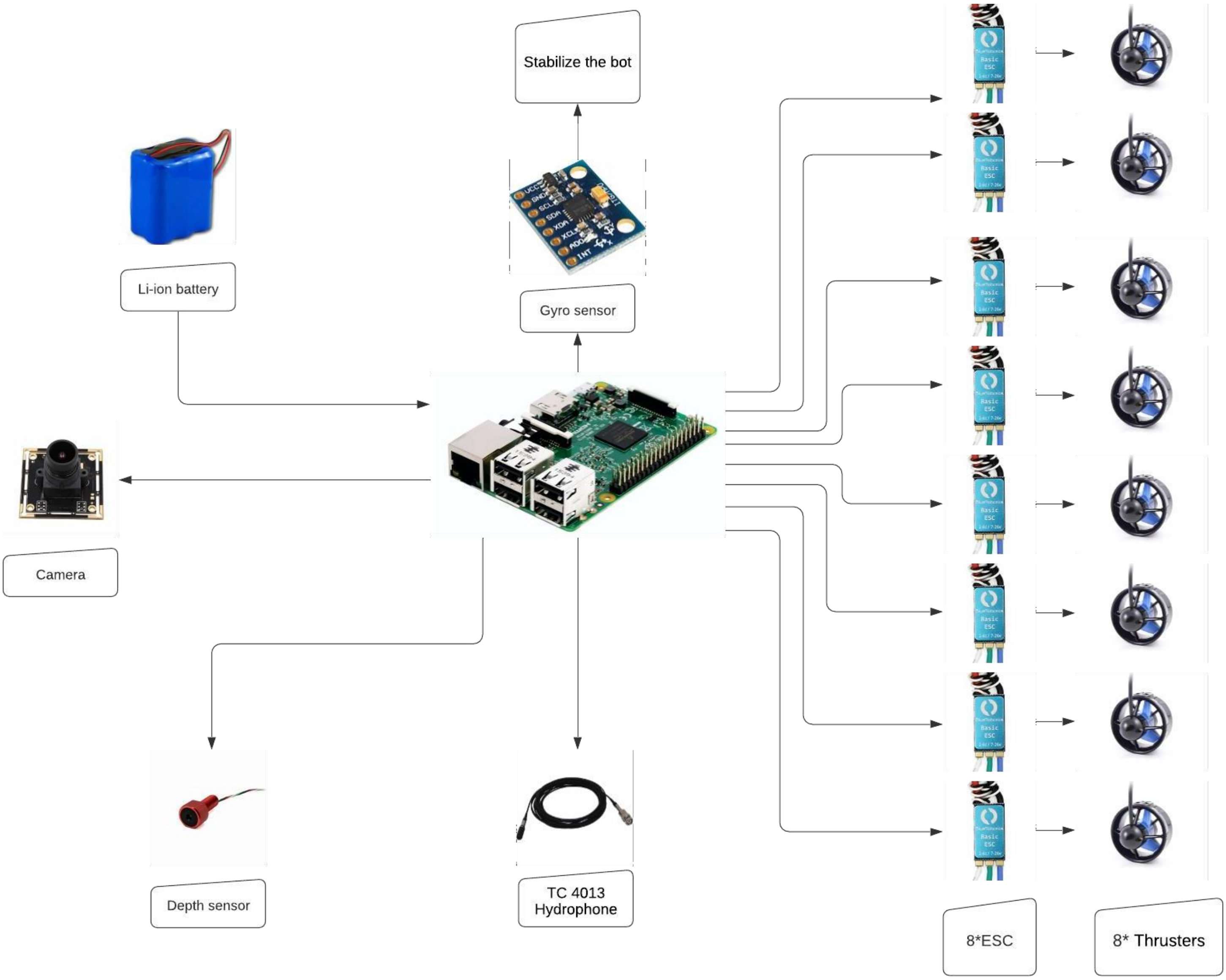


Fig:5.1 System Flowchart

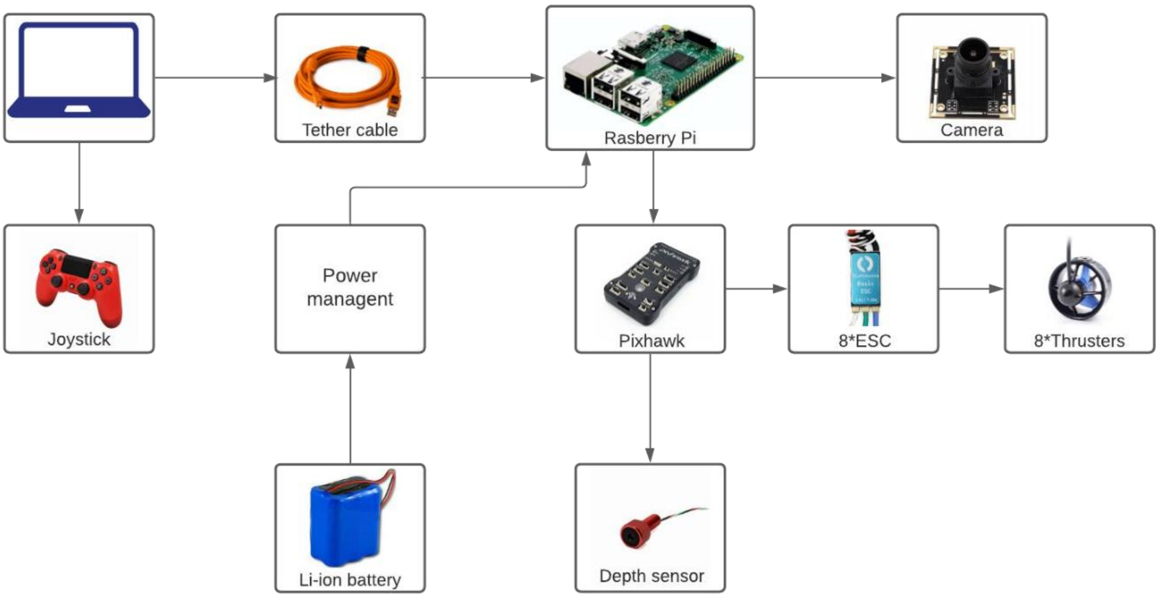


Fig:5.2 BLOCK DIAGRAM

CHAPTER 9

ARCHITECTURE

9.1 MAIN SYSTEM

The fundamental stack includes a hand-crafted framework for the simplicity of availability and upgraded simplicity of supplant capacity in the event of disappointment of any of the parts. The structure comprises openings for the force, GPIO, and engine-driven modules with connectors and engines.

9.1.1 GPIO Board:

The commonly used Input-Output board mostly goes about a control framework for controlling the ROV. Coordinates the sub-modules for creating PWM and Digital Input and Output, ADC. PWM signal created for engines. Computerized Outputs are utilized to control capacity to actuators. The pressing factor sensor perusing is recorded by 12-cycle devoted ADC which shipped off SBC on sequential. Distinctive reference voltage lines are utilized to keep the pressing factor sensor signal unaffected by commotion /vacillations in the Ground utilized in electrical cables.

9.1.2 RASPBERRY PI:

Raspberry pi is an ARM Microprocessor with 1GB of Random-Access Memory(RAM). It works with a customized Linux platform (Only for ARM processors). It contains 40GPIO pins (Digital Pins). Raspberry pi is based on System on Chip (SOC) and the clock speedis about 300MHz. It also contains RJ45 Ethernet Port which is used for high data transmissionhere it is used for high-quality video transmission with Phantom board Microcontroller is shown in fig 6.1

Fig 6.1 Microprocessor.

9.2 SENSORS AND ACTUATORS:

It does high level handling like vision, mission organizer, regulator. It peruses/distributes information from different sensors and electronics and retains the results in actuators for linear working of ROV. The ROV has spaces for force, GPIO, and engine driver module with connectors and engines, sensors, force and off buttons put on the outskirts for simple openness and evacuation.

9.2.1 DEPTH SENSOR:

The 30-bar pressure sensor is a high-pressure, high-goal pressure sensor that is fixed from the water and prepared to introduce in a watertight enclosure on the ROV or ROV. With 0.2 mbar goal, it has a stunning profundity estimation goal of 2mm in the water segment. The sensor is the Measurement Specialties MS5837-30BA, which can compare 30 bar (300m/1000ft profundity) and imparts over I2C. It works on 3.3V I2C voltage yet can acknowledge power contribution up to 5.5V. It comes standard with a 4-pin DF13 connector that is viable with most Drone Code compatible sheets including the APM2.6, Pix Hawk, and others. This sensor incorporates a temperature sensor exact to ±1°C, with information additionally available through I2C. On the off chance that you need something with more temperature precision, kindly look at the Celsius Temperature Sensor.

Depth sensor is shown in fig:6.2

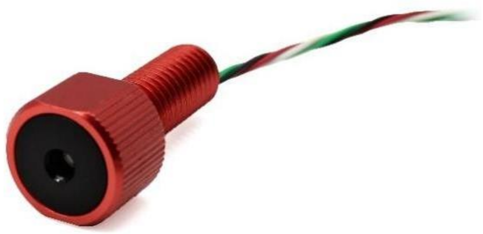


Fig:6.2 DEPTH SENSOR

9.2.2 IMAGE SENSOR:

ROV works under the direction of Low Light HD camera through picture preparing. The brightening variety, brilliance relics, daylight response and so forth … such ecological conditions can be accounted.

This camera is executed with auto openness and gain control calculations. The helpless difference, the diminished shading quality submerged can be restricted and versatile pre-preparing method have been created.

Low Light HD camera has new calculations that identify and track lines for use with line-following robots. The new calculations can recognize convergences and "street signs" too. The street signs can instruct your robot, for example, turn left, turn right, moderate down, and so forth. Low light HD camera is shown in fig:6.3

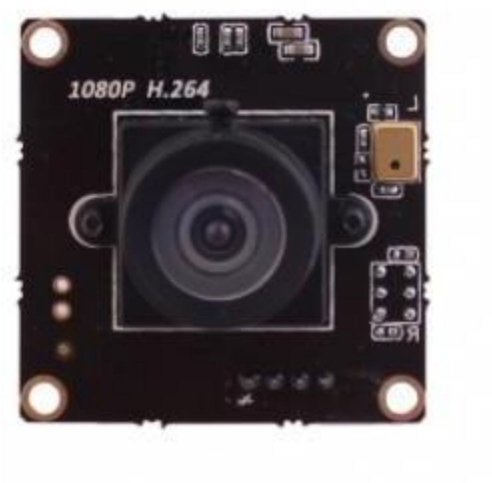


Fig 6.3 LOW LIGHT HD CAMERA

9.2.3 MOTOR DRIVER BOARD:

The Motor Driver Board incorporates all the 8 ESC'S on a solitary hand-crafted board and gives simplicity of supplant capacity and wellbeing highlights. With a force rating of over, every one of these engine drivers are prepared to do productively driving high-power engines with a flow rating of 30A, every one of these engine drivers are able to do proficiently driving Blue Robotics T200. The power to the board is controlled and ON and OFF operations by kill switches.

9.2.4 T200 THRUSTER:

The T200 is made of high-strength, UV-resistant polycarbonate infusion-formed plastic. The center of the engine is fixed and ensured with an epoxy covering and it uses high-execution plastic bearings in a spot of steel direction that rust in saltwater. All that isn't plastic is either aluminum or top-notch hardened steel that doesn't consume. An uncommonly planned propeller and spout provide efficient, powerful thrust while dynamic water-cooling keeps the engine cool. The T200 comes with clockwise and counter-clockwise propellers to counterforce. The T200 Thruster is shown in Fig: 6.4 and the working graph is shown in Fig: 6.5

Fig: 6.4 T200 Thruster

Fig: 6.5 T200 THRUSTER WORKING GRAPH.

9.2.5 ELECTRONIC SPEED CONTROLLER:

Electronic speed regulator (ESC) is important to run any three-stage brushless engine like engines. This 30-amp ESC is adequate for the T100 and T200 ESC is shown in fig:6.6

Fig: 6.6 ELECTRONIC SPEED CONTROLLER.

Key Features:

- Basic, vigorous brushless electronic speed regulator Compact form factor
- Forward/invert revolution heading for forward/turn around push
- Customization settings in a simple to-utilize interface
- High-effectiveness, low-heat configuration advanced for insignificant cooling conditions

9.3 POWER AND BATTERY MANAGEMENT SYSTEM:

The Power Board performs the task of regulating power for all the sub-systems of the vehicle while incorporating various other features like short circuit protection, reverse battery polarity protection with voltage measurement. Standard voltages 3.3V, 5V and 12V are accessible from a power rail ensuring that the voltage requirements for most of the industrial sensors are met. A set of Lithium-ion batteries have been used for power supply which provide a continuous mission endurance of nearly 4 to 5 hours. Lithium ion batteries can hold a high charge density and provide a continuous supply of high current. The current and voltage across batteries, thrusters and other electrical peripherals is regularly monitored through adequate sensors and the data is logged for further analysis. This data is used to monitor the performance and health of various peripherals on the vehicle and use the results to develop an efficient power management system. In Table: 6.2 Power Distribution Diagram is shown.

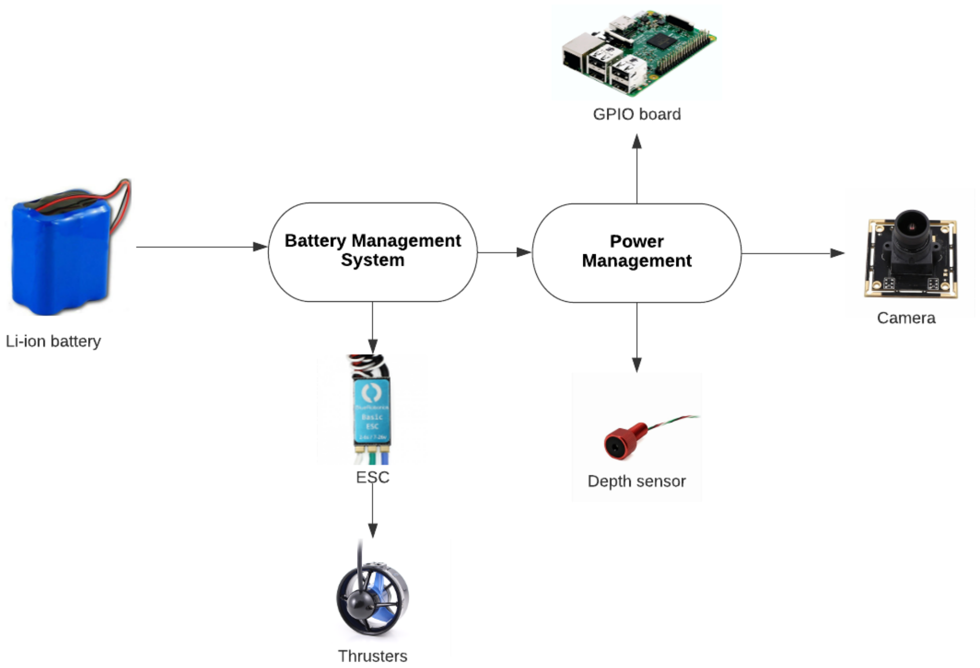


Table: 6.8 Power Distribution Diagram

9.4.1 Li-ion battery

The *Lithium-ion Battery (14.8V, 18Ah)* is a high-capacity custom battery pack made from high quality 18650 lithium-ion cells. This 4S (14.8V) battery has a nominal capacity of 18.0Ah, plenty for up to 4 hours of continuous moderate use. The lithium-ion cells the battery is comprised of have excellent performance characteristics, as well as a high tolerance for accidental mishandling. The battery is CE (Conformité Européenne) approved, ROHS compliant, and UN38.3 certified. Certificates can be provided upon request. In Fig:6.9 Li ION Battery is shown.

Fig:6.9 Li ION Battery

9.4 SOFTWARES:

9.4.1 SOLIDWORKS:

SolidWorks is a solid modelling computer-aided design (CAD) and computer-aided engineering (CAE), we have used this software because help you calculate forces due to motion, flow, part stress, and deflection as well as vibration, and effects of temperature these can be done on creating a 3D model, and it is also user friendly.

9.4.2 ANSYS

Ansys is used to determine how a product will function with different specifications, without building test products or conducting crash tests. For example, Ansys software may simulate how a bridge will hold up after years of traffic, how to best process salmon in a cannery to reduce waste, or how to design a slide that uses less material without sacrificing safety.

9.4.3 QGROUNDCONTROL:

For PX4 or ArduPilot-powered vehicles, QGroundControl provides full flight control and vehicle configuration. It is straightforward and easy to use for novices, while still providing advanced feature support for expert users.

Key features:

1) ArduPilot and PX4 Pro powered vehicles are fully installed and configured.

2) Vehicles employing PX4 and ArduPilot receive flight support.

3) Mission planning for self-driving vehicles.

4) Vehicle position, flight track, waypoints, and vehicle instrumentation are displayed on a flight map.

5) Video streaming with overlays of instrument displays.

6) Support for multiple vehicle management.

7) QGC is compatible with Windows, OS X, Linux, iOS, and Android devices

CHAPTER 10

BILL OF MATERIALS

S.NO	PARTS	SPECIFICATIONS	QUANTITY	RATE
1	Raspberry pi	3 B	1	Rs. 2700
2	ESCs	7-26 volts 30 amps	8	Rs. 20,000
3	Depth Sensor	30 Bar Operating Pressure	1	Rs. 4000
4	Camera	Low light HD cam	1	Rs. 12,000
5	Pixhawk	3DOF accelerometer, Barometer	1	Rs. 4000
6	Joystick	Logistic	1	Rs 1000
7	Battery	14.8 V Lithium ion.	1	Rs 18,000
8	Kill Switch	5A operating current,	1	Rs 1000
9	Aluminum Profile	20mm x 20mm	1m	Rs 300

10	Thruster	T200	8	Rs 1,20,000
11	Aluminum Hull	-	1	Rs 2000
12	Fathom cable	-	10m	Rs 2000
13	Fathom Board	-	2	Rs 4000

CHAPTER 11

CONCLUSION

Till now Remotely operated underwater vehicles (ROVs) had stroked the market. There is a demand for the remotely operated vehicles (ROVs). While considering the requirements of our nearby regions like BhavaniShagar, Kodiveri, Mettur and Azhiyar, we found that they still find it difficult to use humans for surveying the underway of the dams. They are in need of alternate machines for dam's survey which could be cost effective and should have the ability to reduce the human effort. The need of the machine should be compact, easily operated, data manageable and should reach nook and corner i.e. reaching remote areas. This ROV could meet those requirements which is highly compact and reaches remote areas effectively, collects required survey data based on programming. Since it is Remotely operated we need not look after it while the ROV is in work. Further based on the user applications it could be programmed flexibly and this paves way for this feature. Also there is a plan to remodify the current design to make it work effectively.

CHAPTER 12

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