Prince Mohammad University
Department of Electrical Engineering

Water Eyes: An Underwater Robotic Submarine

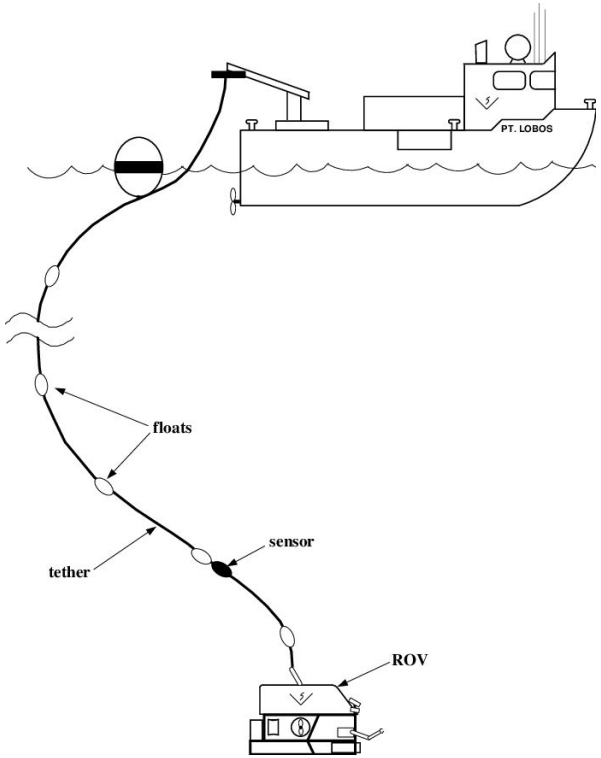
Learning Outcome Assessment lll
Instructor: Mr. Saifullah Shafiq
Spring 2021

Group members:
Fay Alomair 201700509
Dor Alomair 201700071
Sara AlDawood 201701916

Advisor: Mr. Saifullah
Co-Advisor: Mr. Ahmed Hussain

Outline:

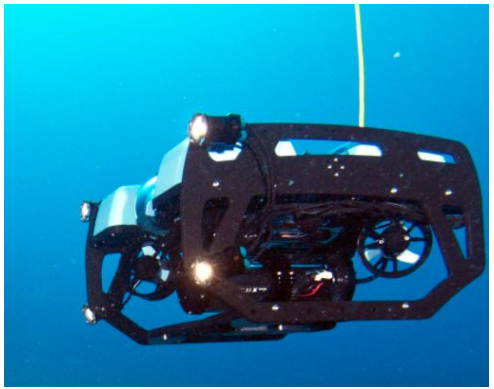
- Project Objectives
- Project Specifications
- Project Architecture
- Planning



Project Definition:

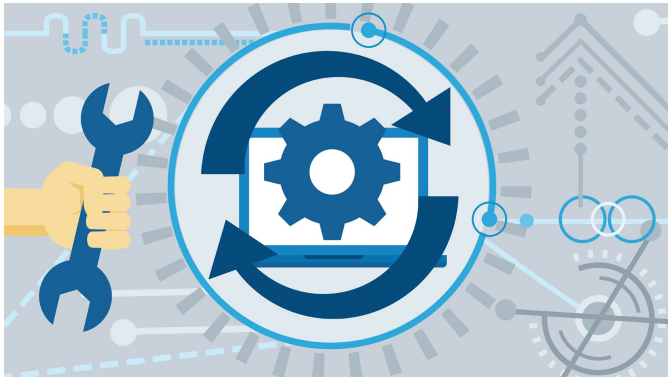
Water Eyes is a smart system to monitor life underwater.

- It consists of multiple subsystems to guide the user through water
- The system will be able to collect data in an optimal way
- It will be controlled by the user.



Project Objectives:

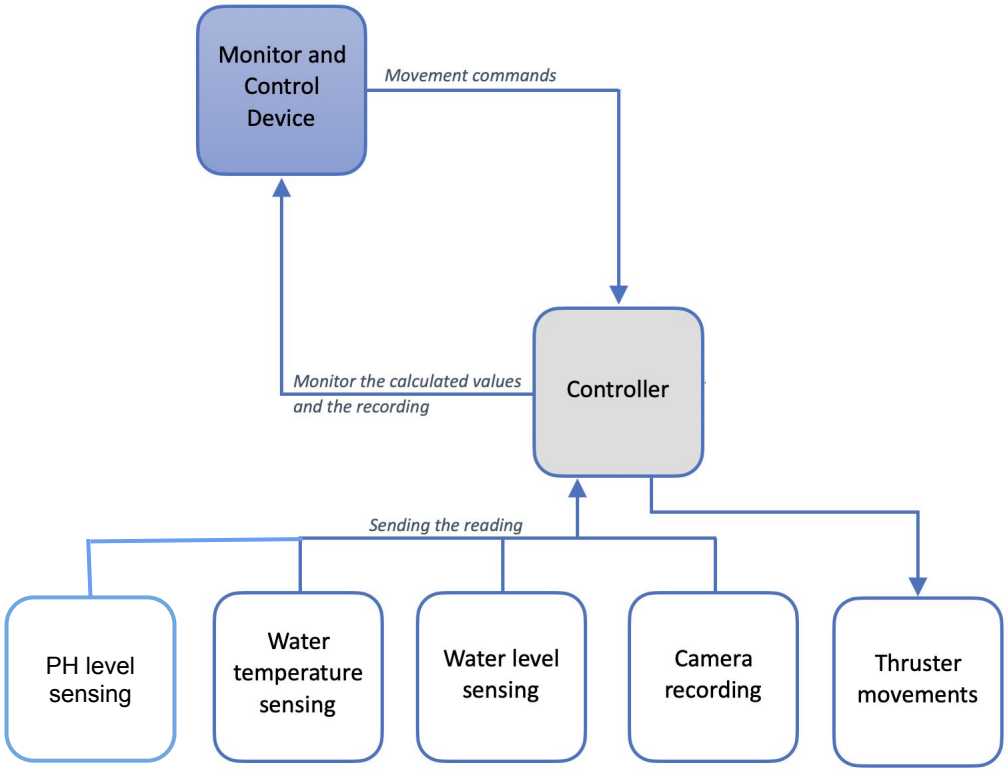
- Designed to Function inside the water
- Develops a tool for marine biologists
- Studies the sea environment
- Helps monitor underwater operations



Project Specifications:

- Controlled by a wire.
- Moves by thrusters.
- Camera monitoring.
- Water level measurement.
- PH level Readings.
- Water temperature sensing.

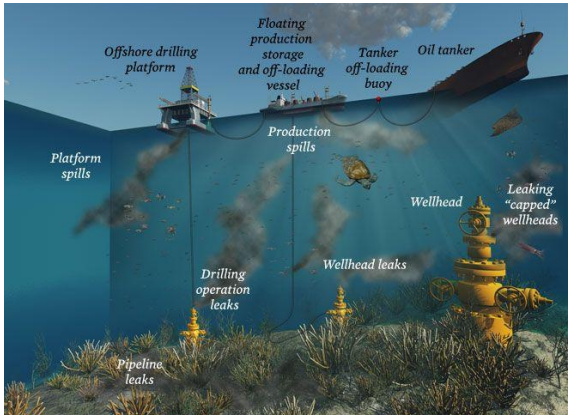
Project Architecture



Background:

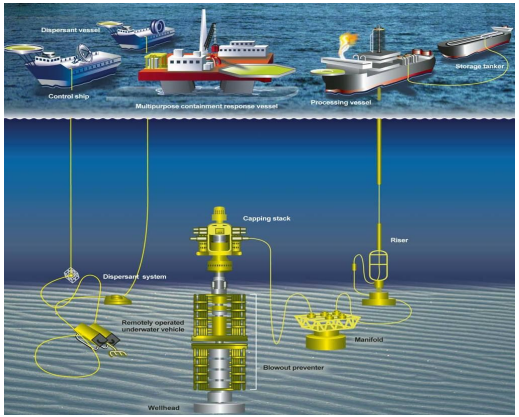
Problem:

- Underwater gas plant issues.
- These issues evolve with time.
- Having a 24/7 maintenance crew is expensive.



Solution:

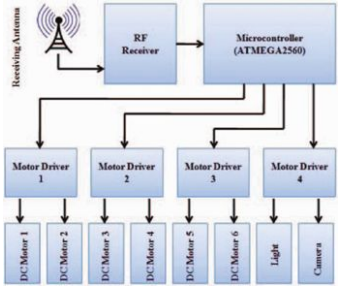
- Implementing a monitoring system.
- Issues will be found at their early stages.
- Cost efficient.

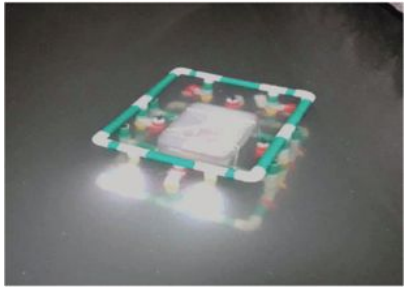


Previous Projects

Project #1:
Design and construction of underwater robot

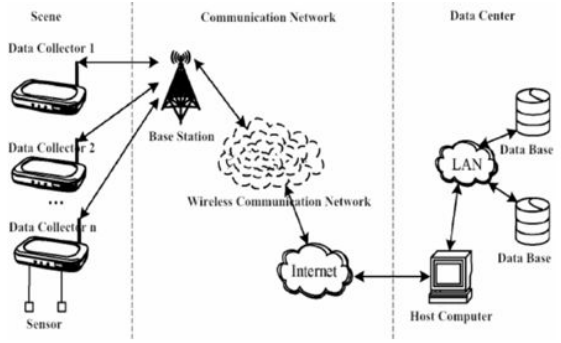
- Built on a PVC chassis.
- Used an Arduino microcontroller.
- Has a monitoring camera.
- Controlled wirelessly using an RF





Project #2:
Design and Implementation of Marine Environment Monitoring Application

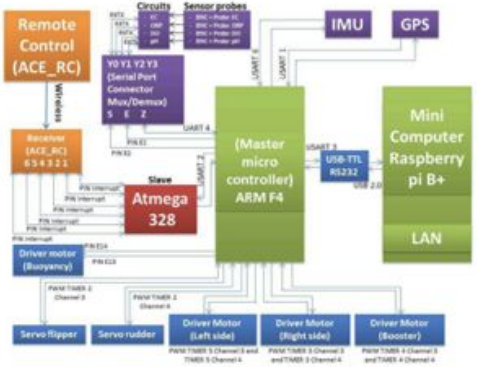
- Used aChartEngine tool for the collected data.
- Water temperature sensor.
- Wireless communication network and controls.

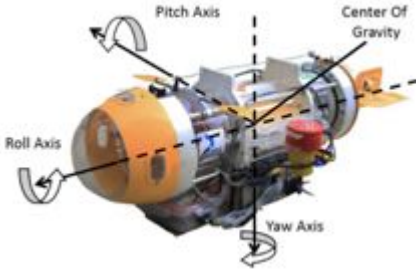


Previous Projects

Project #3:
Radio-controlled Submarine Modification for River Water Quality Monitoring

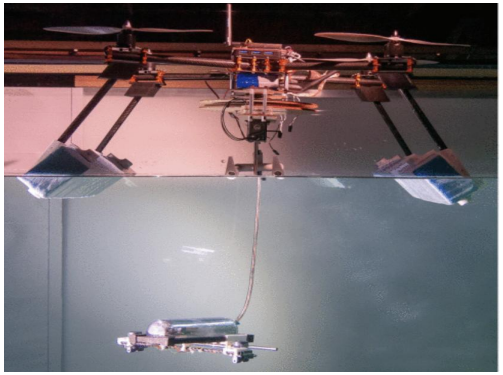
- Monitors water hygiene.
- Radio-controlled submarine.
- Water temperature sensor.
- Has GPS tracking.





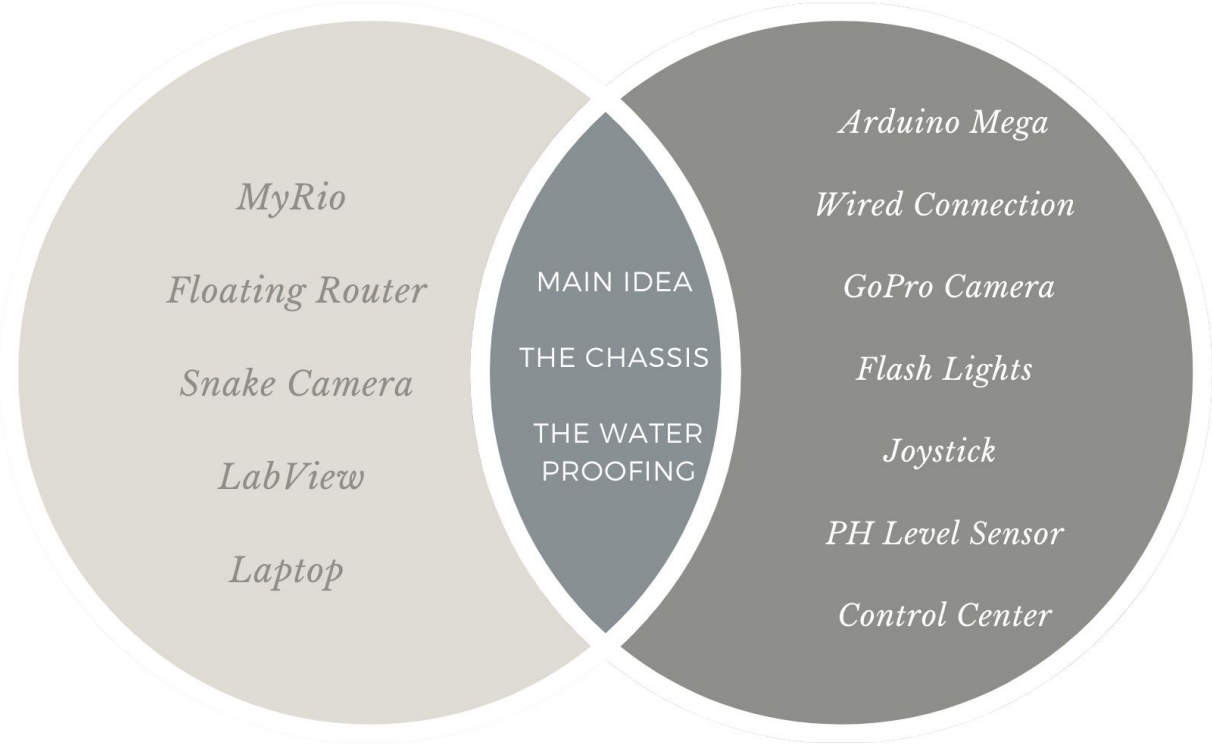
Project #4:
A Multi-Environment Dual-Robot for Underwater Sample Acquisition (MEDUSA):

- Functions under and above water.
- Collects water samples and photos.
- Wire connects submarine to a floating antenna system.



Previous Projects

Remote Controlled Submarine:



Water Eyes:

Summary and Comparison:

Projects	1	2	3	4	Our project
Monitoring	✔	✔		✔	✔
Water Temperature		✔	✔	✔	✔
Water Level				✔	✔
Controlling by wires				✔	✔
Arduino microcontroller	✔				✔
Collecting data		✔	✔	✔	✔

SENSING TOOLS

Temperature sensing:

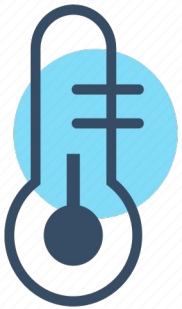
Measures temperature underwater

PH Level sensing:

Measures PH level of water

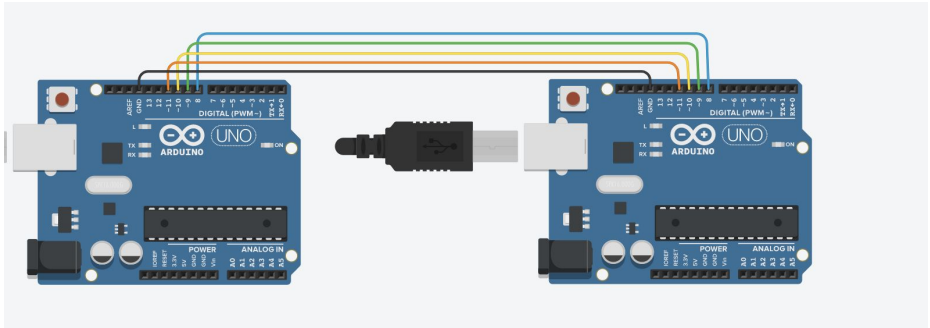
Pressure sensing:

Measures pressure underwater



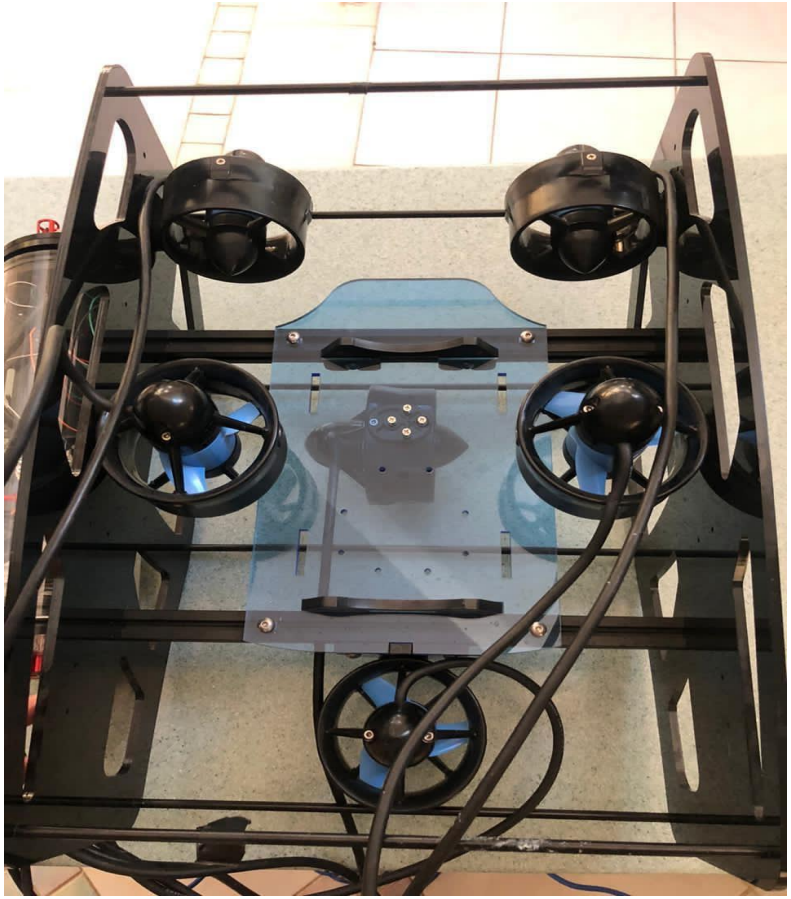
CONTROL STRATEGY

- Joystick.
- Speed control.
- Master-Slave Communication.
- Connected with a wire.



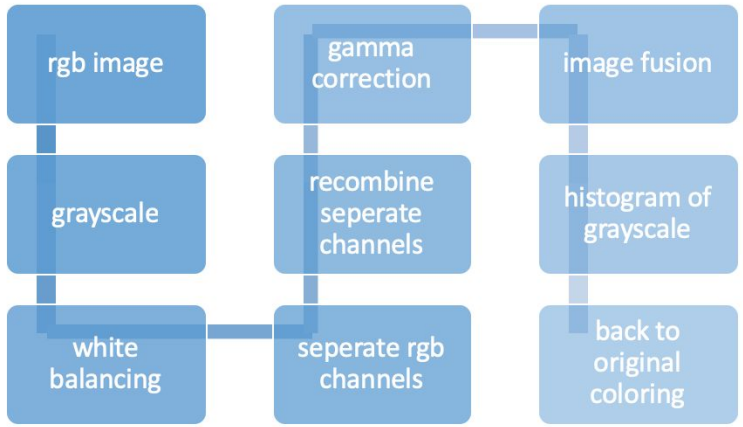
Submarine Module:

BlueRobotics



DISPLAY METHODOLOGY

- Underwater High Quality footage
- Equipped with flashing lights
- MATLAB Image enhancement



BEFORE

AFTER

RISKS AND MANAGEMENT

- CABLES GET STUCK TOGETHER
- COMMUNICATION WIRE ISSUE
- TIME CONSTRAINTS

IMPACT OF COVID-19

- LESS MEETINGS
- COMPONENTS DELAY
- LESS TESTING POSSIBILITIES

Budget Estimate:

Item	Quantity	Unit cost (SR)	Total
Microcontroller	1	160	160
Waterproof camera	1	800	800
Waterproof case	1	52	52
Motor	1	120	120
Joystick	1	41	41
Ultrasonic waterproof sensor	2	300	600
Pressure sensor	1	145	145
pipes	10	25	250
Long wire	2	150	300
Waterproof temperature sensor	1	50	50
PH level sensor	1	100	100

Project management & teamwork:

We have distributed the following tasks between us and managed our time to meet and discuss everything weekly

- Ordering components
- Connecting all sensors
- Connecting the joystick and buttons
- Soldering everything together
- Finishing the codes
- Testing each subsystem
- Testing the whole device

References:

S. K. Deb, J. H. Rokky, T. C. Mallick and J. Shetara, "Design and construction of an underwater robot," 2017 4th International Conference on Advances in Electrical Engineering (ICAEE), Dhaka, 2017, pp. 281-284, doi: 10.1109/ICAEE.2017.8255367.

W. Hu and B. Wang, "Design and implementation of marine environment monitoring application based on Android platform," 2017 3rd IEEE International Conference on Computer and Communications (ICCC), Chengdu, 2017, pp. 2966-2970, doi: 10.1109/CompComm.2017.8323075.

S. Sukaridhoto, D. Pramadihanto, Taufiqurrahman, M. Alif, A. Yuwono and N. Funabiki, "A design of radio-controlled submarine modification for river water quality monitoring," 2015 International Seminar on Intelligent Technology and Its Applications (ISITIA), Surabaya, 2015, pp. 75-80, doi: 10.1109/ISITIA.2015.7219956.

D. Debruyn et al., "MEDUSA: A Multi-Environment Dual-Robot for Underwater Sample Acquisition," in IEEE Robotics and Automation Letters, vol. 5, no. 3, pp. 4564-4571, July 2020, doi: 10.1109/LRA.2020.3001534.

Demonstration Video

Thank you for listening!

Any Questions?