

**SUBMERSIBLE ROBOT USED FOR
MEASURING WATER QUALITY IN RIVERS
AND LAKES
ASSEMBLY AND USAGE MANUAL**

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DESCRIPTION OF THE PRODUCT

The product is a submersible made for the study of water quality. It is part of the Erasmus+ K2 project EUROPEAN WATER INVESTIGATION (EUWI), which brings together the following institutions: Berufskolleg Tecklenburger Land Ibbenbüren Germany, IIS VOLTERRA ELIA Ancona Italy, ZSE im. I.Domeyki w Bolesławcu Poland, Colegiul Tehnic de Comunicatii Nicolae Vasilescu-Karpen Bacau Romania. This is a concept produced by the Romanian students to surf water streams around Bacau, Romania and measure some parameters such as: temperature, conductivity, PH and Oxygen dissolved in water. The measurements are conducted with the help of special sensors connected to an acquisition board. The data is recorded in real time and can be analysed afterwards.

The submarine has a water jet propulsion directed so that it can immerse, emerge and move in water.

Building such a submersible is of a high difficulty and requires knowledge from various domains such as physics, chemistry, biology, electronics, IT, robotics and mechanics.

Assembly Manual

Necessary Materials

No	Name	Parts
1.	Tube PVC D100/L5000	1
2.	Tube PVC 60x120x1000	1
3.	Soldoring Tangit PVC-U	1
4.	Phony camera	1
5.	PH Sensor	1
6.	Temperature Sensor	1
7.	O2 dissolved in water Sensor (school made)	1
8.	Resistivity sensor (school made)	1
9.	Fe 50x50x200 weight 2,5Kg	1
10.	Brushless pump AD20P-1230P	2
11.	Servomotors	4
12.	Arduino development board	1
13.	ABS fiber	1
14.	DrDAQ acquisition board	1
15.	4400mA Batteries	4
16.	Connectors/ switches /power source	10
17.	Driver	1
18.	Battery charger	1
19.	LED white	4

20.	Joystick	2
21.	Gaskets 10 +100	4+2
22.	UTP cable	15m
23.	USB cable	1
24.	Silicon tube 6mm	1,5m

Optional Materials

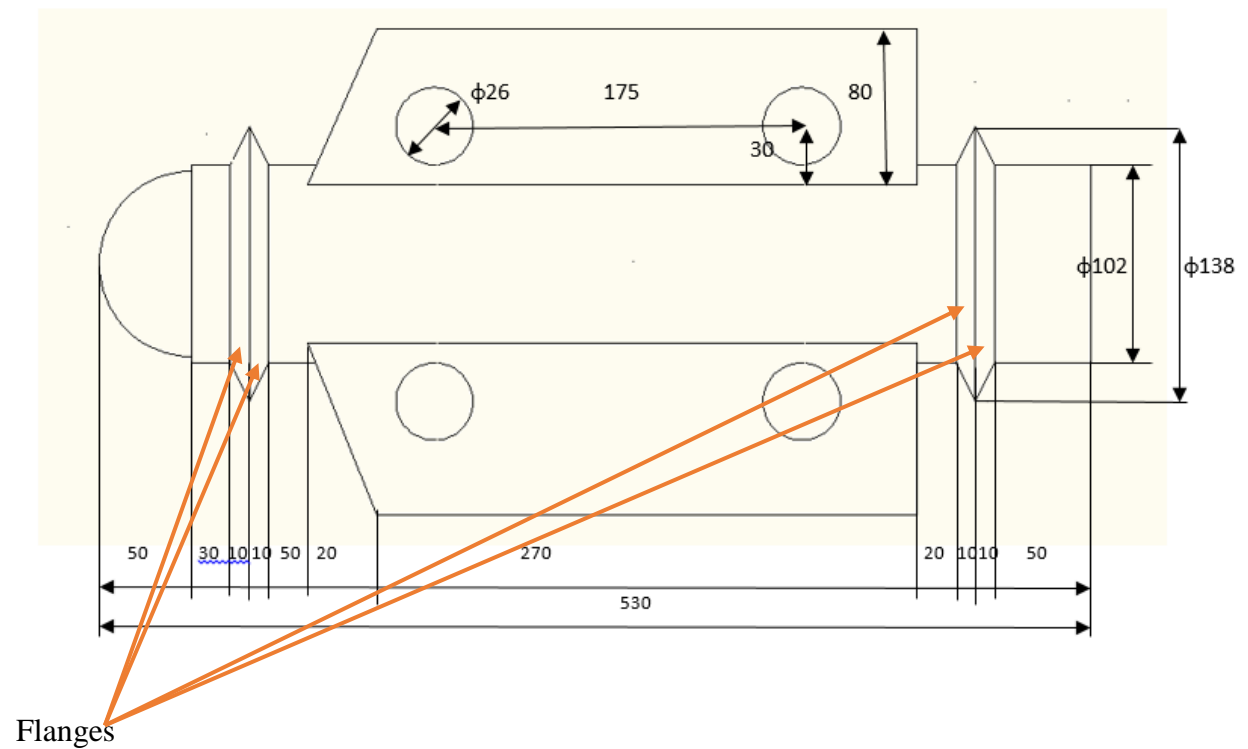
No	Name	Parts
1.	Camera AV	1
2.	Video capture AV-MPEG	1
3.	USB cable	1

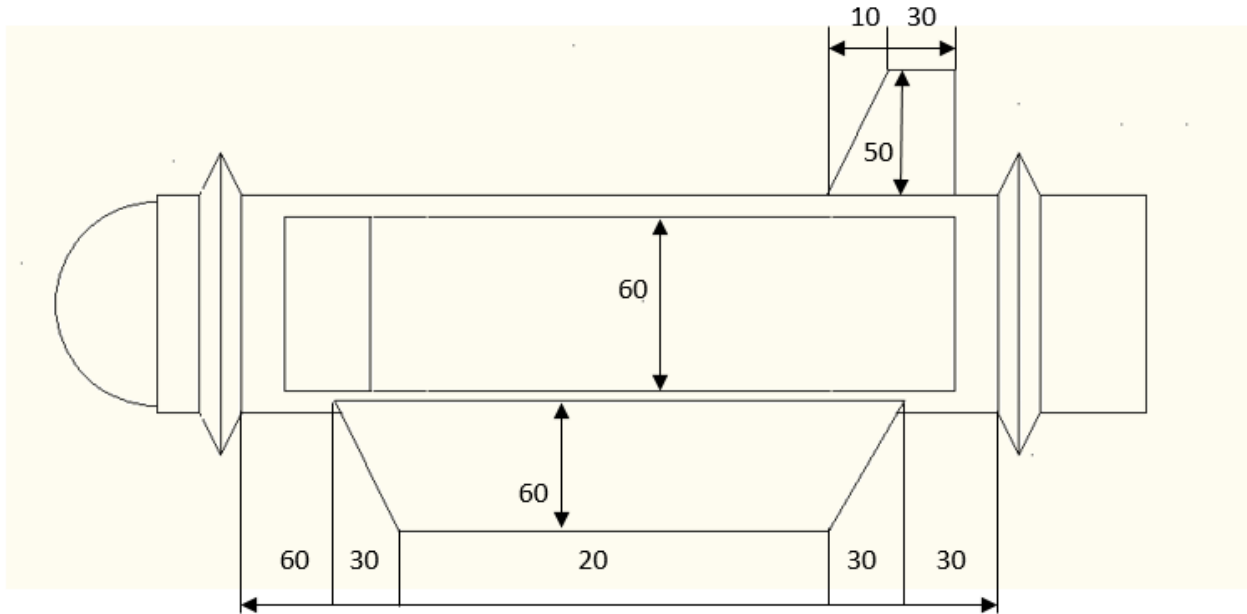
Necessary equipment

3D printer, Laptop, Specialised 3D soft + AutoCad

The body

The diagram



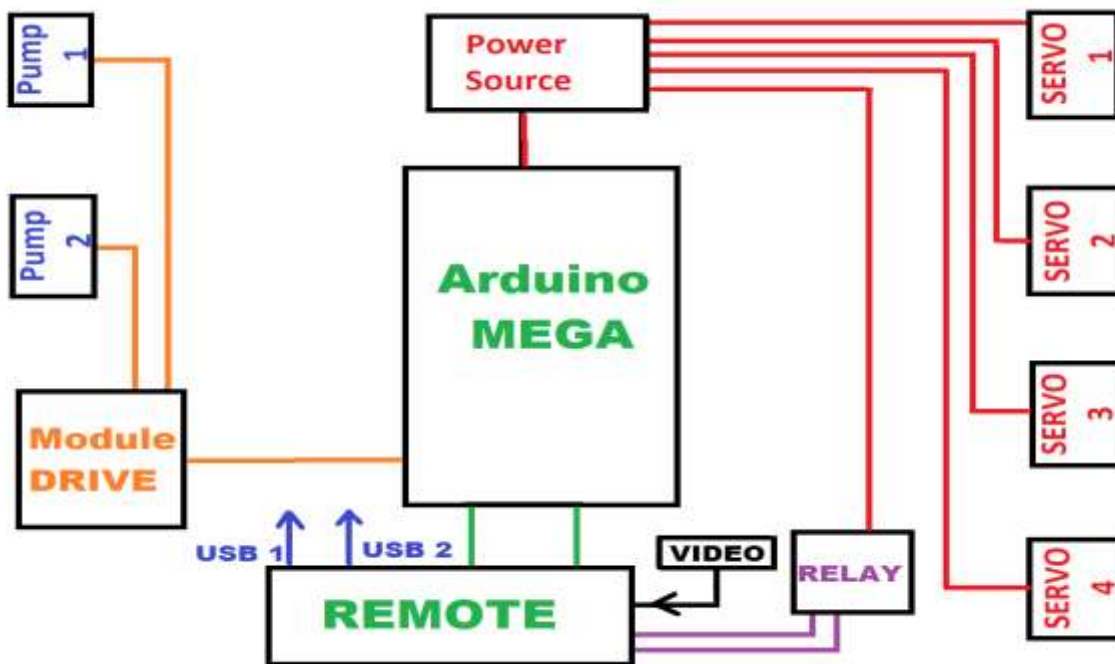


All the components (including those made with the 3D printer) are connected using soldering solution Tangit PVC-U

The flanges and fixed with screws and rubber gaskets. The 3D printer made components are described in the Annexes.

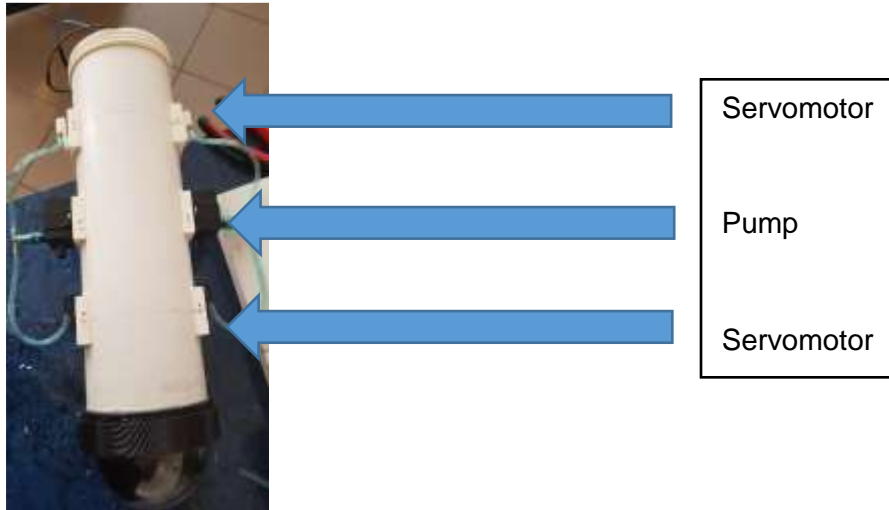
Electronic Equipment

The Electric diagram

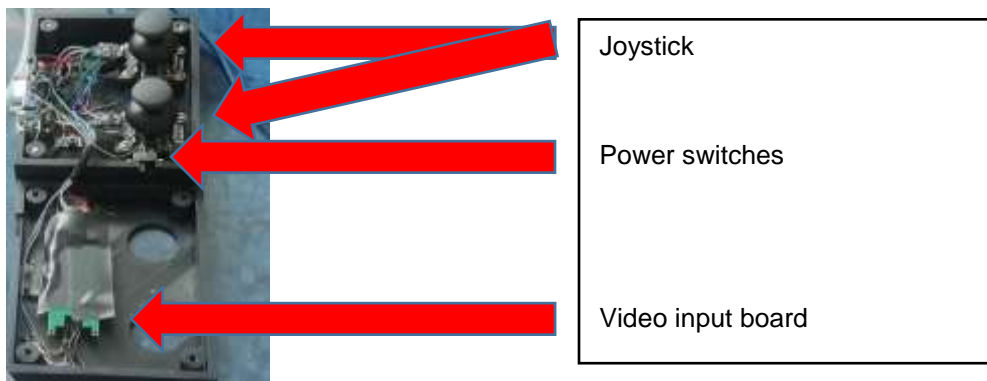


Fixing the components

The submarine has a water jet propulsion directed so that it can immerse, emerge and move in water. For commands we used a development board MEGA2560 with 4 servomotors and 2 pumps.



For remote command we use a remoter containing 2 joysticks, power switches or LEDS and a board to process the video input.



The signals given by the sensors are processed by an acquisition board DrDAQ which sends to a PC the data gathered in real time, which can be recorded. Conductivity and Oxygen measurement sensors have been created using a 3D printer.



Acquisition board



conductivity sensor



oxygen sensor



PH sensor



temperature sensor

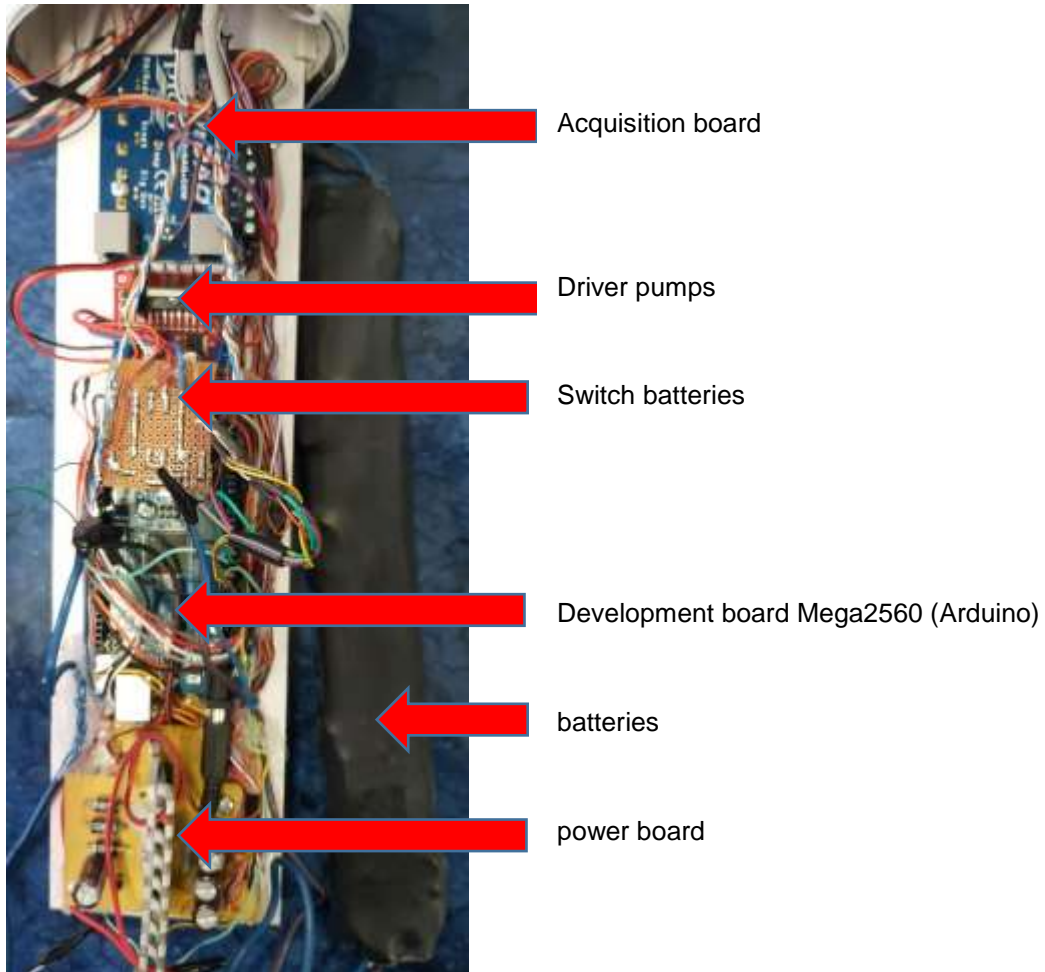
For better navigation a light LED and a camera was connected on the submersible to send images to the PC



The power comes from 4 Li-ion de 4400mA batteries, offering decent autonomy.



Location of electronic circuits on the chassis (PVC).



Checking

It is necessary to check the tightness of the submersible. It can be supplied with a circuit to signal the humidity inside it.

Check the tightness of the cables for the remote and the connector responsible for the charging of the batteries turret.

Floating will form by modifying the weight. The submersible weighs about 4.8kg.

Side view



Back view



Above view



Front view



Usage Manual

Functions

The submersible can immerse and emerge in still freshwater (i.e. lakes and pools). It can move straight forward and turn left or right. The video input can be watched even in minimum visibility conditions with the help of the LED projector.

Due to the 4 sensors (temperature, PH, oxygen, conductivity) it can gather data from the water using the acquisition board. The data can be visualized in real time and stored on a laptop.

Accessories

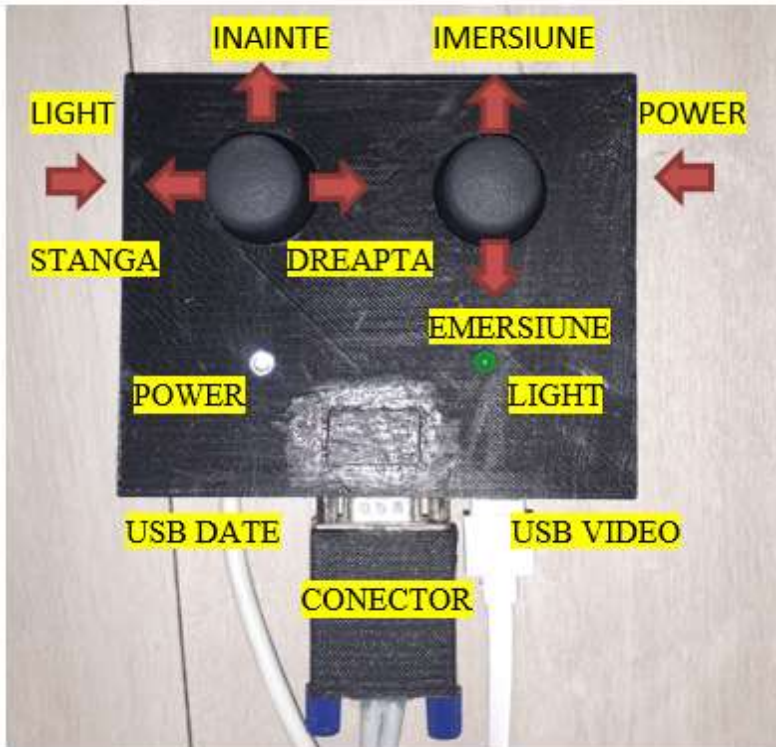
A laptop, a tension source of 16,8V/5A and a video capture board are necessary for the submersible to function.

Technical connection data

Connection is easy: the submersible cable is connected to the remote, the USB cables from the remote are connected to the laptop. Specialised soft for the acquisition board and video board are installed on the laptop.

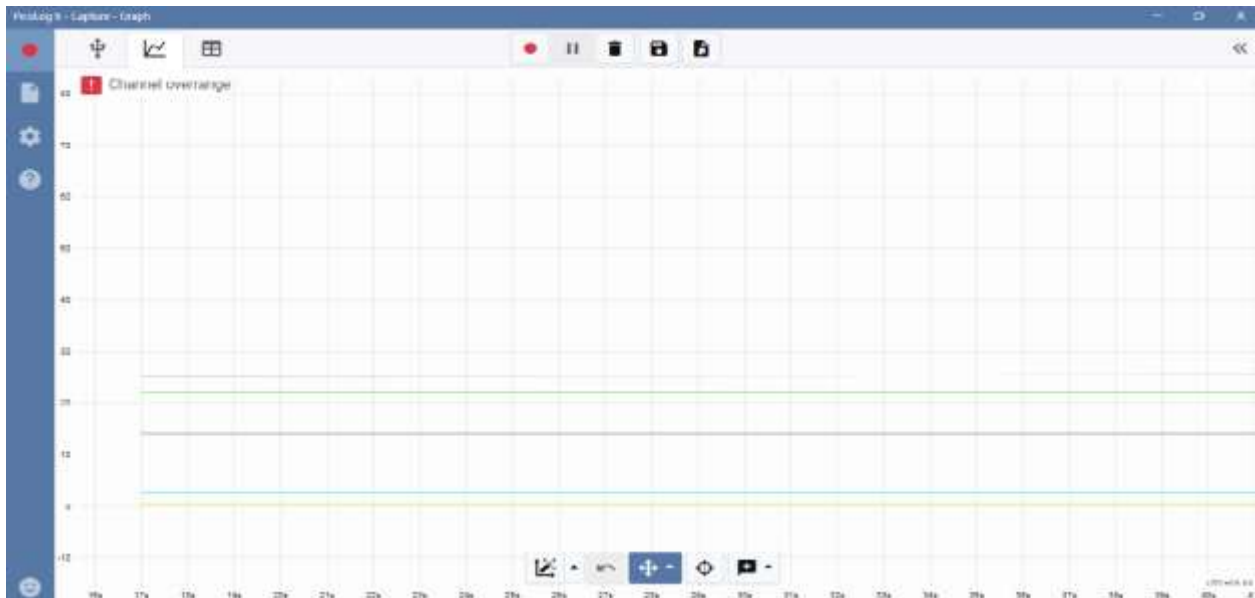
Functioning

To use the robot in optimal conditions it must be introduced in water in such a way as to float with the turret above water. The laptop is started, the soft is accessed, and then the robot is charged through the remote. With the 2 joysticks we move the submersible forward, left, right, in and out of the water.



Data collecting

It is used with the help of PicoLog6 soft dedicated to the acquisition board DrDAQ. The soft needs to be studied previously. The data is correct only if the sensors are calibrated.



Maintenance

After each session it must be well dried. Periodically check the batteries. The pumps work only when the apparatus is under water.

This submersible has been built and designed by the students of “Technical College of Communicatiосn Nicolae Vasilescu Karpen’ Bacau, Romania, participants in the Erasmus + K2 project “European Water Investigation” (EUWI).