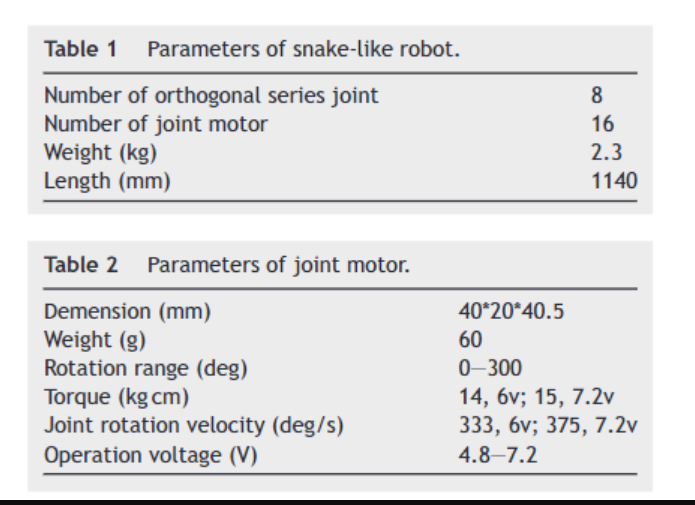
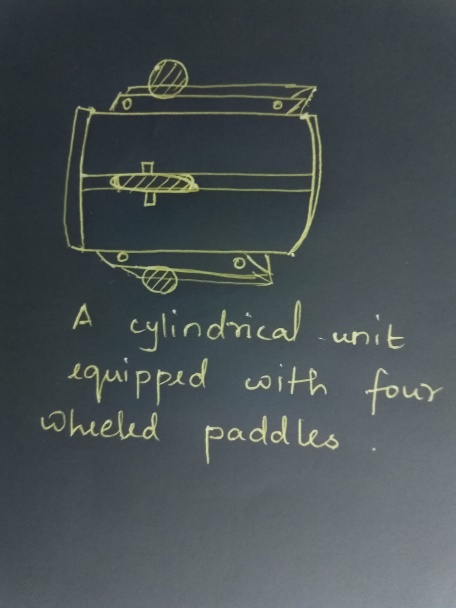
**Portable water testing and purifier Robot**

Group 6

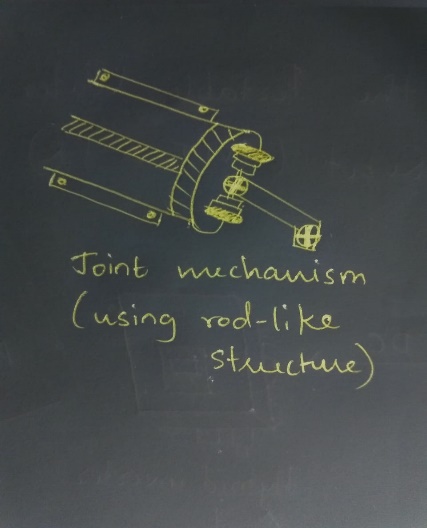
Design of our Robot



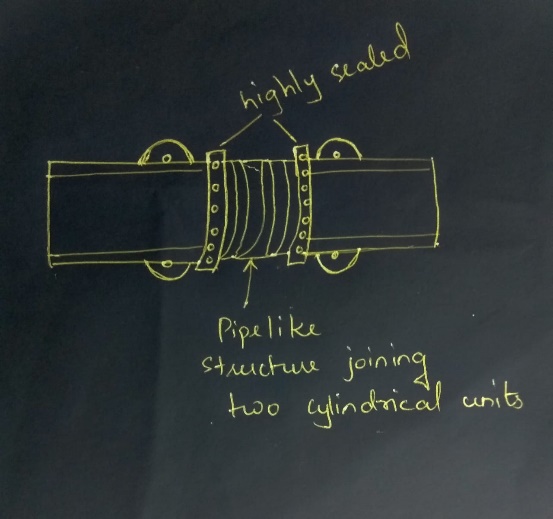
Our water-snake like robot’s body is made of cylindrical units/modules which is stabilized by flexible joints that allow free movement of the snake. To get more propelling force in the water, it consists of wheeled paddles, we are attaching 4 wheels per cylinder.



At first, we thought of joining the cylindrical units like we do the compartments of a train but then we needed our robot to be flexible so we cancelled it out. Then we attached a small rod (much similar to the joints in a train) to increase its flexibility, to increase the snake-like behavior we want to achieve. Even then we didn’t find our solution ideal.



At last we settled on joining the units using a normal pipe and tightly seal it on both the edges because we don’t want the water to tamper our device.



We made sure that the robot is equipped with Bluetooth so that it can detect where it is and track efficiently.

Why a snake like structure?

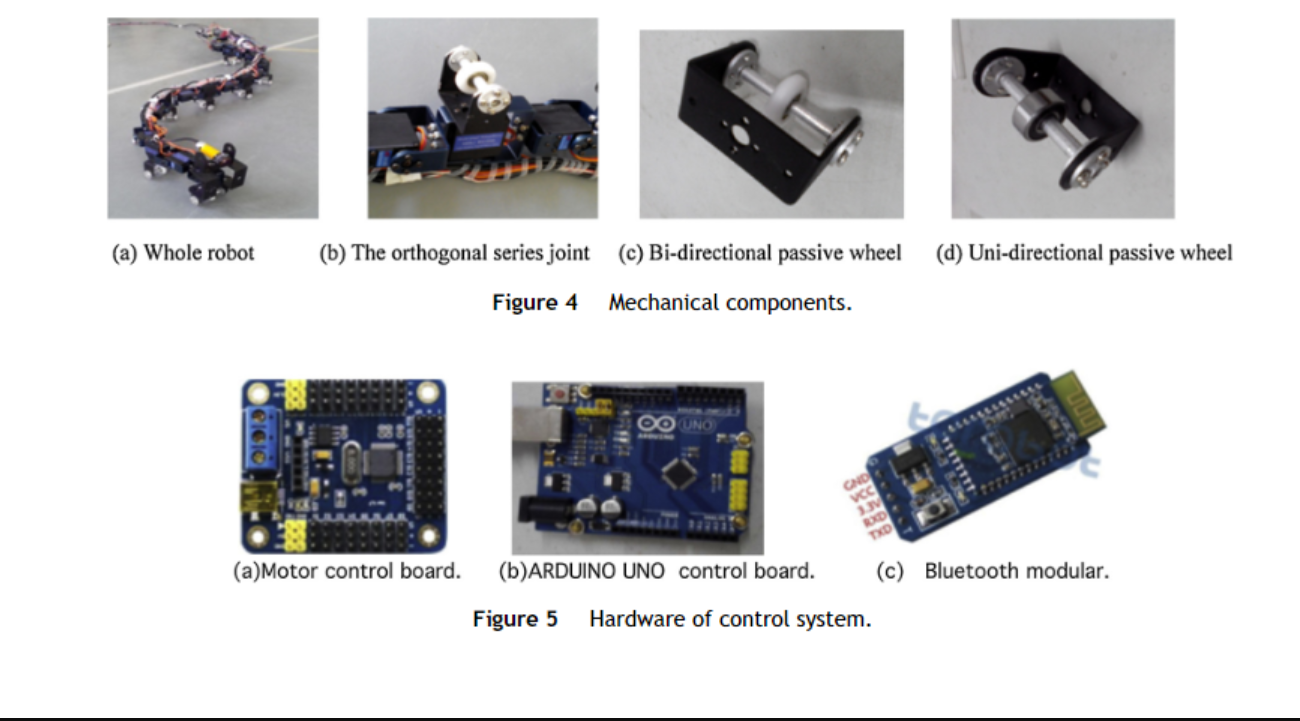


Because a snake can navigate through very tough and disorganized situations and can glide perfectly under water. Its body is designed to cover a lot of area in detecting and purifying Water.

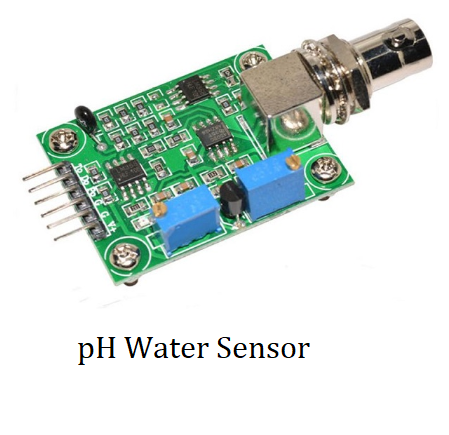
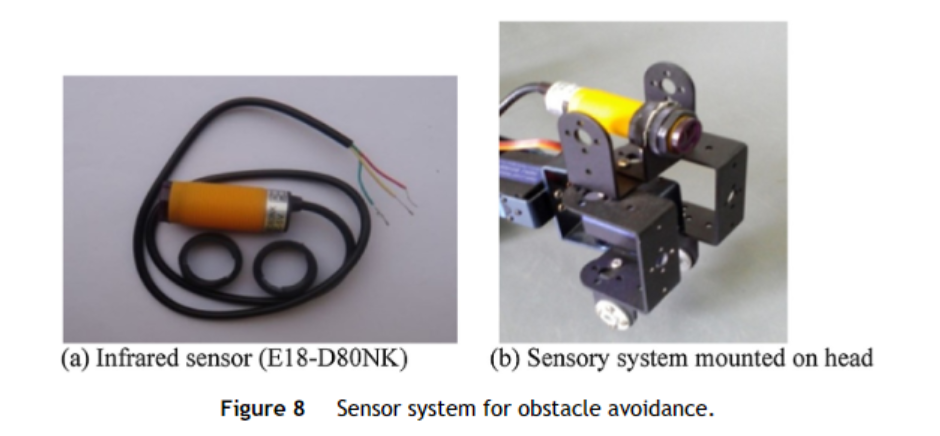
The rhythmic gaits and the legless body (which helps to slither) makes it easy to navigate and inspect.

Testing the water quality

We are using sensors here. The sensors test the level of contaminants and collects data which can be retrieved after the robot reaches us.



We have embedded the robot with sensors, pollution sensors to find out the concentration of various elements. For instance, the electrochemical sensors are used to detect heavy metals such as lead and biosensors to detect bacterial presence, which is very important since bacteria are very sensitive when it comes to testing.

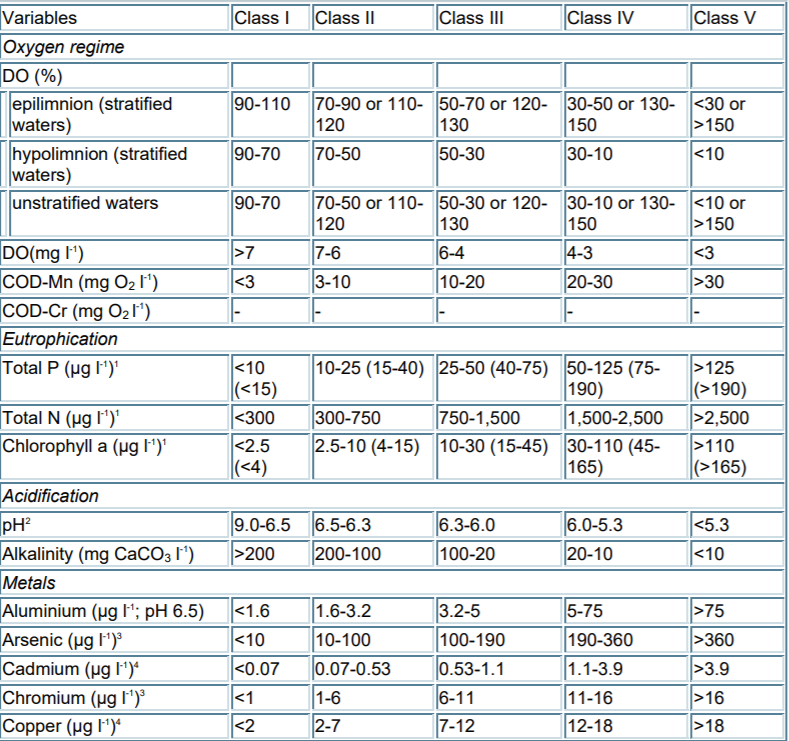
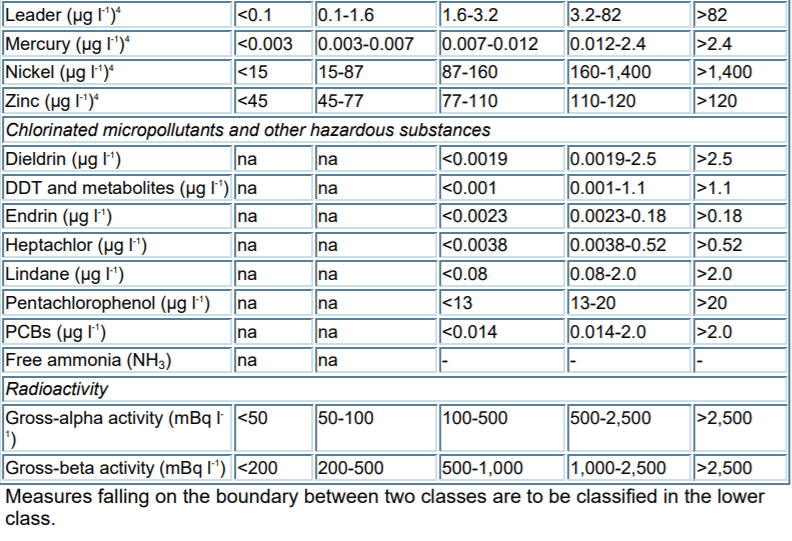


The pH value and the hardness of the water is also noted down using pH calculating sensor.

**We are following the standard water criteria given by the WHO-**

Water quality variable Quality objective (mg kg-1)

* Cadmium 1.0
* Chromium 100.0
* Copper 50.0
* Lead 100.0
* Mercury 0.5
* Nickel 50.0
* Zinc 50.0

Water Purification

By water purification, we mean removing undesired chemical compounds, organic and inorganic materials such as chloride, copper, manganese, sulphates and zinc, biological contaminants (microbial pathogens) and radioactive materials. And to also reduce the concentration of contaminants such as suspended particles, parasites, algae, viruses and fungi.

Though regular boiling and carbon induced filtration can be used to purify, it doesn’t remove many harmful chemicals.

So first we transport the water to the central location and begin the process.

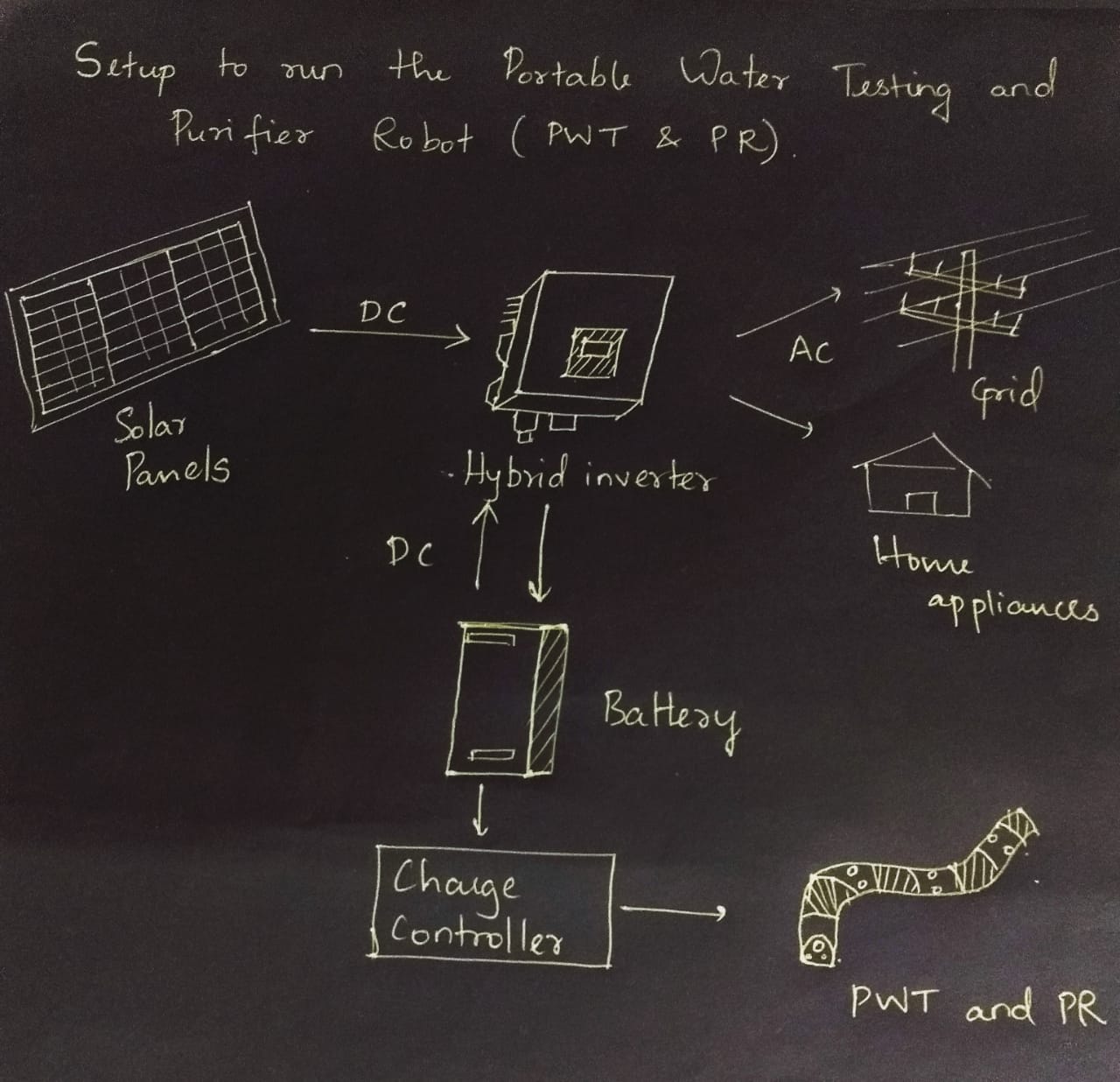
We remove the larger (visible to the human eye) debris and trash using screening. Then during pretreatment (addition of chemicals to control the growth of bacteria in pipes and tanks), the robot mixes chemical to control and destroy the bacteria.

Perchlorinating is carried out by our robot.

The hardness of the water is also removed by the robot. For that, we use sodium carbonate (soda ash) to precondition the water.

Sometimes we don’t use excessive chlorine since chlorine gas is very toxic. In that case water is treated using UV radiation, ozone, and hydrogen peroxide. Our robot generates and distributes it in the water to destroy microbes and other organic materials.

Energy used



We are using Solar Energy, convert it to electrical energy and store them in Batteries which will further be used by our Robot.

* First the Solar Photovoltaic (SPV) is used to generate the power using Sun Energy.
* Hybrid Inverter (HI) converts the input DC power to both AC and DC usable voltage and power level.
* Battery Energy storage (BES) stores the energy which can be used later by our robot.
* Charge Controller unit (CCU) charges the battery of the robot.
* Micro Controller Unit (MCU) controls the position and phase angle of the Robot.

To sum-up everything

We use the robot-

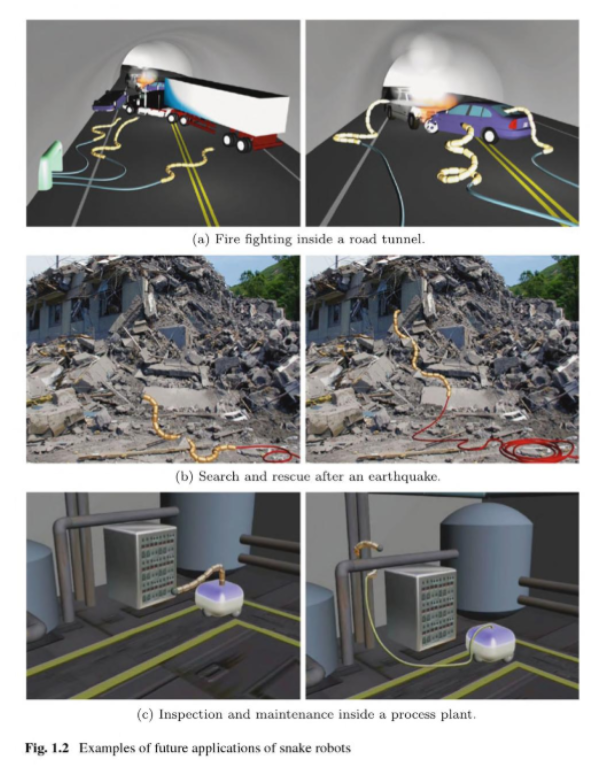
1. In testing part:

* Collect water samples from pond, well, river and sea
* Check the bacterial infection, hardness and other organic and nonorganic contaminants in the water
* Check the pH level of water

1. In purifying part:

* Perchlorinating
* Removal of hardness of water using sodium carbonate (soda ash)
* Disinfection using ultraviolet radiation, ozone or hydrogen peroxide.

Future applications of snake robot



References

* <https://www.sintef.no/en/latest-news/a-giant-subsea-snake-robot/>
* Shumei Yu, Shugen Ma, Bin Li and Yuechao Wang, "An amphibious snake-like robot with terrestrial and aquatic gaits," 2011 IEEE International Conference on Robotics and Automation, Shanghai, 2011, pp. 2960-2961, doi: 10.1109/ICRA.2011.5979869.
* <https://reader.elsevier.com/reader/sd/pii/S2213020915000622?token=DB947CC4D5F975825BB43F237D223C91CCD64844F1BFADD4516B3808A600F403C4E6ABEF7E8982F73B9882BFCB167265>
* <https://www.who.int/water_sanitation_health/resourcesquality/wpcchap2.pdf>
* <https://www.sciencedirect.com/science/article/pii/S2213020915000622>

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