

Hong Kong Student Science Project Competition 2023

Extended Abstract (Invention)

(Word Limit: 1,600 words, Pages: 3 pages only)

Team Number: SAPE038

Project Title: Qaqua- an IoT water quality monitoring station

Project Type: Invention (Type A project)

*To our best knowledge, there are/are no * similar works in the market; (if there are,) related product links are as below:*

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The enhancement our project made / the difference with related products are:

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**Please delete if not applicable. The competition values the originality of works. Students must do enough literature research to ensure that their works are unique and list relevant reference materials before starting research or invention.*

I. Background

Water pollution has always been a major problem around the world and this widespread problem of water pollution is jeopardising our health. Unsafe water destroys important food sources and contaminates drinking water with chemicals which can possibly cause immediate and permanent harm to human health.

We now propose a novel approach towards the tasks of monitoring water quality, in which we are able to conduct water quality tests and upload the collected data online automatically, by using Micro:bit and IOT:bit extension board.

By traditional methods, water specimens are collected by hand manually and tested in laboratories. If one were to collect the specific data at night, it would require manpower labor and be an inconvenience to do so. Also, traditional methods require you to go to the river to obtain data in person. Sampling water from rivers and testing it in the laboratory may lead to inaccurate results due to travel time spent.

II. Objectives

We invented Qaqua, which is an automated system which is capable of monitoring water quality. Real time reliable data is sent to an internet site, allowing people to get free access to the data collected. Qaqua can partially replace the traditional redundant workload by sending manpower to the test site, which greatly lowers the cost and significantly increases efficiency.

Qaqua is a self-powered, sustainable and automated system which is capable of monitoring water quality of rivers.

III. Methodology

First, the water pump draws water from the water source. It stops automatically when the water level meets all sensors. The four sensors (pH, Dissolved Oxygen, Total Dissolved Solid and turbidity sensor) start collecting data. The IOT bit will then upload data collected onto the Thingspeak website and it will automatically generate a graph for users to read and analyse the water quality. After that, the water pump will pump water out and wait until the next testing cycle (every 12 hours).

IV. Design of Invention

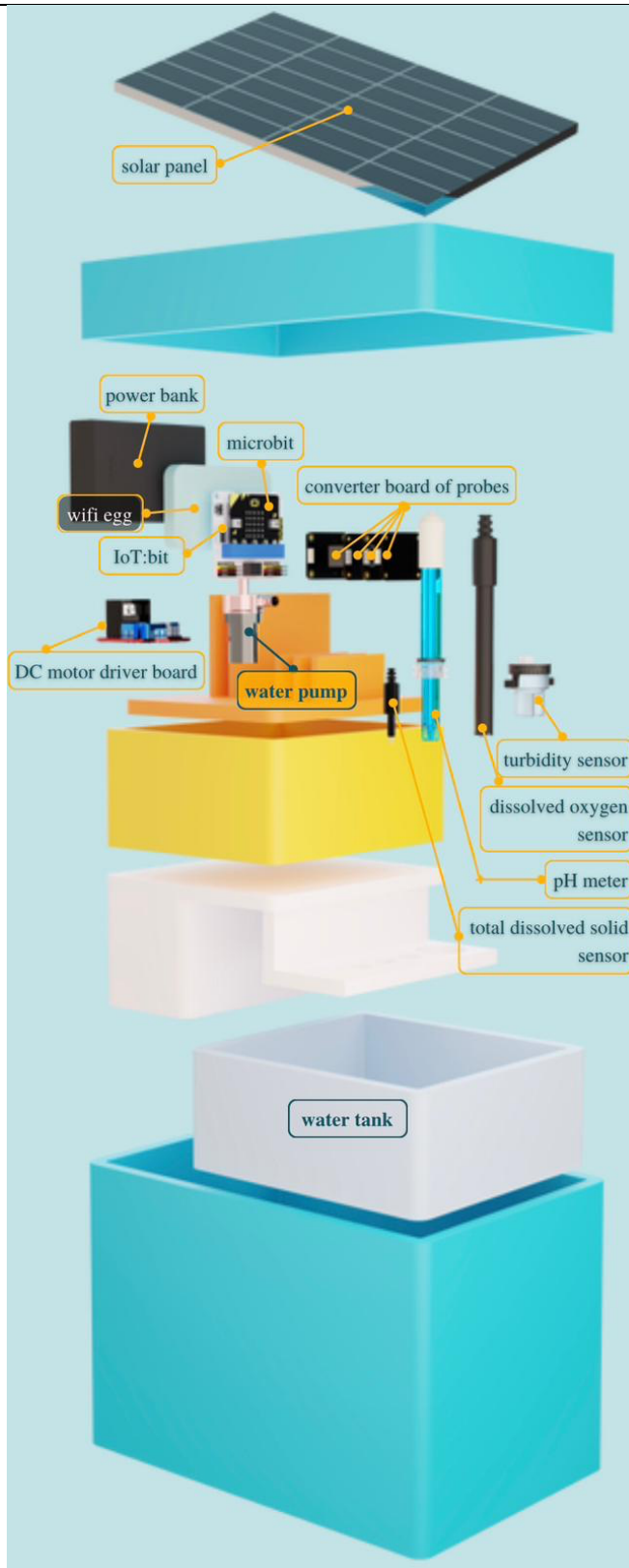


Fig. 1 Qaqua design

The IOT:bit is one of the most important parts of our machine. It is responsible for uploading the data collected by the four different sensors to a website, Thingspeak, which shows the data by plotting a graph. This solves the inconvenience of sampling river water by manpower.

Besides, another important part of our machine is the water pump. It pumps water into and out of the machine which allows our machine to be placed far away from the actual water source. Considering the fact that the

IOT:bit and other circuit boards inside the machine aren't waterproof, we have decided to use the method of pumping water in instead of actually placing the machine in the water.

V. Application / Market Need

As we know that the government is still using manpower to monitor water quality. Our machine is definitely a good substitute, Qaqua can surely be introduced to our government's project due to its cost efficiency, accessibility and accuracy.

We would also like to establish sponsorship programs with big companies. With the help of these giants, we can mass produce our machine at a cheaper price, and hence can be able to introduce our machine to third world poor countries. Since mobile phones are so popular, we can consider developing a mobile app so that the public can use it.

VI. If your team will compete the Sustainable Development Award, please indicate the specific sustainable development goal the project is related to, and provide justification for competing for this award. (Word limit: 300 words)

Sustainable development goal 6 and 14: Clean water and sanitation, Life under water.

Our design has a solar panel on its top as well as a power bank to store the energy, which is provided by solar power, which is a renewable energy source, and does not require any electricity.

Qaqua is a water quality monitoring system, it assures a convenient and reliable access to water quality index. In light of this, we can measure the fitness of water for different uses, especially for the habitat of aquatic life such as coral reefs and react to the changes immediately if necessary. Therefore, it can safeguard the stability of marine ecosystem.

VII. If your team will compete the Social Innovation Award, please list the target group or social issue the project focuses on, and provide justification for competing for this award. (Word limit: 300 words)

VIII. Conclusion

We will review the formulas and check for potential malfunctions in the probes. This is important because, in previous testing sections, some probes took a long time to reach a stable value or produced inaccurate results, which could have been due to malfunctions or errors in the formulas used to calculate the measurements. By conducting a thorough review, we can identify and correct any issues that might be affecting the probes' performance.

In the next step we will test Qaqua again with our solar panel. Ultimately we hope to test our machine in Shan Pui River in Hong Kong because it is close to the Deep Bay, which may be exposed to waste water from factories in the mainland.

*** Our project is developed based on previous project and the enhancement is below:**