Water Quality Monitoring Using IoT

IoT Innovation Challenge

Smart Water

Design Idea

The essential idea for this project is to collect significant data of the waterway for monitoring the water quality. From the analysis of the collected data, unhealthy water can be treated as soon as possible from the respective authorities. A monitoring system consisting of water capsule with sensory devices, microcontroller, and communication device is developed and the system is named as Qwater. To prolong the life of batteries, solar panel is installed on Qwater. The energy saving technique is implemented to sustain the lifespan of Qwater.

How it works

The Qwater system is used for data collection. The collected data includes water acidity (pH), water temperature, total dissolve solid (TDS), dissolved oxygen level and turbidity. A microcontroller (Arduino or Raspberry Pi) is programmed to transmit data to a gateway via cellular network. It transmits data once in every 6 hours and will remain in idle mode to conserve power consumption. The data is stored in cloud database (Google Cloud Platform) and is analysed for pre-intervention action. The results are visualized in a dashboard created using Python-based machine learning. If abnormalities occur, an alert system is triggered and the respective authorities are notified. The collected data is further employed for the water quality prediction by using Long-Short Term Memory (LSTM) Deep Neural Network algorithm.

What makes it novel / innovative/specialty

With the development of Qwater system, sensing, collecting and analyzing the 5 parameters simultaneously will produce a better monitoring system and instant remedial action. Storing data in cloud database and visualize the data in dashboard makes the water quality surveillance tasks easier and efficient as data can be traced back anytime. The system includes alert notification whenever the threshold water quality is reached. Furthermore, analysis of the data using LSTM Deep Neural Network algorithm can predict the water quality 6 months ahead in future so that preventative action can be taken. Attachment of solar panel and frequency for data transmission can extend the battery lifetime and reduce the maintenance cost and time.

How it would be produced/ manufactured

The Qwater system is made from simple and available devices. The capsule is modified from a plastic storage and pool noodle to make it floats above water. Self-made anchor is attached at the bottom of Qwater to keep it statics on the water. The sensor devices such as water pH, temperature, turbidity, oxygen dissolve and total dissolve solid (TDS) are attached in the capsule for data sensing and collection. Meanwhile, microcontroller (Arduino UNO) is used to control, collect and transmit data. GPRS/GPS module is implemented for the communication between the gateway and the cloud. The Google Cloud Platform is utilized as a database. The dashboard is created using Django.js and javascript.

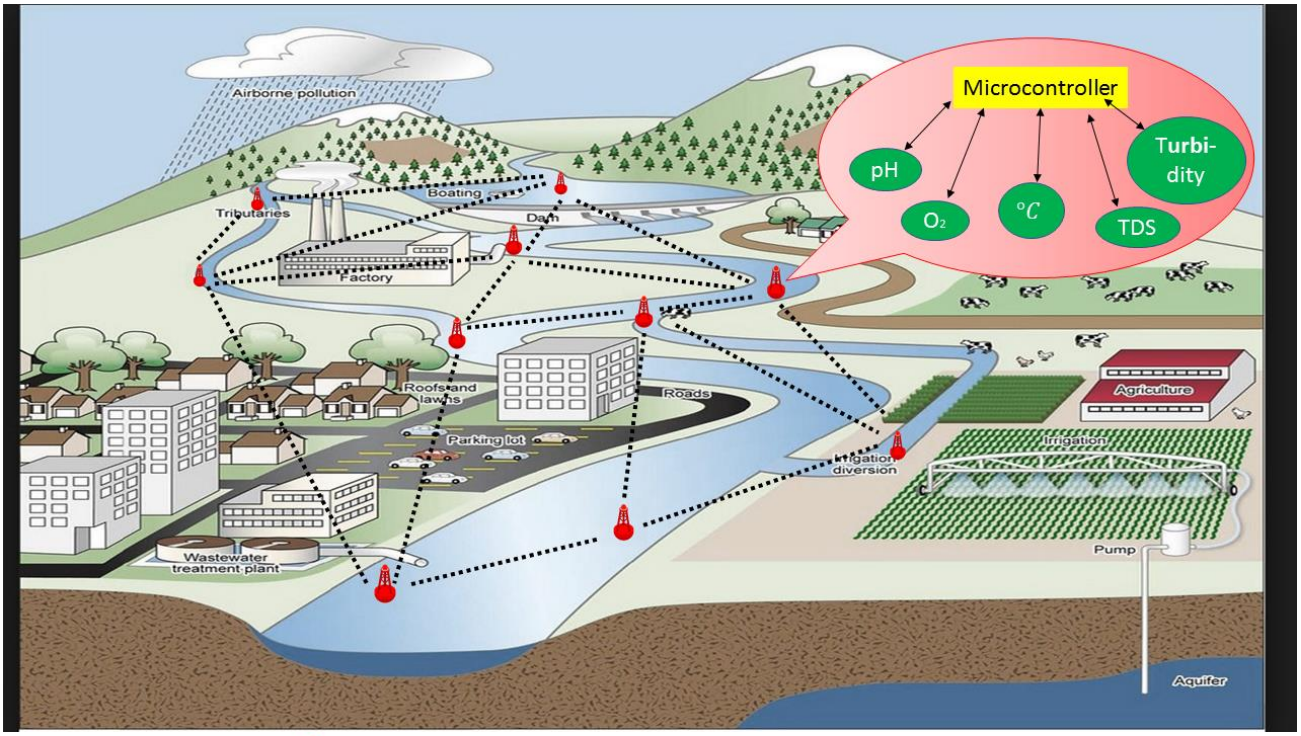
Where it would be applied

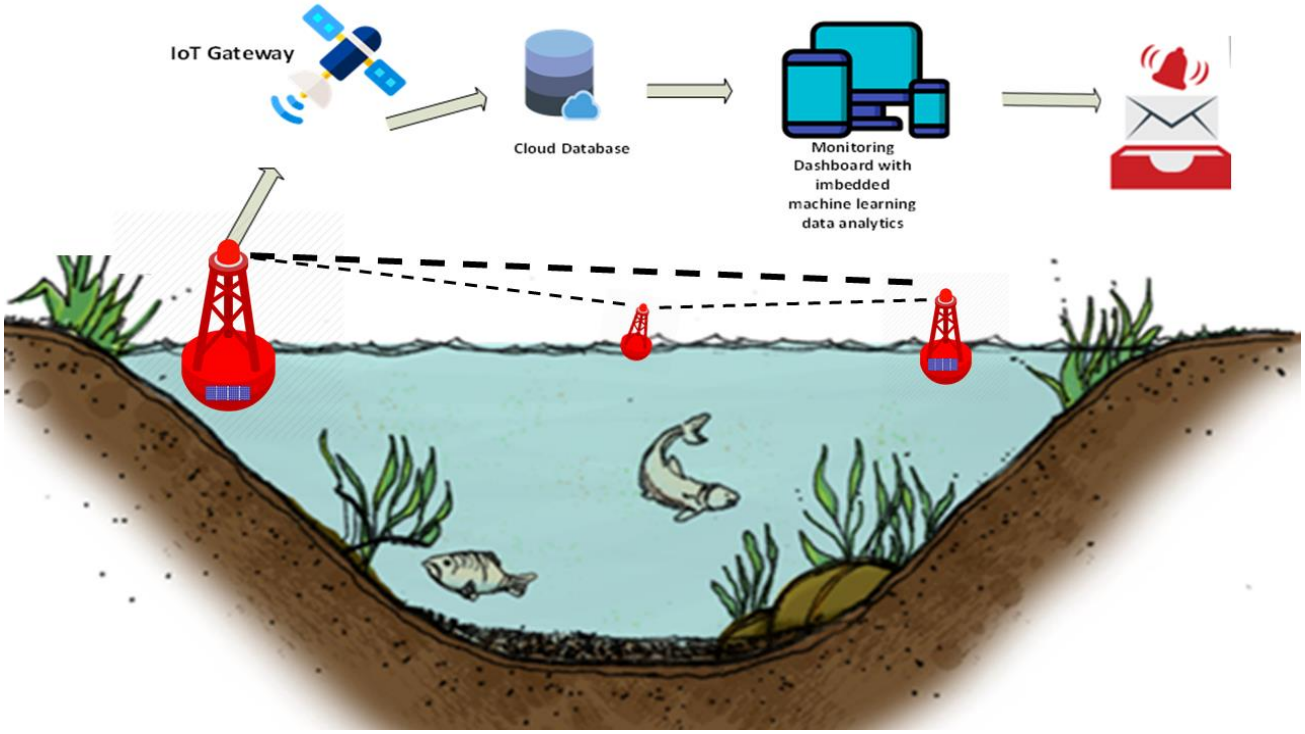
The Qwater can be deployed in major waterways such as water source from lakes and rivers. This is to ensure the source is clean and unpolluted. Qwater can be deployed at the industrial water treatment plant and reservoir to monitor and ensure the water is not contaminated before it is released into the river. The waterway near to farming, agriculture, housing and factories area are also be monitored with Qwater sensors to supervise the discharged wastewater.

Inspiration (250words)

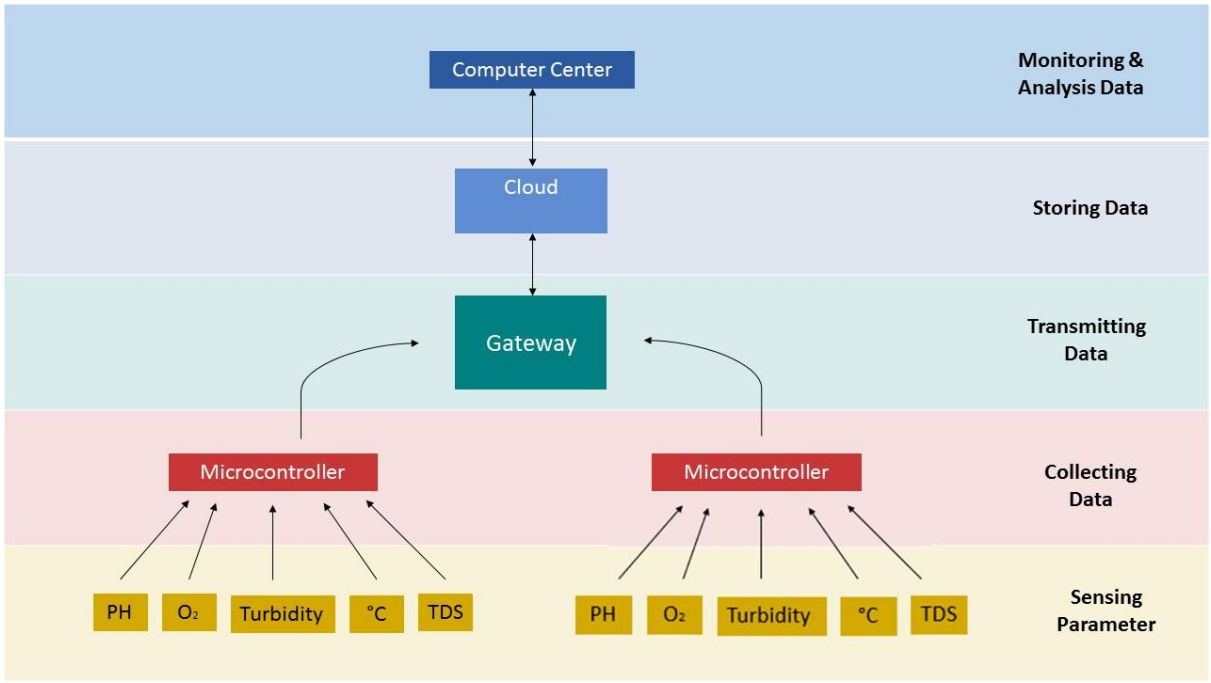
In early March of 2019, illegal dumping of chemicals into Kim Kim River located at Pasir Gudang, Johor, Malaysia, had forced the closure of 111 schools and 975 people suffering in poisoning. Based on the investigation, the chemical is suspected as delaminate which is used in tyre pyrolysis, a process of recycling old tyre. Government had spent at least RM 1 Million to solve the pollution and to help the victims. If a monitoring system had been installed, a corrective action can be done earlier to lessen the impact of the situation in terms of cost and toxicity toward the environment.

Appendix 2


Airborne pollution
Microcontroller
pH
Turbi-
dity
O₂
°C
TDS
Boating
Tributaries
Dam
Factory
Roofs and lawns
Roads
Parking lot
Agriculture
Irrigation
Irrigation diversion
Pump
Wastewater treatment plant
Aquifer


IoT Gateway
Cloud Database
Monitoring Dashboard with imbedded machine learning data analytics

Appendix 2



https://www.youtube.com/watch?v=59QTYDDVcCo&rel=0