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Semadang River Quality Detection Using Arduino.

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Semadang River Quality Detection Using Arduino.

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ABSTRACT

A section of Semadang River is gaining in popularity as the ideal spot for water sports and recreational activities such as hiking from Semadang Village to Danu Village in the upper reaches. The two settlements, about 40 km from Kuching near Jalan Puncak Borneo, place to the population of Bidayuh and have similarity in terms of tourism services with breathtaking rivers with plenty of fish, stunning caves and forest areas. The Tagang system also establishes at the Semadang River to conserve the aquatic environment along the river and some portion of the river is prohibited for fishing. Semadang also contributes to its kayaking activity as a tourist spot. Kampung Semadang leader Samson Mangang said as a popular tourist attraction, there was a lot of opportunities to develop this community. Introducing Semadang River Quality Detection system to detect water quality of Semadang River for the activity held at the river. The functionalities of this system are to monitor water flow, turbidity and pH level of the Semadang River to ensure the river is in good conditions and able for local and tourist to enjoy their activity.

ABSTRAK

Sebuah seksyen Sungai Semadang semakin popular sebagai tempat yang sesuai untuk sukan air dan aktiviti riadah seperti mendaki dari Kampung Semadang ke Kampung Danu di bahagian atas. Dua penempatan itu, kira-kira 40 km dari Kuching berhampiran Jalan Puncak Borneo, tempat penduduk Bidayuh dan mempunyai persamaan dari segi perkhidmatan pelancongan dengan sungai yang mengagumkan dengan banyak ikan, gua-gua yang menakjubkan dan kawasan hutan. Sistem Tagang juga menetap di Sungai Semadang untuk memelihara persekitaran akuatik di sepanjang sungai dan beberapa bahagian sungai dilarang memancing. Semadang juga menyumbang kepada aktiviti berkayak sebagai tempat pelancongan. Pemimpin Kampung Semadang Samson Mangang berkata sebagai tarikan pelancongan popular, terdapat banyak peluang untuk membangunkan komuniti ini. Memperkenalkan Sistem Pengesanan Kualiti Sungai Semadang untuk mengesan kualiti air Semadang Sungai untuk aktiviti yang diadakan di sungai. Fungsi sistem ini adalah untuk memantau aliran air, kekeruhan dan paras pH Sungai Semadang untuk memastikan sungai berada dalam keadaan yang baik dan dapat untuk pelancong tempatan dan tempatan menikmati aktiviti mereka.

CHAPTER 1: INTRODUCTION

1.1 Introduction

There are many villages from the Bidayuh tribe along the river and most of the villagers use the river as the water source. Many activities also being done at the river and the river could also be their transportation route for the villagers to go to their orchard. Bengoh Dam is also located nearby the Semadang river and the dam is built to secure the water supply in Kuching. Semadang river also introduces by the Tagang system to preserve the aquatic ecosystem along the river and some part of the river are restricted for fishing activity. Some of the problems that caused by nature such as the dry season the river could flow very low and affect the quality of the river to limit the activity at the river such as the Tagang Festival and kayaking activity. This problem leads not only to the villagers but also tourists postponing river activity. This can be avoided by collecting information that needed to be notified to the public to know the situation daily that activity at the river are safe to do or not. The automatic feature when the device is turn on, it will detect the water level and the pH value of the river and it will transmit the information to the public so that the people will know the water is safe for activity to be done and to avoid poor water condition for the villagers and also for the tourist. The system will also provide notice for the native to villagers that when the water is at fast current, some area of the river that boat could not get through.

1.2 Problem Statement

Water pollution has increased and become more worse in recent year. Not just in the drain or in water supply but also in the river. To ensure we have safe water not only for drinking, but also for safe for the

people to do activity along the river. A water quality detection will be able to determine whether the condition is good or not by taking measurement water flow, turbidity and the pH value of the water in some area of water. This measurement is then compared with the recommended measurement in the application. A water quality detection must show the reading of the water pollution level whether the water is safe to drink and to ensure least risk on the river while the users of the river held their activity at the river such as kayaking. The information then transmits online for the villagers, the Kayaking operator, and the tourist.

1.3 Project Description

The concept of the River Quality Detection System is to detect the turbidity, water flow and pH values of the river. These sensors will be implemented to its function using Arduino IDE and the reading of the data will be shown with mobile application. The mobile application also serves as a controller for other purposes that will be listed in Chapter 2.

1.4 Scope

Semadang River Quality Detection System is designed for the people who lived along the river and also for the people who want to do an activity at the river. Through the application on a computer and sensor attached to the Arduino board, the application is installed to the computer and it must be on Windows version.

The control of the River Quality Detection is for each measurement, only particular sensor can be used. For example, to measure the water flow of the river. This means it requires to have many sensors for many types of measurement and might require more than one Arduino board to do the computational. Other than that, the application used must be in Windows version and not available in any other platform such as IOS.

1.5 Objective / Aim

There are three objectives in developing Semadang River Quality Detection. The objective is:

- i. To propose the river quality detection system and propose a monitoring system for the Semadang River. // to study and analyse ...
- ii. To design and implement the Semadang River Quality Detection system for the user to study the data when user is notified by mobile notification.
- iii. To test that the Semadang River Quality Detection able to take the data the pH value, turbidity and the current flow of the river.

1.6 Methodology

For this project, prototyping model (Jacobson, Spence, & Ng, 2017) is implemented for developing this Semadang River Quality Detection using Arduino project. This prototype is first assembled part by part according to the requirement that use to detect the depth of the river and to detect the pH value of the water. The parts of the Arduino are first prepared and to program the device to monitor and to collect data to achieve the goal of this system. This prototype also gives the user an actual feel to the product of the system. At any stage, if the user is not satisfied with the prototype, modification can be done and a new system will be developed. The goal is to provide a system with overall functionality and fulfil usability.

1.6.1 Requirement Gathering

The prototype model starts with the requirements analysis and the requirements of the system that are specified feature. Research on Semadang River and relate on which Arduino sensors that can be implemented in the system. Discussion sessions and receiving approval from the supervisor will be done in this phase. The full documentation of this system will be prepared when approved by the supervisor.

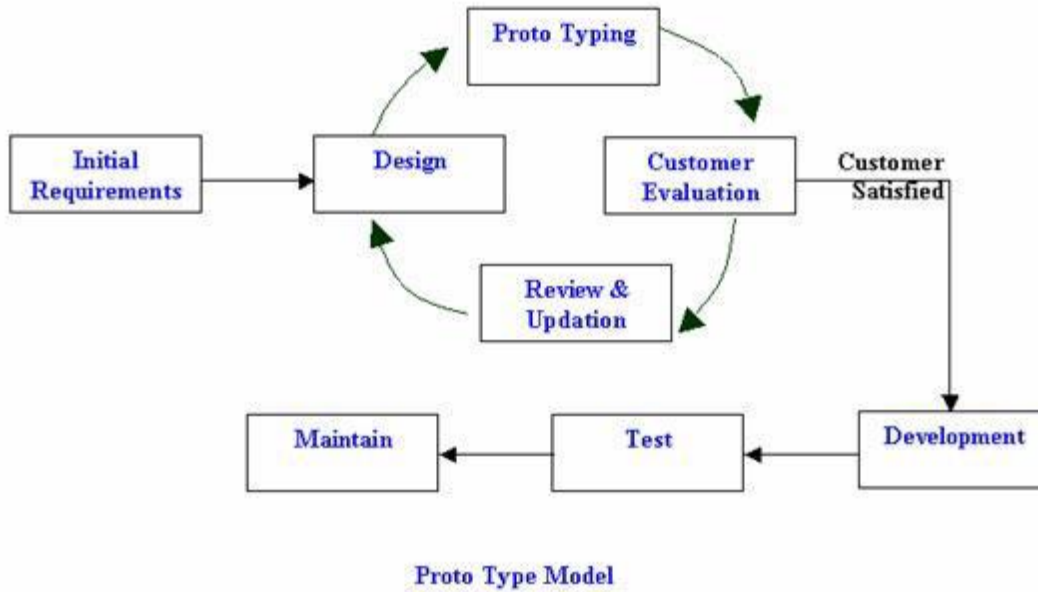


Figure 1.1: Prototyping Model (Verma, 2014)

In **initial requirements**, research will be done by gathering the relevant information from the target user for this task. In addition, work will be carried out on appropriate hardware and software to build this design.

Next is **the design phase**, in this step, the mobile application user interface is built with sketches and UML diagrams on how the chosen hardware should view the task.

For **building the prototype phase**, construction of the prototype begins with the sketches as guidance. Further details will be given on all the sensors and actuators used. In this phase, there will also be a Blynk application for this project.

In **the client evaluation phase**, a partially completed model will be demanded from the developer. The client will test the usability of the prototype according to the given test case and any improvements or concerns about the prototype will be recorded

In **the review and evaluation phase**, during this process, data collected from the client review stage will be analysed and any improvements will be applied according to the needs of the client. The model will be sent

back to the design phase. The cycle continues until the prototype satisfies the customer and an agreement has been established.

After all the phases are completed, only then the **development product phase** will be conducted. In this phase, the prototype is agreed upon the client and ready to market the real product.

Then, a **test phase** will be done to the final product to make sure all the component of the product is working and easy for the client to implement it at the river area

Finally, **maintaining phase**, this provide long term business partner to do service to the product or to make any update for the hardware and software of the product.

1.6.2 Quick Design

When all the requirement is acknowledged, a preliminary design for the system is created. It is not a detailed design but includes the important aspects of the system, which give an idea of the system to the user. For every meeting stage, the speedy structure has either upgrade or downgrade depend on the opinion of the supervisor and the user.

1.6.3 Building Prototype

Information are collected from the preliminary design is modified to form the first prototype, which represents the working model of the required system. The prototype for this system will be built stage by stage according to the latest requirements given by the supervisor. Starting date on building the prototype will be developed on FYP 2.

1.6.4 User Evaluation

The system is presented to the user, in this case, my supervisor for a detailed evaluation of the model to perceive its qualities and shortcomings, for example, what should be improved and reject. Remarks and proposals are gathered from my supervisor to actualise any adjustments in the improvement of the system. The system will be evaluated dependent on system working criteria, detailed measurement reading, and level of ease of use for user.

1.6.5 Refining Prototype

The user evaluates the prototype and if the user is not satisfied, the current prototype is improved according to the requirements. The improvement process also occurred when having a discussion with my supervisor. The new prototype will be developed with additional information provided by the user. The new prototype is evaluated just like the previous prototype. This process continues until all the requirements specified by the user are met. When the user is satisfied with the developed prototype, a final system will be developed for the final prototype.

1.6.6 Engineer Product

Once the requirements are completely met, the user accepts the final prototype. The final system is evaluated thoroughly followed by routine maintenance on a regular basis for preventing large-scale failures and minimising downtime. For this system, the final prototype will be developed and shows to the examiner during FYP 2 for final evaluation.

1.7 Significance of Project

The significance of this project are:

- i. To provide the user with information about the condition of the river to monitor and
 - a. take act if needed.
- ii. To create a good recommended condition in the river for the health of the villagers and the tourist.
- iii. To provide notice to the public either the river condition is safe for public or not.

1.8 Expected Outcome

The expected outcome of this project is the working prototype where the tourism industry can collect the data easily and save it for public use. This will allow the user to learn the pattern of the river condition in Semadang River.

1.9 Thesis Outline

Chapter 1 is mostly an introduction of the prototype of the system. It tells on how the idea for this project comes to be, the subject to be researched and the expected outcome for this project.

Chapter 2 is comparing every existing prototype with the current system work on. A comparison of strengths and weaknesses is analysed and documented. After several reviewing and comparing on other prototypes, a list of suitable components of hardware and software will be announced in this chapter.

Chapter 3 is the requirement and analysis design, for this chapter, the prototype will be developed with the methodology mentioned in Chapter 1. Requirements for this prototype will be listed during the development.

Chapter 4 is the implementation and testing, after the final prototype is developed, the prototype will be tested based on hardware and software. Bugs and error found during testing will be fixed before launching and presented towards the examiner.

Chapter 5 the conclusion for the last chapter, everything will be summarised and concluded after the project has been successfully developed into a working prototype. Every important detail of the project must be re-examining before the summarisation of the project is written in this chapter.

1.10 Summary.

The Semadang River Quality Detection system is mainly focused on monitoring for the quality of the river for the activity done at the river are safe for the people that use the river daily and also for those who wanted to go for any recreational activity along the river.

CHAPTER 2: LITERATURE REVIEW

2.1 Overview

This chapter is about the reviews on the existing system that is similar to the proposed project to Semadang River Quality Detection using Arduino. The overview about this chapter is there are three projects that are similar to my proposed project and also some of the tools are used is also will be implemented to the proposed project. Although the other three reviews are similar but there are also some differences between the other existing system.

2.2 Reviews on the existing system

The literature study on 3 existing systems which consist of Design of River Height and Speed Monitoring System by using Arduino, Water Quality Measuring Station, and Water Quality Monitoring in IoT Environment. Each systems will the discuss on the system features, strength and weaknesses.

2.2.1 Towards an IoT-based Water Quality Monitoring System with Brokerless Pub/Sub Architecture

The goal of this project is to track the quality of water within a given time and region by means of dedicated public and subscribed interaction method. The planned pub/sub approach is brokers and was designed to increase network performance in terms of low end-to-end congestion and high throughput detector with notification payload scale variability.(Pranata, 2017)

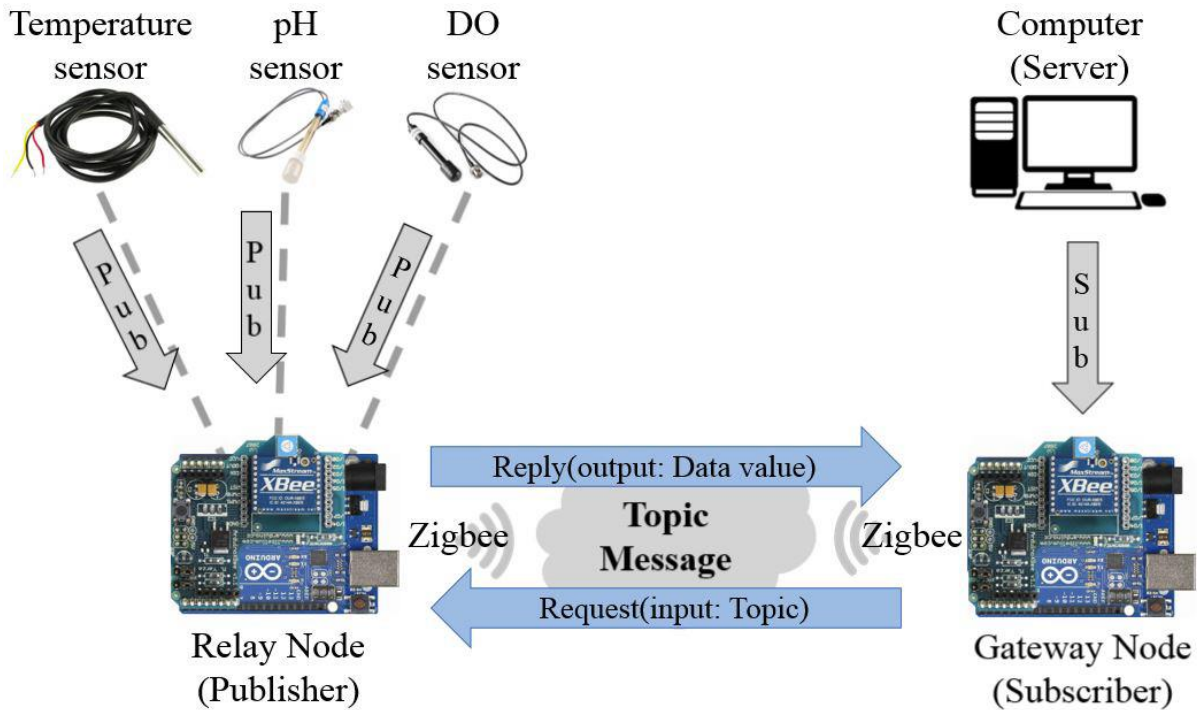


Figure 2. 1: Hardware with brokerless pub/sub architecture.

As shown in Figure 2.1, the sensors are positioned submerged inside a water container. It can also be one or more containers in various locations to find the detectors. A transmission device is mounted in each container from which the sensors read and extract the measurement information. The contact between the collection and the relay node is wired. Promptly, the transfer node transmits the calibration information of the detector to the gateway node through wireless transmission. The amount of relays and gateway nodes is presumed to be another in the current system, however more access points can be implemented to satisfy a larger surface area of device coverage as a feature of IoT.

2.2.2 Water Quality Measuring Station

May 24th 2017, Water Quality Measuring Station was made by Bishal Sigdel from Helsinki Metropolia University of Applied Sciences has carried out a project for the measurement of the quality of water that is using sensors and microcontroller. This project is focused on the pH value measurement, turbidity of water and also the temperature of the water. This system uses Arduino Serial Monitor to display the measurement of the pH value, the turbidity of the water and the temperature of the water. (Sigdel, 2017)

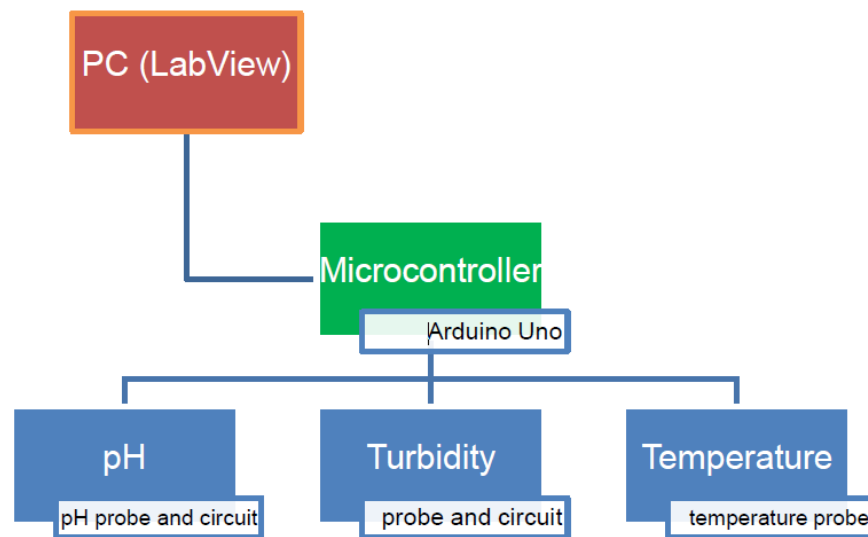


Figure 2.2: : Prototype Model of Water Quality Measuring Station

Figure 2.2 shows that the model before the prototyping is done. The Water Quality Measuring Station have slightly like the Semadang River Quality Detection with measuring the pH values and turbidity of the water. This model is using a computer to display the result of the data (LabView).

```
Turbidity: 436
Ph value: 6.94
Temperature 19.12 Deg C
```

Figure 2. 3:Result of the tap water of lab in Arduino Serial Monitor

Figure 2.3 shows the result of the tap water using Arduino Serial Monitor and state all the data include turbidity, pH value and the temperature of the tap water that has been tested. Although the project is using tap water as specimen, this method of visualisation could also implemented on the Semadang River Quality Detection to display the result of the data using the Arduino Serial Monitor.

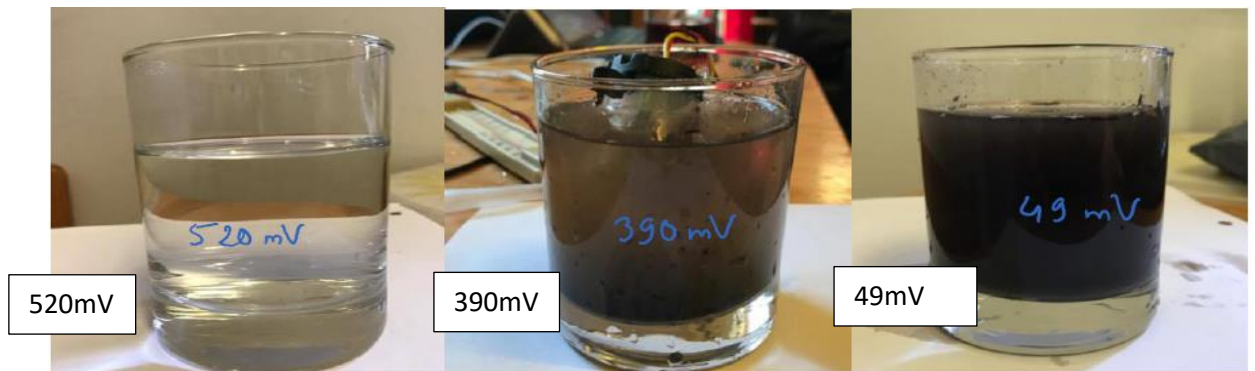


Figure 2. 4: Water with different Turbidity level

Figure 2.4 shows that the test using the turbidity sensor to show the sensor could read the turbidity of the water and to know whether it is safe to drink. With the test is shown, the could also implement on the Semadang River Quality Detection this can be implemented also as the river at Semadang changes its turbidity throughout the year and it is essential to know when along the year it is safe to do the activity at Semadang River

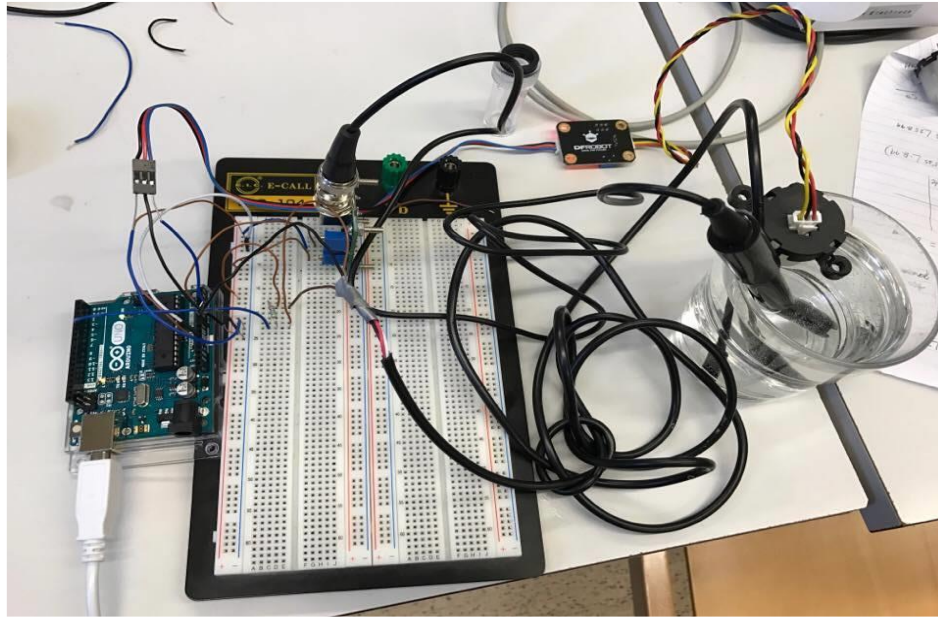


Figure 2. 5: Complete prototype in Breadboard, water Quality measuring station

Figure 2.5 shows the complete prototype of the Water Quality measuring Station. This prototype is built and also tested whether all the sensor are working to each function to avoid missed connected to the main board as the River Height and Speed Monitoring System.

2.2.3 Water Quality Monitoring in IoT Environment

This project was inspired by Bhavesh Patil and Dr. Jyothi Digge that made this project possible where the system is almost like the Semadang River Quality Detection especially on the display of the data using mobile application for the end-user. This system consists of temperature sensor, turbidity sensor, pH sensor, water level sensor, accelerometer, WiFi module and transceiver. The system is designed to monitor the water environment daily and work for disaster management such as Tsunami detection. (Patil & Digge, 2018)