. **Real Time Water Quality Monitoring System**

Abstract

Water is essential for life. Frequent water disruption in Malaysia caused turbulence in daily lives and livelihood of thousands Malaysian. The water operators in Malaysia are facing serious challenges to ensure consumers have continuous access to clean water and to ensure a sustainable water future. River pollution in Malaysia had been identified to be one of the causes of water crisis in Malaysia. Hence, a continuous monitoring system utilizing the concept of Internet of Things had been proposed in this paper. Agile model is used due to its simplicity. The water's pH measurement, turbidity, temperature and flow can be measured and the reading will be sent to end-user. The sensors that detects the pH value, turbidity, temperature and flow measurement of a water sample will pass through the information to the Arduino, and the result will be shown on the mobile devices via an app called Blynk. This portable and comprehensive prototype is suitable to be used in Smart Cities where WiFi signals is available as the transmission medium

INTRODUCTION

Water is one of the most important substances on earth. Human, plants and animals need water to survive. Apart from drinking water to survive, people have many other uses for water such as washing and recreation. It is very crucial that the drinking water is clean, clear, free of germs and chemicals. However, rapid economic development has begun to increase industrialpollution and the degradation of urban surroundings (Borhan and Ahmed, 2019) In Malaysia, 98% of the total water use originates from the rivers (Huang et al., 2015). Although Malaysia is blessed with many rivers, but large quantity of water resources available in the catchment unfortunately does not guarantee adequate supply to all users because of the river pollution (Bao, 2010). Generally, water pollution in Malaysia is caused by point and non-point sources. Point sources comprise of sewage treatment plants, manufacturing and agriculture-based industries as well as animal farms. Non-point sources are caused by activities that involve earthwork operations, logging and land clearance (Sahid et al., 2009). Department of Environment (DOE) have identified approximately 2,292 industries as significant waterpollutant sources in Peninsular Malaysia. The major potentially polluting industries were 928 (40%) food and beverage factories, 324 (14.1%) rubber producing premises and 270 (11.4%) chemical producers. Based on the distribution of water pollution sources by state in Peninsular Malaysia, the majority was found in the most industrialized states in the Peninsular Malaysia; Selangor (414), Johor (384), Pulau Pinang (328) and Perak (253) (Muyibi, Ambali, and Eissa, 2008 )METHODS The information that is needed in this project was gathered and analysed based on the related project so that the project objective and scope can be determine. Figure 1 thismethodology had been chosen to be used in this project because the resource requirements are minimum, it is suitable for fixed or changing requirements, it delivers early partial working solutions, it is a good model for environments that change steadily and it have minimal rules hence documentation easily employed see. These factors are suitable for Internet of things

Figure 1. Agile modelThe information that is needed in this project was gathered and analysed based on the related project so that the project objective and scope can be determine. Figure 1 this methodology had been chosen to be used in this project because the resource requirements are minimum, it is suitable for fixed or changing requirements, it delivers early partial working solutions, it is a good model for environments that change steadily and it have minimal rules hence documentation easily employed see. These factors are suitable for Internet of Things project

Figure 2 shows the block diagram of Real time sense water monitoring system. Arduino Uno will be used as the microcontroller for this project. The sensors needed in this project consist of pH sensor, Turbidity sensor and conductivity. Wi-Fi module is used to send the results to the smart phone via Wi-Fi. The results were sent through Blynk software where the results will be shown on the smartphone.

2.2. Hardware2.2.1. Arduinouno Figure 3 the main controller for this project is Arduino Uno. It is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. It can be simply connect it to a computer with a USB cable or power it with AC-to-DC adapter or battery to get it powered up.

2.2.2. pH sensor Figure 4 pH sensor is a device to measure the level of acidity or alkalinity of a solution, the pH scale ranges from 0 to 14. The pH indicates the concentration of hydrogen [H] + ions present in certain solutions. It can accurately be quantified by a sensor that measures the potential difference between two electrodes: a reference electrode (silver / silver chloride) and a glass electrode that is sensitive to hydrogen ion. This sensor gives an output in the form of analog signal. It requires ADC (Anolog-to-Digital Converter) before connected to the Arduino.

2.2.3. Turbidity sensor Turbidity sensor detects water quality by measuring level cloudiness/haziness in the water see Figure 5. It able to detect suspended particles in water by measuring the light transmittance and scattering rate which changes with the amount of total suspended solids (TSS) in water. As the TTS increases, the liquid turbidity level increases. This Arduino turbidity sensor have both analog and digital signal output modes. Mode can be selected according to the MCU as threshold is adjustable in digital signal mode. It needs to be connected to the ADC before connected to the Arduino

2.2.6. Wi-Fi module Figure 8 the ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware so that it can simply hook with an Arduino board and get about as much Wi-Fiability as a Wi-Fi Shield offers. The ESP8266 module is an extremely cost-effective board with a huge, and ever-growing community. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions and requires no external RF parts.

2.3. Software 2.3.1. Blynk Figure 9 is blynk a new platform that allows user to quickly build interfaces for controlling and monitoring hardware projects from iOS and Android devicedownloading the Blynk apps, user can create a project dashboard and arrange buttons, sliders, graphs, and other widgets onto the screen. Using the widgets, user can turn pins on and off or display data from sensors. Blynk supports most Arduino boards, Raspberry Pi models, the ESP8266, Particle Core, and a handful of other common microcontrollers and single-board computers, and more are being added over time. Arduino Wi-Fi and Ethernet shields are supported, though it can also control devices plugged into a computer’s USB port as well. 2.3.2. Arduino IDE Arduino is an open-source platform used for building electronics projects. It consists of both a physical programmable circuit board or a microcontroller and a piece of software, or IDE (Integrated Development Environment) that runs on computer to write and upload computer code to the physical board see Figure 10.

2.3.3. DEV-C++ Dev-C++ is a free full-featured integrated development environment (IDE) distributed under the GNU General Public License for programming in C and C++ see Figure 11. It is written in Delphi. It is bundled with, and uses, the MinGW or TDM-GCC 64bit port of the GCC as its compiler. Dev-C++ can also be used in combination with Cygwin or any other GCC-based compiler.

3. PROJECT DEVELOPMENT 3.1. Prototype design Figure 13 shows the circuit design of developing and assembling hardware for Real time sense water monitoring system. It is shown that all the components and sensors were connected to a board circuit and certain wire from the sensor were also been connected to the Arduino. The only sensors that was not connected the Arduino is the temperature sensor. Figure 14 shows all the components that have been assembled. All the sensors are shown

5. ACKNOWLEDGEMENTS This project is sponsored by the MIIT, University Kuala Lumpur.

6. AUTHORS’ NOTE The author states that there is no conflict of interest regarding the publication of this article. The author confirms that the paper is free from plagiarism. There are still many shortcomings and need further research from this article so that the resulting battery is used like a conventional battery.

. CONCLUSION The real time sense water monitoring system has been successfully developed. The system has been tested and results have been collected and presented as a picture format. Also, the system achieved its objectives whereby it can read precise data fast simultaneously. The prototype of real time sense water monitoring integrates many sensors such as turbidity sensor, temperature sensor, flow sensor and pH sensor into one and the development of this system prototype is interesting and quite unique. Developing this system's prototype utilizes a bunch of clear, inexpensive materials. There are two limitation for this project one is time consumption, This system should be operated in a long period of time due to the heat that caused from the wi-fi module and it could damage component. The other one is the system could only detect on sample at a time, even though it is time consuming, the result retrieved were instantaneous and simultaneously. Some recommendations are proposed to help the workers manage the implementation process and increase the productivity of the water monitoring system. Firstly ,the design of the prototype can be improved. A minimum and easy carry system will make the process of bringing it anywhere to test samples could be a lot easier for the administrator to do the testing. Making the design more portable and simpler in the future.