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A WIRELESS WATER POLLUTION MONITORING SYSTEM

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project and, in my opinion, this project is adequate in terms of scope and quality for the award of the degree of Computer Science(Computer Systems & Networking)

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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for the award of the degree of
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ABSTRAK

Pada masa kini, pencemaran air merupakan ancaman yang serius bukan sahaja terhadap alam sekitar dan ekologi tetapi juga memberi kesan kepada manusia. Sebelum ini, mengesan dan memantau air hanya dilakukan secara manual dengan membawa sampel dari sungai atau laut ke makmal. Projek ini mencadangkan sistem pemantauan pencemaran air tanpa wayar. Selain itu, sistem ini bertujuan agar kakitangan Jabatan Alam Sekitar memantau sungai dengan lebih cekap dan mengurangkan beban kerja semasa pemantauan. Sistem ini disepadukan dengan reka bentuk alat pengesan untuk memantau kualiti dan pencemaran di atas air. Sistem ini menggunakan Arduino R3 untuk menyokong alat pengesan. Penggunaan sensor untuk projek ini ialah sensor Ph, sensor kekeruhan dan sensor aliran air. Peranti GSM berfungsi sebagai sambungan antara sensor dan aplikasi. Sistem ini juga akan menghantar semua maklumat yang dikumpul dari alat pengesan ke applikasi web melalui internet. Kakitangan boleh memantau sungai menggunakan aplikasi web yang akan menunjukkan hasil kualiti air. Selain itu, sistem ini juga memberikan tindakan yang perlu diambil untuk mengurangkan pencemaran air yg berlaku. Kakitangan juga boleh memperoleh data yang dikumpul sebelum ini oleh system digunakan untuk analisis dan kegunaan pada masa depan. Metodologi yang dipilih untuk projek ini adalah model waterfall kerana metodologi yang jelas dan tepat. Dalam membangun system pemantau pencemaran air, Notepad++ dan Arduino Software (IDE) digunakan untuk membangunkan antara muka dan fungsi yang memenuhi keperluan pengguna. Pada akhir projek ini, diharapkan WWPMS memenuhi keperluan pengguna. Oleh itu, aplikasi ini dapat memberikan cara yang mudah untuk memantau sungai yang tercemar.

ABSTRACT

Nowadays, water pollution is a serious threat not only to the environment and ecology but also effect the human as well. Before this, detecting and monitoring water only conduct manually by bringing sample from the river or sea to the lab. This project proposes a wireless water pollution monitoring system. Furthermore, this system are purposed to the staff of Jabatan Alam Sekitar to monitor the river more efficiently and reduces the workload during monitoring. This system integrated with sensors design to monitor the quality and pollution on the water. This system uses Arduino R3 to support and generate the sensors. The sensor use for this project is Ph sensor, Turbidity sensor and Flow sensor. The GSM devices acts as a connection between sensor and web application. This system also will pass all the information gather from the sensor to the web application via internet. The staff can monitor the river using the web application that will show the result of the water quality. Others, the system also provide an action taken to reduces the pollution base on the result of the water quality. Staff also can view data collected in form of graph by the system to use it to do analysis for future event. The methodology chosen for this project is Waterfall model which is well defined methodology and precise. In developing Wireless Water Pollution Monitoring system, Notepad++ and Arduino Software (IDE) are used to develop the interface and function that meet the requirement. In the end of this project, it is expected that the WWPMS meet the user requirement. Therefore, this application can give a convenient way to monitor the polluted river.

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LIST OF ABBREVIATIONS

WWPMS	Wireless Water Pollution Monitoring System
UWSN	Underwater Wireless Sensor Network
PIC	Programmed Interface Controllers
PH	Potential Hydrogen
GSM	Global System for Mobile Communication
WiMax	Worldwide Interoperability for Microwave Access
NTU	Nephelometric Turbidity Units
DO	Dissolved Oxygen

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Water is the most important thing in human life for survival. Also, water is an essential habitation for life ecosystem. With the rapid development of industry and economy of the countries more waste from the industrial are discharged into the water such as river or sea. Water are polluted with mineral waste that come from a mine. For example Sungai Air baloi in Pontian, Johor are pollute because of the industrial waste nearby(TheRocket.com,September 26, 2014) or Sungai Telang in Pahang that are causes of mineral mining nearby the river(NEWSTRAITSTIME, Gold mining to blame for pollution in Sungai Telang). The water nearby industry zone are polluted with debris, chemicals and toxic waste. This situation might endanger the ecosystem and also to human life. The polluted river also can bring disease or death to human if no action taken to solves or reduces the water pollution.

Other than that, water pollution in Malaysia is a serious threat however this the issues are ignore and taken lightly by the authorities and people. The water pollution issues will be aware by the authorities when there is a serious case such as sickness from the people that are suspected using or drinking a polluted water. An action should be taken to prevent the water pollution by monitoring the river from being pollute especially water that are nearby industrial area. In order to detect the water is going to the polluted water area and take a sample of the water sends back to laboratory to determine the parameter of the industrial waste and the result determine the condition of water is clear or polluted. Jabatan Alam Sekitar have taken an action by placing a few telemetric stations nearby industrial area that can detect water pollution such as of the Kuantan port and Gebeng industrial site.

Therefore, this project proposes a wireless water pollution monitoring system to address the stated problem. These monitoring devices will detect a water pollution at the river with a few sensors. The PH sensor is used to detects and determine the quality of the water base on the quality index of classification that determine the water are clean or polluted. Other than that, turbidity sensor will be used to measure the suspended particles in a fluid. The sensor also measures the turbidity of fresh water on the river. The other sensor is flow sensor which is to measure the current flow of the water. Arduino devices is an electronic platform that are able to read inputs such as electronic devices and turn it to output. All of those sensors will be connected to Arduino to generate input that are collected from the sensor. The wireless pollution monitoring system will be used GSM to pass the information gather from the sensor and those data retrieve will be display on a website. The user can view the current situation and condition of the water plus the system will alert the user about what action need to take if the water is polluted.

1.2 PROBLEM STATEMENT

Nowadays, with the rapid development of technology and growth of economy more and more serious of environment arises which one of the environment pollutions is water pollution. In order to detect the pollution, the authorities will have to do manually by go to the nearby river or sea to collect sample of the water and send back to the lab to determine the amount of parameter in the water and the result will determine the water are clean or polluted. This method took a long time to determine the water quality and too much man power. This problem can be addressed by providing new devices that are portable and can be placed at anywhere.

In Malaysia, the authority that conducts and monitor the environment is Jabatan Alam Sekitar(JAS). Jabatan Alam Sekitar have taken a measure to monitor the environment by place a Telemetric station at certain places such as in Kuantan port and industrial zone in Gebeng. This station will monitor and send information about the water quality to Jabatan Alam Sekitar. The drawback of the telemetric station is that it is costly to maintain and it only places at a certain are like industrial area that are highly cost more environment pollution but water pollution also can come from mining waste or garbage disposal in water. Therefore, it is great to build a low cost water monitoring system and

can be placed nearby industrial zone, mining sites or river nearby village that uses river water as daily life basis.

1.3 OBJECTIVE

The objectives of this project are :

1. To study the required parameter of the water properties in order to determine the water quality
2. To design a water pollution monitoring system with a database and the system give further action for user based on the water condition result.
3. To build a low-cost wireless water quality monitoring sensor.

1.4 SCOPE

I. Staff

- The staff of Jabatan Alam Sekitar that are task to monitor the water quality.
- Staff obtain the information recorded by the system about the quality of the water.

II Admin

- Manage the Database

REFERENCES

Adu-Manu, K. S., Tapparello, C., Heinzelman, W., Katsriku, F. A., & Abdulai, J.-D. (2017). Water Quality Monitoring Using Wireless Sensor Networks: Current Trends and Future Research Directions. *ACM Trans. Sen. Netw.*, *13*(1), 4:1--4:41. http://doi.org/10.1145/3005719

Daud, H. (2010). Water Quality (River) Monitoring System/ Programme and Pollution Control, 1–52.

Kamble, R., Kakade, S., Mahajan, A., & Bhosale, A. (2017). Automatic Water Quality Monitoring System Using Arduino. *International Journal of Recent Innovation in Engineering and Research Scientific Journal*, 87–90. Retrieved from https://ijrier.com/published-papers/volume-2/issue-2/automatic-water-quality-monitoring-system-using-arduino.pdf

Wei, D., Liu, P., Lu, B., & Guo, Z. (2012). Water quality automatic monitoring system based on GPRS data communications. *Procedia Engineering*, *28*(2011), 840–843. http://doi.org/10.1016/j.proeng.2012.01.820

Markovic, N. (2009). Sensor web for river water pollution monitoring and alert system. *12th AGILE International …*, 1–9. Retrieved from http://www.ikg.uni-hannover.de/agile/fileadmin/agile/paper/120.pdf

Daigavane, V. V, & Gaikwad, M. A. (2017). Water Quality Monitoring System Based on IOT, *10*(5), 1107–1116. https://doi.org/https://www.ripublication.com/awmc17/awmcv10n5_24.pdf

Hu, X., Wang, J., Yu, Q., Liu, W., & Qin, J. (2008). Water Quality Monitoring System Using Zigbee Based Wireless Sensor Network. *October*, *9*(October), 1367–1370.

Borden, C., & Roy, D. (2015). Water Quality Monitoring System Design. *International Instiute for Sustainable Development*.

Barabde, M. N., & Danve, S. R. (2015). Continuous Water Quality Monitoring System for Water Resources at Remote Places, 3(3), 172–177.

P. M. Pujar, H. H. Kenchannavar, and U. P. Kulkarni, "Wireless Sensor Network based Water Monitoring Systems: A survey," *Proc. 2016 2nd Int. Conf. Appl. Theor. Comput. Commun. Technol. iCATccT 2016*, pp. 155–159, 2017.

T. I. Salim, H. S. Alam, R. P. Pratama, I. A. F. Anto, and A. Munandar, "Portable and online water quality monitoring system using wireless sensor network," *Proc. 2nd Int. Conf. Autom. Cogn. Sci. Opt. Micro Electro-Mechanical Syst. Inf. Technol. ICACOMIT 2017*, vol. 2018–Janua, pp. 34–40, 2018.