Research and Innovation in Technical and Vocational Education and Training Vol. 1 No. 2 (2021) 042-048

RITVET

Homepage: http://publisher.uthm.edu.my/periodicals/index.php/ritvet
e-ISSN : 2785-8138

Prototype of Leak Detection using Blynk Application in IoT

Muhammad Afiq Zurkifli[1], Tamil Selvan Subramaniam[1]*, Normah Zakaria[1] , Azmanirah Ab Rahman[1]

[1]Faculty of Technical and Vocational Education,
Universiti Tun Hussein Onn Malaysia, Parit Raja, 86400, Johor, MALAYSIA

*Corresponding Author Designation

DOI: https://doi.org/10.30880/ritvet.2021.01.02.005
Received 15 July 2021; Accepted 03 August 2021; Available online 28 September 2021

Abstract: Leakage, Turbidity and Water Pressure Detectors Using IoT is a prototype developed to measure the level of water performance. The problem obtained is the problem of unconsciousness of water leakage in private home areas. In addition, the problem of quality caused by water pollution ensures that the water source obtained is safe to use. Furthermore, strong water pressure problems can also result in leaks in the water tank. Therefore, the purpose of this study is to develop a prototype of leak detection, turbidity and water pressure using IoT that will detect the problem as well as send water quality to users using the Blynk application. The three objectives of the study set are to design, develop products and test the prototype functionality of Leak Detector, Turbidity and Water Pressure Using IoT. The development of this prototype is based on the Design Thinking model which has five main phases namely empathy phase, defining phase, idea phase, prototype phase and testing phase. This model was chosen because it is an effective way of problem solving and very helpful in the development of prototype development. Based on the engineering analysis made, the water quality detector will detect whether the water is unconscious, and the problem of quality caused by the water source obtained is safe to use. In addition, raindrop detectors will detect water leaks in the event of a leak. While a water pressure detector will detect water for high and low water levels. Overall, the prototype produced has successfully met the objectives and the analysis made successfully demonstrates the functionality of this prototype.

Keywords: Leak Detection, Iot, Blynk, Design Thinking, Water Performance

1. Introduction

The great contribution of water to economic productivity and daily life is rarely appreciated even though all social and economic activities depend entirely on water supply and quality (Allen, 2012). With the increase in population as well as economic activities, many countries face economic development that is nearing its limitations. Demand for water supply has been steadily increasing over

Corresponding author: tselvan@uthm.edu.my

the past 10 years with a rate of 70 per cent required for drainage, less than 20 per cent for industrial and 6 per cent for domestic use. (Bakar, 2000).

Water leakage is a common issue in Malaysia. Apart from that, water leaks are also common in residential areas or in the house itself. Usually leaks occur on the pipes in the house and cause unconsciousness when there is a water leak on the pipes in the house. This case was detected when the water bill soared during the month because it did not know that the pipes in the house were leaking. This case of leakage occurs because the connection between the pipes is not well connected or the pipes outside the house are exposed to hard or sharp objects. This is because the pipes outside the house are usually planted and it is not noticed by the owner of the house. If the leak is only small, then the water petals cannot be detected because the water is too little. But if it continues for a month, it can result in very high-water bill. On the other hand, if a large water leak occurs, then a lot of water petals or water flow will be detected, and the location of the leak is also easy to identify in advance.

Water pressure is also one of the causes of water leakage. Among the common causes for home water pressure problems can be pressure regulators. A pressure regulator is a control valve that reduces the input pressure in the piping system to a safe level that will not damage the pipe. When the pressure controller fails, there will be an effect on all the pipes in the house, and it will happen suddenly. Although stress regulators can sometimes be replaced with the same brand and size, in most cases it is best to call a professional to manage them (Basori, 2018).

Although most water quality problems, especially in rural areas in developing countries (Beetz, 2015) are related to bacteriological contamination or other contaminants. A large number of very serious problems may occur as a result of contamination of water resources from chemicals. Therefore, a product needs to be developed to detect the level of turbidity of the water.

The literature review has provided a lot of information to researchers in the process of developing a prototype for leak detection, turbidity and water pressure using IoT (Badri et al. 2018). Thus, this study serves to identify problems, needs and solutions in the process of producing a prototype. Product development is a way in which it is developed based on the problems encountered. In addition, product development is developed by improving existing projects by adding functions to facilitate users. Table 1 shows the results of previous prototype.

Table 1: Result of previous prototype

Researcher's Name and Project's Title	Objective	Result
Elias Farah, Isam Shahrour Smart Water for Leakage Detection: Feedback about the Use of Automated Meter Reading Technology 2017	Preparing clear usage patterns that can help customers track and control their water consumption and repair active leaks targeting and leak detection capabilities.	Allows to measure water consumption with increased accuracy. Leak detection capabilities began to develop. Leaks in the customer side of the meter can be identified by analyze usage profiles; alerts can be sent by email or SMS message.
Muhammad Arman Uddin Mohammad Mohibul Hossain Akil Ahmed Hasibul Hasan Sabuj Samin Yasar Seaum Leakage Detection in Water	To determine the continuous water leakage this project is proposed which uses two water flow sensors	The project uses water flow sensors as they are effectively accessible on the market, providing exceptional productivity and ingenuity. The detected sensor information is entered remotely on the Arduino UNO microcontroller where pressing is complete.

Pipeline Using Microcontroller 2019		
Anuj Purwar, Mohit Patel, Mohit Garg, Karan Ahuja Novel Approach for Water Leakage Detection and Localization 2018	Develop and implement system monitoring water where automation is done using sensor data for the quantity of water supplied from the main tank to various tanks with an efficient leak detection system in supply lines.	Water flow sensor that detects water leakage in stages. Pipeline leakage tests are performed on each the sensor and data hubs are then transferred to the Arduino UNO microcontroller for further procedures. The results of this proposed strategy can be achieved differently water flow readings with sensors.

2. Methodology

The Design Thinking model was chosen because it is an effective way of problem solving and very helpful in the development of prototype development (Chatigny, 2012). The production of prototype that run well and are widely accepted depends on the selection of the implementation phase of the project completion. In developing a prototype of leakage, turbidity and water pressure detectors using IoT, it requires five main phases namely:

(i) Empathize phase

In this initial phase, the initial research analysis is done to identify the problems that occur, and it is done to determine the direction and objectives of the study model developed. Knowledge related to what users do, say and think is important to identify problems that occur. The method used in this phase is by observing, interviewing users, reading articles or journals and engaging with problems encountered in the context of the user's daily life.

(ii) Define Phase

This phase the researcher combines the findings of previous studies and observations are made based on the problems faced by the users. Problem statements were identified through analysis using the 5W1H technique. Once user needs are identified, study objectives are set and planned according to project simulations.

(iii) Ideate Phase

This phase the researcher uses the brainstorming method which is to think of thoughtful and creative ideas in producing a new simulation that meets the needs of the user based on the information obtained in the Define phase. This phase takes quite a long time because various things need to be taken into account and emphasized. Among them are simulation functionality, improvements from previous projects, and components used.

This ideate phase is a combination of understanding of problem space and ideas in producing solutions to users. For the initial start of product design, several solutions are provided so that the selection to get the best solution. In this phase, the process of brainstorming ideas and generating creative ideas to develop a product that can solve consumer problems systematically and effectively. Therefore, to illustrate the idea, a final sketch is provided to explain the product developed.

(iv) Prototype phase

In this phase, the researcher has developed software and development prototype for water leakage, turbidity sensor and pressure sensor. This phase also the researcher has planned the layout of the components used to be connected into the NodeMCU and Blynk functionality is good. Figure 1 shows the prototype.

Figure 1: Prototype

In this phase, the researcher has finished the prototype to testing the functionality of this prototype. Based on the engineering analysis made, the water quality detector will detect whether the water is unconsciousness and problem of quality caused by water source obtained is safe to use. In addition, raindrop detectors will detect water leaks in the event of a leak. While water pressure detector will detect water for high and low water levels.

(v) Test Phase

The testing process is done to test the functionality of the simulation to ensure that product development objectives can be achieved. Expert verification related to the overall production of simulations needs to be done to further strengthen the project implemented. Four experts from electronics and electrical have been selected to evaluate the project. Figure 2 shows the schematic circuit.

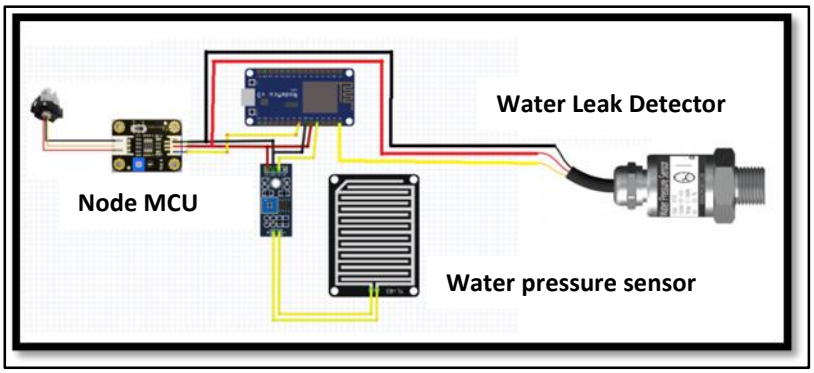

Figure 2: Schematic circuit

In this schematic circuit contains three different sensor that is raindrop sensor module, turbidity sensor module and water pressure sensor. In this circuit, NodeMCU is a main component to connect the input and output for this prototype.

3. Result and Discussion

In this section, there is a feedback given by three experts when evaluating the overall prototype that has been developed. This analysis is also known as the evaluation phase because the specialist will evaluate the effectiveness of the prototype that has been developed.

In this analysis, based on feedback received and confirmed by experts. Expert evaluation is done using a questionnaire has three parts namely:

a) Design aspects
b) Aspects of suitability
c) Functionality aspects

3.1 Design aspects

The design aspect of prototype development for Leakage, Turbidity and Water Pressure Detectors using IoT have five things. Table 2 shows the evaluation of the design aspects that have been carried out.

Table 2: Design aspects

Num.	Things	Yes		No	
		Num.	%	Num.	%
1.	This prototype has a user-friendly design.	3	100	0	0
2.	This prototype has a neat and orderly arrangement of components.	3	100	0	0
3.	Selection of suitable materials and hardware to use on this prototype.	3	100	0	0
4.	This prototype is safe for users to use.	3	100	0	0
5.	This prototype is not too heavy and portable.	3	100	0	0

In the conclusion, from the findings of the questionnaire, the three experts agreed with the developer in terms of design aspects.

3.2 Aspects of suitability

The assessment of suitability aspects lies in part B of the questionnaire. In this section there are four things to evaluate the suitability aspects of the Leakage, Turbidity and Water Pressure Detectors Using IoT. Table 3 shows the evaluation of suitability aspects.

Table 3: Evaluation of suitability aspects

Num.	Things	Yes		No	
		Num.	%	Num.	%
1.	This prototype meets the needs of consumers	3	100	0	0
2.	The use of this prototype can make it easier for users	3	100	0	0
3.	The operating system is easy to operate	3	100	0	0
4.	The size of this prototype is suitable to be shown to the user as an example	3	100	0	0

In the conclusion, from the findings of the questionnaire, the three experts agreed with the developer in terms of suitability.

3.3 Functionality aspects

The functional aspect of prototype development for Leakage, Turbidity and Water Pressure Detectors Using IoT has five things. Table 4 shows the evaluation of the functional aspects that have been carried out.

Table 4: Evaluation of the functional aspect.

Num.	Things	Yes		No	
		Num.	%	Num.	%
1.	This prototype demonstrates its full functionality.	3	100	0	0
2.	The display of the Rain Drop Sensor on the blynk signals a leak	3	100	0	0
3.	The display of the Turbidity Water Sensor on the blynk shows a murky water signal if the water is not clear.	3	100	0	0
4.	The display of the Water Pressure Sensor on the blynk shows low water pressure at low water level and high-water pressure in case of high-water level.	3	100	0	0
5.	This prototype was developed into a real product.	3	100	0	0

In the conclusion, from the findings of the questionnaire, shows the three experts agreed with the developer in terms of functionality.

4. Conclusion

Overall, this prototype Leakage, Turbidity and Water Pressure Detectors Using IoT product achieves the set objectives. All components work well, and the detector can respond in detecting water leaks, water turbidity and water pressure. Most importantly, the NodeMCU component is the most important component to notify users using the Blynk application used via smartphones. The display on the Blynk also shows a clear reading of the function of each detector. Thus, the developed product meets the specifications set in the objective.

Acknowledgment

The authors would like to thank the Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia for its support.

References

Allen, R. C. (2012). The British industrial revolution in global perspective. In *The British Industrial Revolution in Global Perspective*. https://doi.org/10.1017/CBO9780511816680

Anuj, P., Mohit, P., Mohit, G., Karan, A. (2018). Novel Approach for Water Leakage Detection and Localization.

Badri, A., Boudreau-Trudel, B., & Souissi, A. S. (2018). Occupational health and safety in the industry 4.0 era: A cause for major concern? *Safety Science*, *109*(May), 403–411. https://doi.org/10.1016/j.ssci.2018.06.012

Basori, B. (2018). The Evaluation of Occupational Health and Safety (OHS) Implementation in Vocational High School Workshop, Surakarta. *201*(Aptekindo), 121–125. https://doi.org/10.2991/aptekindo-18.2018.27

Beetz, M., Bartels, G., Albu-Schaffer, A., Balint-Benczedi, F., Belder, R., Bebler, D., … Worch, J. H. (2015). Robotic agents capable of natural and safe physical interaction with human co-workers. *IEEE International Conference on Intelligent Robots and Systems*, *2015-Decem*, 6528–6535. https://doi.org/10.1109/IROS.2015.7354310

Chatigny, C., Riel, J., & Nadon, L. (2012). Health and safety of students in vocational training in Quebec: A gender issue? *Work*, *41*(SUPPL.1), 4653–4660. https://doi.org/10.3233/WOR-2012-0104-4653

Elias, F., Isam (2017). Smart Water for Leakage Detection: Feedback about the Use of Automated Meter Reading Technology.

Muhammad, A.U., Mohammad, M, H., Akil, A., Hasibul, H, S., Samin,Y,S. (2019). Leakage Detection in Water Pipeline Using Microcontroller.