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Water Level Precision System Using IoT Enabled Sensing Technology

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Abstract: Precision refers to the amount of information that is conveyed by a number in terms of its digits. It shows the closeness of two or more measurements to each other. It is independent of accuracy. For this system, two ultrasonic sensors are used to determine the reading of the water level. The author intends to show the closeness value of the water reading when there are two values from two sensors by placing two sensors. Next, solar energy is a process of converting light to electricity (voltage), called the photovoltaic (PV) effect. Currently, solar panels convert most of the visible light spectrum and about half of the ultraviolet and infrared light spectrums to usable solar energy. This project uses solar energy as the main supply to transfer the energy to the load and was created to monitor the water level, the error value of the sensor, and notify the user when the water level is at an undesirable level using the Blynk application. Aside from that, improving data transmission and monitoring by implementing an IoT-enabled Blynk application is one of the project's goals. By using the Blynk Application, the data transmission can be transmitted smoothly, and the user is able to monitor the level of water anytime and anywhere, as long as there is an internet connection. Next, to examine the precision of two sensor data sets, a suitable formula is used to show the error value for sensor 1 and sensor 2. This is to ensure the accuracy of the water level in the flood-prone area.

Keywords: Precision, PV Solar, Water Level, IoT, Ultrasonic Sensor

1. Introduction

Despite the fact that conventional energy supplies are starting to run out, the world's daily demand for electricity keeps rising. Furthermore, conventional energy sources will eventually run out. Therefore, it is time to look for an alternate energy source. Renewable energy sources are a top contender for the role of "best alternative energy source." Solar energy stands out for being both cost-effective and non-intrusive to the environment, given the vast quantities of energy produced by the sun. Due to the universal availability of sunlight and the fact that it has no negative environmental impact, the solar energy industry is experiencing rapid expansion.

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The photovoltaic (PV) effect describes the mechanism through which sunlight is transformed into usable power. At present, solar panels can harness the sun's energy from around half the ultraviolet and infrared spectrums, in addition to the entire visible one. To power the load, solar energy is being used as the primary source in this project.

Next, precision refers to the amount of information that is conveyed by a number in terms of its digits. It shows the closeness of two or more measurements to each other. It is independent of accuracy. For this system, two ultrasonic sensors are used to determine the reading of the water level. The author intends to show the closeness value of the water reading when there are two values from two sensors by placing two sensors.

Other than that, this project is using the Internet of Things (IoT) to perform monitoring on the output value, such as the distance of water, calculate the error value of the distance of water, and give notification to the user when the water level is at an undesirable level. When the water level is at an undesirable level, it will flood. Floods have various effects on people, the environment, animals, and so on when they happen. Floods cause property damage, deaths, hypothermia, mental and emotional stress, and more. By building a real-time, reliable water level monitoring system, it is crucial to monitor a more accurate output value from time to time, monitor the value from a distance, and give notification when floods occur.

This project will discuss the development of a water level precision system using IoT-enabled sensing technology. For the development of the project, a waterproof ultrasonic sensor is used to monitor the water level, and a real-time clock (RTC) is used to turn the sensor on and off at the desired time.

2. Literature Review

According to previous study, the researcher made use of a rain sensor module as well as a water level sensor. The water level sensor, which may also be referred to as a float sensor, is used to determine if the water level has grown or decreased in relation to the amount of resistance present. It is made up of a float that is attached to a potentiometer. Next, the rain sensor module analyses the amount of precipitation that has fallen as well as its presence. The module functions as a switch whenever a raindrop lands on the rainy board. It has components such as a potentiometer (which may be used to alter the sensitivity) and an LED (power indicator). The ease of having a separate rain board and control board may be seen here. It creates what is known as the analogue output [1]. From another study, the author also used water level sensor. The continuous flow of water or other liquid content in a water system may be measured with the use of sensors that monitor the water level. These sensors have a wide variety of applications, including usage in water tanks, water-level indicators, water-level alarms, and other similar devices. This sensor has an expected lifetime of 15 years under normal conditions. This sensor will not get less accurate with time. GND and VCC are the only components that make up this sensor's circuit. This sensor detects the amount of water present and either activates the pump or sets off an alert that is produced by a buzzer [2].

Next, from another research, the author has created a website that allows anybody with a device that can connect to the internet to read all the information that they have compiled on the flood. Downloading the mobile app or using a web browser on a mobile device gives authorized users access to the real-time monitoring dashboard, where they can examine the current state of the water. The information on the flood is also available on a mobile app, which allows users to get notifications and observe the development of the flood over the course of time[3].

From previous study, Arduino Uno microcontroller board based on ATmega328 has been used. An ATmega 328 serves as the system's mainboard, and it is responsible for controlling all of the other components that are connected to it. The information obtained from the sensor is then sent to an Arduino microcontroller for processing, after which it is displayed on an LCD screen. In addition, the data that has been measured is sent from Arduino to a web server via the SIM900. Every three minutes, the data that was captured on the platform reflecting the water level is updated[4]. Another researcher also has used Arduino Uno as a microcontroller. In this study, a microcontroller board called Arduino was utilized. The configuration process for this device is completed by connecting it to a computer through USB. A connection was made between the sensors and the Arduino Uno, and XBee was used to transfer the data[5].

3. Materials and Methods

3.1 Water Level Precision System using IoT enabled Sensing Technology Block Diagram

The solar charge controller manages the voltage and current from the solar panel to the battery to prevent overcharging. The project uses the Internet of Things (IoT) to follow the ultrasonic sensor's distance and error readings and alert people of floods. This project describes the Water Level Precision System's monitoring system, which employs an Arduino Mega as its main controller. The ultrasonic sensor's output will be saved in the Blynk application as an IoT implementation as part of the project's development. The hardware must be tested to ensure it functions properly. Identify and fix the issue if it doesn't work. Figure 1 shows the IoT-enabled Water Level Precision System block diagram.

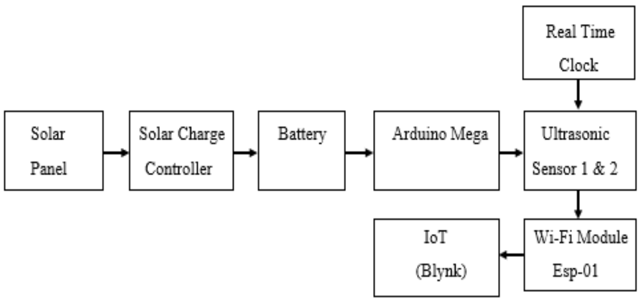

Figure 1: Block Diagram for Water Level Precision System using IoT enabled Sensing Technology

3.2 Methods

As providing notification alerts is an important aspect of this project, Figure 2 shows how a notification will be provided when the water level exceeds an undesirable level.

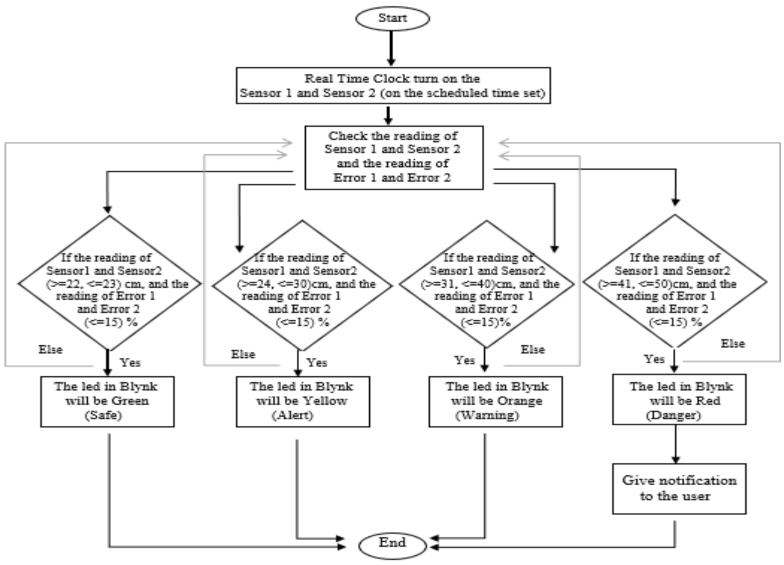

Figure 2: How Notification Alert will be sent to the user

A formula is used to determine the error value. When the value of distance 1 is greater than the value of distance 2, the error will be utilizing a formula $(\frac{\text{Sensor 1}-\text{Sensor 2}}{\text{Sensor 1}})$ x 100%. Whenever the value of distance 2 is found to be greater than the value of distance 1, the error will be computed by utilizing a formula $(\frac{Sensor\ 2 - Sensor\ 1}{Sensor\ 2})\ x\ 100\%$. The formula was used to examine the precision of two sensor for ensuring the water level accuracy of the flood prone area.

3.3 Hardware Setup

Several key components are needed to construct this project's hardware monitoring system. First, the Arduino Mega board was the system's major component. The Arduino Mega board contains all sensor and real-time clock code. Second, the sensor and RTC will be linked to Arduino Mega board analog and digital pins. Water distance is measured by ultrasonic sensors. Use the Arduino Mega board to read each sensor after connecting. The Wi-Fi module Esp-01 replaces the Arduino Mega board and controls the monitoring system. Once the Wi-Fi module is linked to the internet, it periodically updates the Blynk platform and application with sensor readings. Figures 3, 4 and 5 show how all the components has been set up

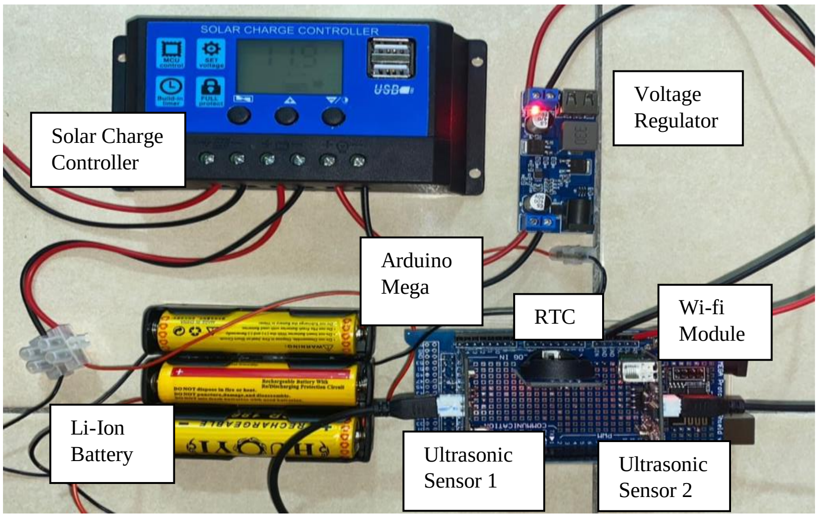

Figure 3: Connection of the components

Figure 4: Sensor 1 and Sensor 2

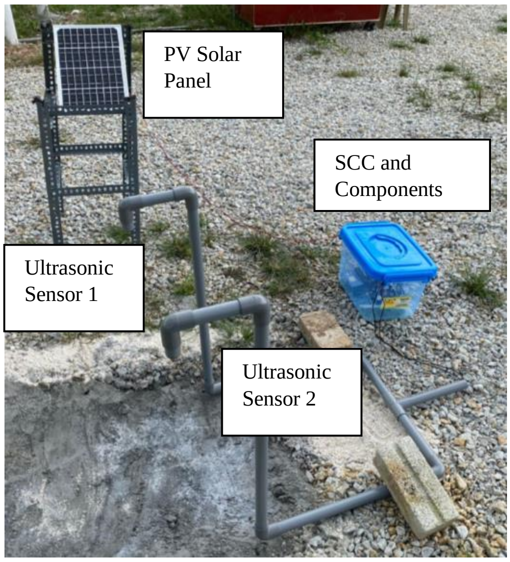

Figure 5: Connection between PV Solar Panel to SCC to the load

4. Results and Discussion

Figure 6 shows Blynk Application's output on the Water Level Precision System on January 7, 2023. System results are recorded from 15.56 p.m. to 16.32 p.m. Due to a sunny day, this data was collected by using a water tank to measure the distance of the water. When there is a flow of water, the sensor will read from 22 cm. The results show that the sensor was able to take a reading of the distance of the water. To get the distance value, water was added bit by bit at various points throughout the process. The graph can indicate that there is not a significant difference in the value produced by sensors 1 and 2, despite the fact that there is water flow. Both sensors are able to deliver reliable readings, and the readings between them are precise. The sensor can measure the distance between two bodies of water and display the error value. It may also notify the user through an LED on the Blynk App when the water level rises to 41 cm to 50 cm and the error value for both sensors is less than 15%.

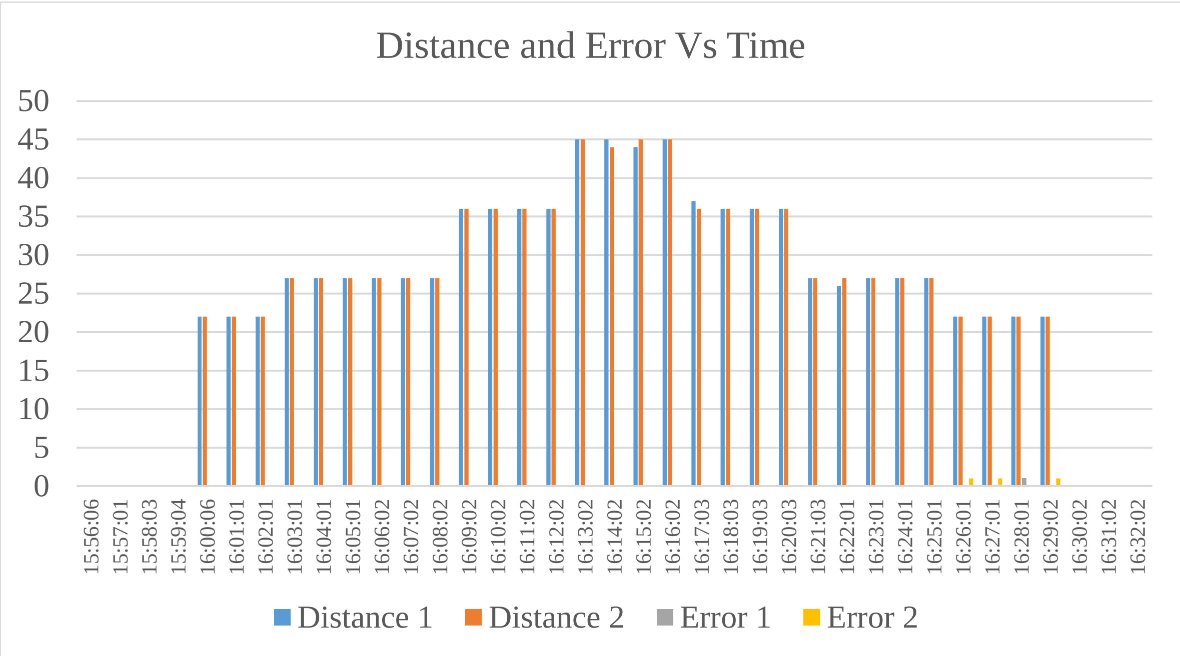

Figure 6: Distance and Error Vs Time

The data that is shown on the graph in Figure 6 and is now being presented on the screen receives an update every minute. It is able to increase the quantity of data that is transmitted by the sensor because of its utilization of Blynk. Aside from that, the fact that the Blynk has been configured to only give an integer number output indicates that the outcome displays a more precise value between the sensors.

The green LED should light up when sensors 1 and 2 are between 22 and 23 cm and errors 1 and 2 are less than 15%. Figure 7 activates the green LED and "safe" message. Both sensors are 22 cm from the water source, and the error value is 0%, which is less than 15%. This confirms data collection

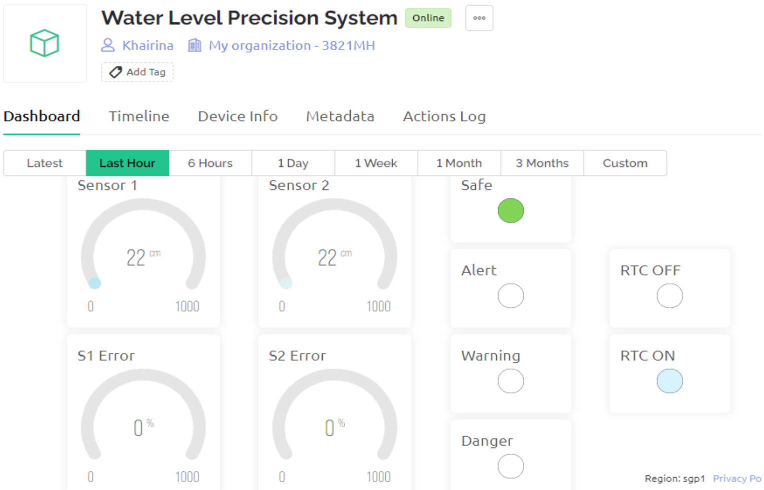

Figure 7: Green LED is on

The yellow LED should light up when sensors 1 and 2 read 24–30 cm and errors 1 and 2 read less than 15%. Figure 8 shows the "alert" message and yellow LED on. The water is 25 cm from both sensors, and the error value is 1%, less than 15%. Data was received.

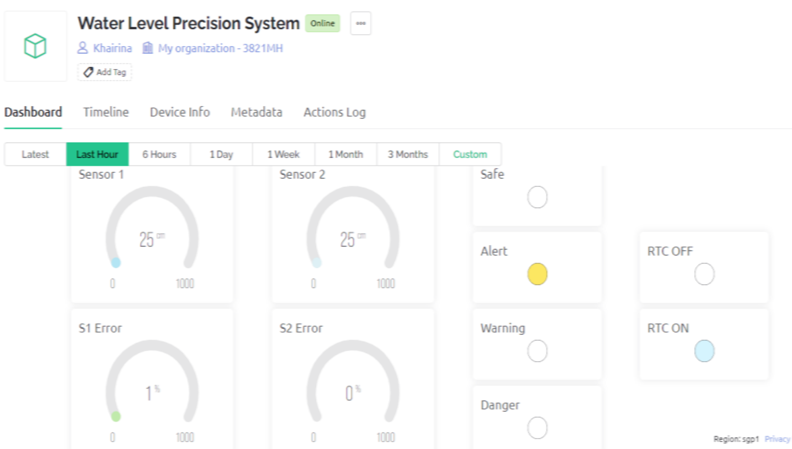

Figure 8: Yellow LED is on

When both sensors detect distances between 31 and 40 cm and their errors are less than 15%, the orange light bulb should switch on. Figure 9 shows "warning" with an orange LED. The sensors are 31 centimeters from the water, and the 1% error value is less than 15%. Thus, information was transmitted.

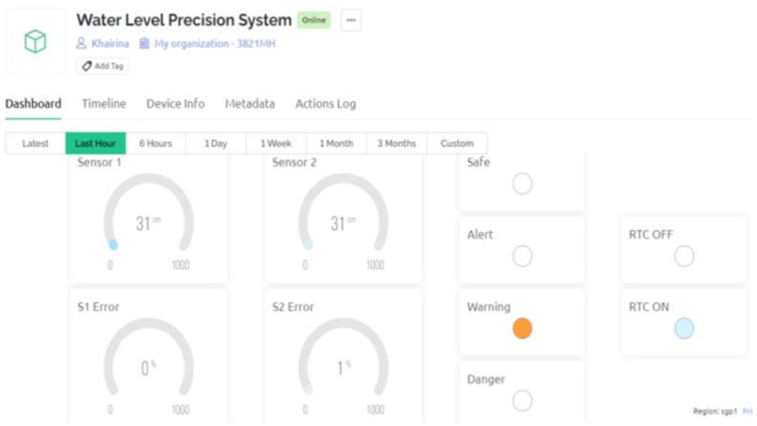

Figure 9: Orange LED is on

The red-light bulb and notification should turn on when both sensors report distances between 41 and 50 cm and the sum of their inaccuracies is less than 15%. When these conditions are met, it will notify the user. Figure 10 and 11 shows a "danger" situation with a red LED and user notification. This is most likely because the water is 42 centimeters from the sensors and the 0% error value is less than 15%.

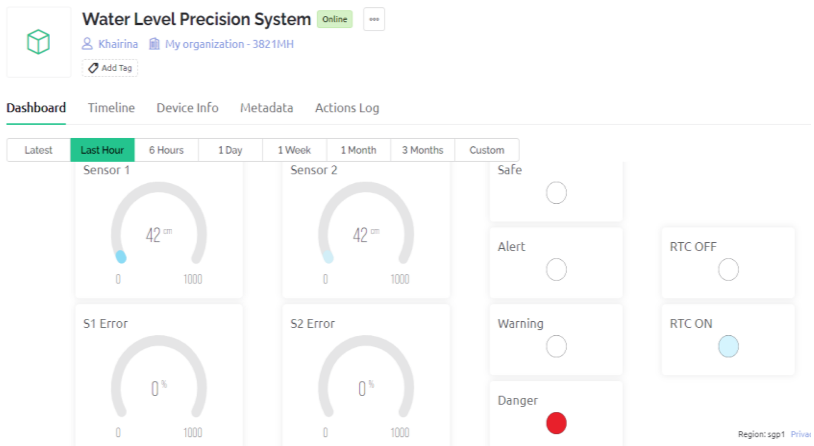

Figure 10: Red LED is on

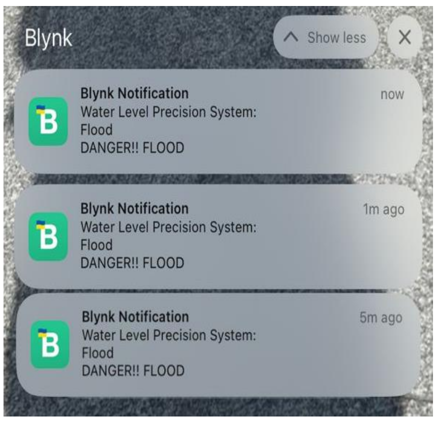

Figure 11: Notification given to the user

4. Conclusion

In conclusion, the development of the prototype for Water Level Precision using IoT enabled Sensing Technology succeeded. This project's objective is successfully archive, developing Water

Level System with smart monitoring using IoT system that can monitor through Blynk application. Test output is generated on UTHM Parameters Measurement Data Centre, Johor. For the first objective, to improve the sensor data transmission and monitoring by implementing IoT enabled Blynk web Application is successfully achieve where the author able to monitor the Water Level System by using IoT also monitor the data transmitted through Blynk Application. For the second objective, to examine the precision of two sensor data for ensuring the water level accuracy of the flood prone area also successfully achieve. The author managed to show that the value of both sensors is more or less the same when reading the same water level by getting the error value for both sensors. For overall performance, the Water Level System using IoT enabled Sensing Technology show that it is easily to be used by the user to monitor and receive notification of the system.

Acknowledgement

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References

[1] V. Babu and V. Rajan, "Flood and Earthquake Detection and Rescue Using IoT Technology," *Proc. 4th Int. Conf. Commun. Electron. Syst. ICCES 2019*, no. Icces, pp. 1256–1260, 2019, doi: 10.1109/ICCES45898.2019.9002406.

[2] D. S. Rani, G. N. Jayalakshmi, and V. P. Baligar, "Low Cost IoT based Flood Monitoring System Using Machine Learning and Neural Networks: Flood Alerting and Rainfall Prediction," *2nd Int. Conf. Innov. Mech. Ind. Appl. ICIMIA 2020 - Conf. Proc.*, no. Icimia, pp. 261–267, 2020, doi: 10.1109/ICIMIA48430.2020.9074928.

[3] F. Curumtally and R. Khoodeeram, "Real time flood monitoring and prevention using IoT sensors in developing countries," *2021 IST-Africa Conf. IST-Africa 2021*, pp. 1–9, 2021.

[4] A. K. Nawar and M. K. Altaleb, "A Low-Cost Real-Time Monitoring System for the River Level in Wasit Province," *ICASEA 2021 - 3rd 2021 Int. Conf. Adv. Sustain. Eng. its Appl.*, pp. 54–58, 2021, doi: 10.1109/ICASEA53739.2021.9733092.

[5] H. Yuliandoko and A. Rohman, "Flooding detection system based on water monitoring and zigbee mesh protocol," *2019 4th Int. Conf. Inf. Technol. Inf. Syst. Electr. Eng. ICITISEE 2019*, vol. 6, pp. 385–390, 2019, doi: 10.1109/ICITISEE48480.2019.9003928.