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Prototype of Water Level Detector Using Node MCU

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Abstract

Nowadays, the internet and human life are inseparable. Those who do not keep up with developments and apply the latest technology in their daily lives are considered to be lagging behind. The concept of the internet of things is very simple where all devices that have an ON and OFF button can be connected to the internet. The purpose of this project was developed to produce a prototype device called a water level detector. This prototype was developed to know the water level in the tank automatically without the need to measure it manually every time there is a problem of lack of water or water leakage to avoid wasting water. With this prototype, it can facilitate maintenance to know the water level from time to time. The project was developed using several components and applications such as the NodeMCU ESP8266 as a microcontroller and the Blynk application used to control the NodeMCU over the internet and also to allow creating an interface for prototyping. The main purpose of this prototype is to determine when the water level in the tank is above normal, alert or dangerous levels. This prototype can also identify the absence of water in the tank by sending a notification to the user so that the water pump can be turned on. When the water in the tank is full and touches the sensor at the top, a notification of full water and the water pump is closed will be sent to the user. If the user receives a no water detected notification that is sent continuously without stopping and does not send a notification that the water is full then it means that the water pump is not working properly. Through this project, maintenance does not need to manually check the water level in the tank because the water level can be known through notifications sent through mobile phones. This water level detector is very useful for schools, industries or homes that use water tanks. Finally, this project still needs to be improved from time to time for better use in the future.

Keyword: *Water level, notification, sensor, Blynk application, Arduino.*

1. Introduction

Malaysia is an equatorial country that is hot and humid throughout the year. Therefore, every resident's house or building will have a tank, whether small or large to store water as a supply. Every human needs a water source of at least 30 litters for drinking and personal care needs, besides humans also need additional water for other needs such as washing and cleaning the house (JY Engineering, 2022). Therefore, the water level indicators in the tank are very important to ensure that there is always enough water and that it is not wasted if the water in the tank overflows. Indicators of water level are crucial for numerous sectors. Water level indicators, for instance, are used in cooling towers to monitor tank water levels and take remedial action as needed.

Using the water tank's water level without a water level indicator, the process of measuring the water level in the tank needs to be done manually to identify the required water level in addition to ensuring that the tank is not empty which will eventually cause the coolant to overheat. Water level indicators enable remote monitoring of water levels and enable automatic corrective actions to be taken so that focus on important issues is not neglected.

There are cases that occur causing water tanks to leak such as on the roof of a house, building or in a resident's house. Factors that cause leaks to occur are due to leaks in the main water tank not being detected earlier or the water tank no longer being able to handle excess water capacity beyond its normal range. This can be more serious when there is damage if the tank is close to the residential area. Therefore, the safety of the population is also threatened.

To prevent this from happening, a prototype called Water Level Detector was developed. The main purpose of this prototype is to determine whether the water level in the tank is above average or exceeds the normal level, alert level or dangerous level. In addition, it can also be monitored through mobile phones or other suitable devices. Finally, precautionary measures can be taken to prevent accidents from happen.

2. Literature Review

Nowadays, the use of the Internet of Things (IoT) in our daily lives is becoming more and more widespread. This phrase comes from a combination of the words "Internet" and "Things" which is eventually better known as IoT. Refer to (Madakam et al., 2015), the broad and open network of intelligent devices that can self-organize, share data and resources, and react to and adapt in reaction to environmental events and changes is the best definition of the Internet of Things. This part will be discussed about the Internet of Things (IoT), water detection or other detection system. Water is the most important need for all living things in this world, especially humans. Where the need to use water includes as a drink and to meet other daily needs such as washing clothes and others.

Table 1: Several projects for review

Research	**Issues**	**Findings**
Prototype of Water Level and Rainfall Detection System as Flood Warning Based on Blynk IoT Application (Faisal et al., 2023)	The Blynk IoT Application served as the foundation for the prototype created to design a rainfall and water level monitoring system.	The system calculates the distance between the sensor and the water's surface. It offers timely notifications and real-time data visualization, which contribute to a thorough and effective strategy for controlling rain-related risks and reducing potential flood threats.
A Real-Time Flood Detection System Based on Machine Learning Algorithms with Emphasis on Deep Learning (Hashi et al., 2021)	This project is carried out in a country that does not have a meteorology department such as Somalia. It employs a real-time flood detection system-based machine learning method. This technology can estimate impending floods and detect water levels.	As an instant response, flood detection systems have been designed to alert the appropriate authorities before the disaster occurs. In terms of accuracy, the Random Forest algorithm performed better than the competing classification techniques.

Prototipe Penerapan Internet of Things (IoT) Pada Monitoring Level Air Tandon Menggunakan Nodemcu Esp8266 Dan Blynk (Gunawan et al., 2020)	Create water level control device prototype project using IoT. This device employs an ultrasonic sensor to measure the level of the water, a NodeMCU ESP 8266 as a microcontroller, and the Blynk application as a means of control.	Despite various drawbacks, the production of water height control devices using IoT functions successfully. however, by using an ultrasonic sensor that has a certain range limit, at a certain water height the sensor cannot detect it.
Flexible Automatic Water Level Controller and Indicator (Hudedmani et al., 2018)	The use of automatic water level controls is adequately justified to support such requirements and it does not use any microcontrollers and it is uses NE 555 timer IC and Buzzer as part of the components. This technology not only keeps track of the tank's water level, but it also automatically turns on the motor whenever the overhead tank is empty. The motor and LED indicators are turned OFF when the required level in the overhead tank is reached.	The findings for the research are although this system is developed without using any microcontroller but still successful. When comparing various water level controller circuits that are both economically feasible and flexible, the overhead tank level can be selected while pumping water from the underground tank.
The Development of Smart Flood Monitoring System using Ultrasonic sensor with Blynk Applications (Noar & Kamal, 2017)	This project is to develop a flood monitoring system that makes use of an ultrasonic sensor, NodeMCU, Blynk application, buzzer, LED, and LCD display. The objective is to implement a system that can detect flooding and alert the neighborhood using both NodeMCU-based technologies and reasonably priced ultrasonic sensor network components.	The projects successfully integrate blynk apps with ultrasonic sensors, when the Blynk app's buzzer, LED, and data from the ultrasonic sensor are all in working order.
Prototype of Water Level Detection System With Wireless (Jatmiko et al., 2012)	This project is to create a water level detecting prototype that may be used as a component of a system for managing river flow using ping sensor. The distance between the sensor and the water's surface is measured using an ultrasonic sensor (a ping sensor). Ping sensors determine the water's level by using the idea of sound reflection.	Since the data on the water level may be effectively shown locally or remotely, this prototype can be employed as a component of a larger system, such as a river flow management system that regulates the stream to lessen flooding.

3. Design and Development of Prototype System

Prototype System Block Diagram. Water conducts electricity, which is the basis for the water level controller's functionality. The sensing probes and circuits of the controller track changes in water level as they occur. The pump motor can be turned ON or OFF using these signals (Hudedmani et al., 2018). The purpose models block diagram is present in Figure 1 and electrical circuit diagram in Figure 2. Water Level Detector is a product created to make it easier for consumers to know the water level in the tank. In addition, users can also know the water level through mobile phones via long distance. Users need to make sure the mobile phone is always connected to Wi-Fi to know the current level of water in the tank. Furthermore, the software used can know the water level is at a high or low level with this water pump can be turn off immediately if the water level is at a high level.

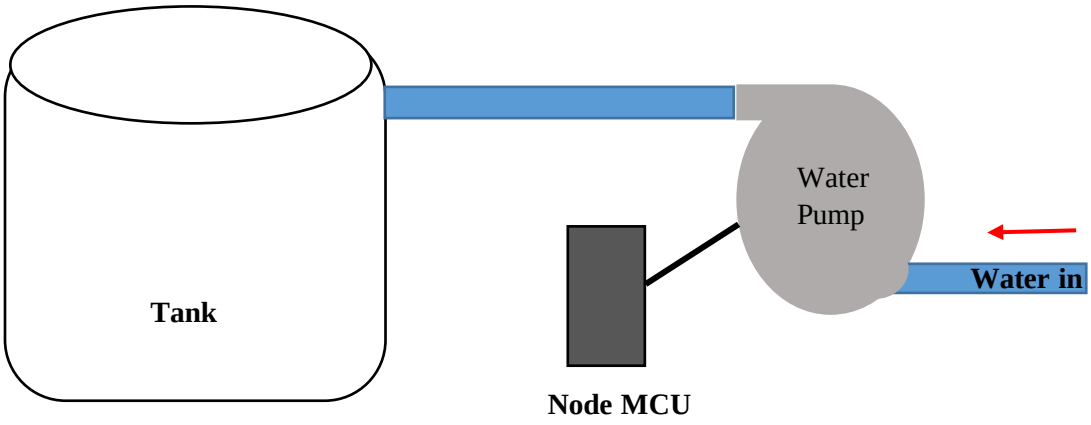


Figure 1: Block diagram of water level detector

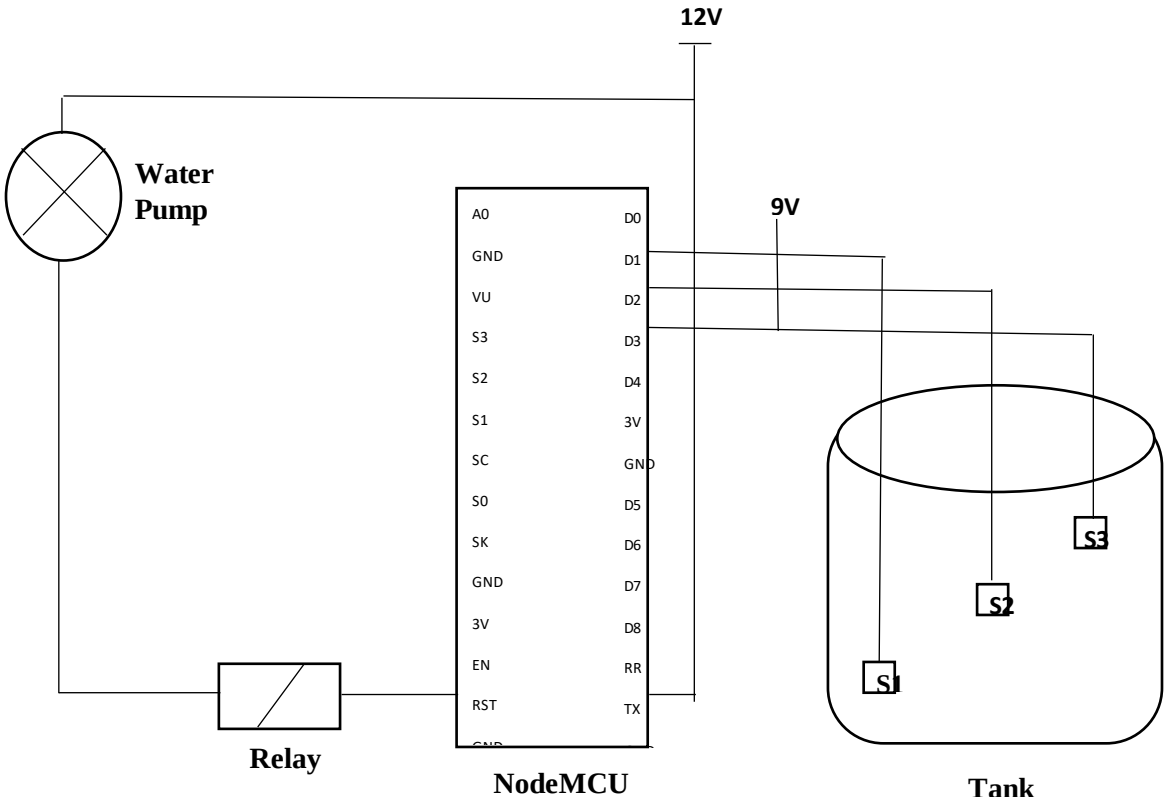
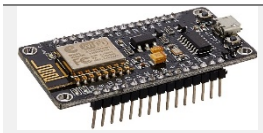
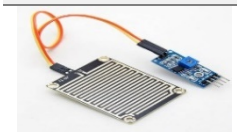


Figure 2: Circuit diagram for water level detector

4. List of Components and Description.

User interface, hardware devices such as sensors, actuators, and CPUs, backend software, and connection make up an IoT prototype (Singh Parihar, 2019). The purposed detector requires software and some hardware component as listed. The Table 2 shown below given the information about the components used in preparing the water level detector.

Table 2: The hardware and software elements in the IoT architecture

Hardware	Description
 **NodeMCU-ESP8266**	A low-cost, open-source development board for Internet of Things applications is the NodeMCU-ESP8266. Its integration of Wi-Fi and Bluetooth is one of its highlights. In addition to the processor's strength, the tiny design minimizes project area requirements. NodeMCU-ESP8266 to control the movement of water and determine the water level in the tank.
 **Rain drop sensor**	The raindrop sensor used for detect water in the tank from time to time. It is made up of two modules: a rain board that detects rain and a control module that compares analogue values and turns them into digital values.
 **Water pump**	A system that employs an Arduino to regulate the functioning of a water pump is known as an Arduino-controlled water pump. The Arduino may be used to control the water flow rate and direction, as well as turn on and off the pump.
 **Relay**	Relays are switches that work both electromechanically and electronically to close and open circuits. It regulates how an electrical circuit's circuit connections open and close. The relay is not energised with the open contact when the relay contact is open (NO).
 **Jumper Wired Cable**	Used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.
 **9-12-volt Battery**	Long WP1236W, 12V 9AH, Rechargeable Sealed Lead Acid Battery provides high performance and long service life. Compliant with the IATA/A67 and IMDG/238 requirements for transportation, Safe and effective explosion-proof and ventilation design. Non-spill able and maintenance-free, Available for side, vertical, or upright installation. Function 12v battery to turn on the water pump.
 **9-volt Battery**	A 9-volt battery is a category of battery that offers 9 volts of nominal voltage. Small electronic gadgets like smoke alarms and portable radios frequently use it. Some 9-volt batteries are disposable, while others can be recharged. They typically have a cylindrical shape and two terminals on top. Function 9v battery to turn on the node MCU.

Software tools	Description
ARDUINO	A platform that can turn a finger on a button into an output by reading inputs from a light source or sensor, starting a motor, turning on an LED, or posting content online. In this project to configure node MCU.
Blynk	Platform that to quickly build interface for controlling and monitoring. In this project used to find out the water level in the tank through notification.

5. Finding and Discussion

In this section the working of water level detector is understood easily by considering the scenario as explained below. Figure 3 below is a prototype view of Water Level Detector.

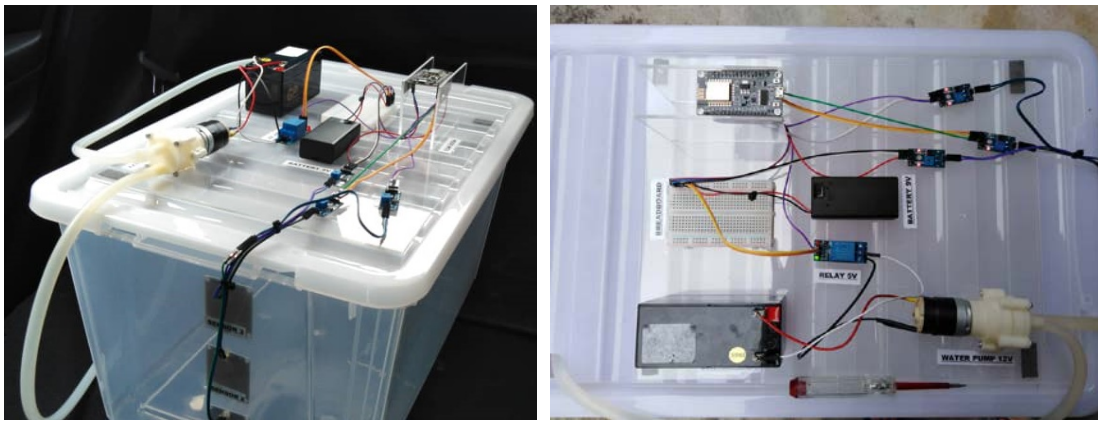


Figure 3: Prototype of water level detector

In the Figure 4, firstly switch on the button on/off battery. When it is turned on, the Blynk program will automatically display signals of being online. This indicates that the node MCU is already operational.

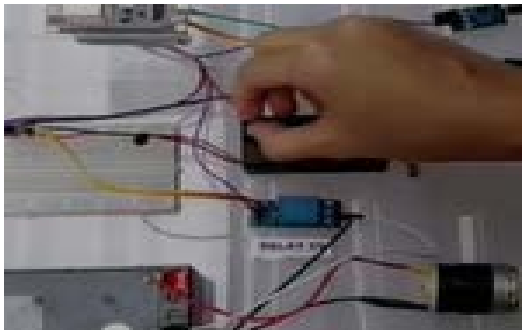


Figure 4: Switch on battery

When the Blynk program has begun to function, a system will send messages to the smartphone reading "NO WATER DETECTED" as seen in Figure 5. This occurred as a result of the lowest sensor's ability to detect the lack of water.

Figure 5: Notifications 'NO WATER DETECTED'

Once the notification has been sent, the water pump will automatically turn on and the water will start to enter the tank until it full fills the tank as figure 6.

Figure 6: Water enter a tank

Finally, in Figure 7 when the water was full in the tank and touches the top sensor, a notification 'WATER FULL, WATER PUMP OFF' will be sent to smartphone and the water pump will turn off automatically.

Figure 7: Notification "Water full and water pump off"

In this prototype, when the notification is sent non-stop which is 'NO WATER DETECTED' and does not send a notification indicating the water is full, it indicates the water pump is not working properly.

6. Conclusion and Future Recommendation

The prototype of water level detector has been successfully developed to automatically detect and control the water level in the tank to prevent water overflow. From the tests that have been done it shows that the water pump works well which successfully fills the tank automatically. This happens when the bottom rain sensor can detect the absence of air in the tank. When the water tank is full and touches the sensor at the top, the water pump closes successfully. However, this model needs to be further improved in terms of sending notifications of each water level used to users via mobile phones. The message display must also be appropriate and in line with the current status of the water level. In order to strengthen the prototype model in technical aspects, it is necessary to pay attention so that the problem of damage to the air pump can be properly dealt with along with the correct notification display. Thus, this model can be applied in real life application in the future.

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