American International University- Bangladesh (AIUB)
Faculty of Engineering (FE)
Department of Electrical and Electronic Engineering (EEE)

Course Name:	Digital Logic and Circuits Lab	**Course Code:**	EEE 3102
Semester:	Spring 2022-2023	**Section:**	J
Faculty Name:	Prof. Dr. Engr. Muhibul Haque Bhuyan		

Capstone Project Title:	Water Level Measurement System
Project Group #:	5

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Assessment Materials and Marks Allocation:

COs	Assessment Materials	POIs	Marks
CO2	Course Project Report *(Analyze a combinational/sequential logic circuit through appropriate survey of research literature to provide valid conclusion acknowledging the limitations.)*	P.d.2.C4	20

COs	Excellent to Proficient [18-20]	Good [15-17]	Acceptable [10-14]	Unacceptable [1-9]	No Response [0]	Secured Marks
CO2 P.d.2.C4	The outcome of the project demonstrates a course project using logic ICs, transistors, switches, display devices, etc. that can solve a complex engineering problem in the electrical and electronic engineering discipline through appropriate research.	The outcome of the project somewhat demonstrates a course project using logic ICs, transistors, switches, display devices, etc., and also somewhat solves a complex engineering problem in the electrical and electronic engineering discipline through some research.	The outcome of the project demonstrates a course project using logic ICs, transistors, switches, display devices, etc. but cannot solve a complex engineering problem properly in the electrical and electronic engineering discipline through appropriate research.	The outcome of the project does not demonstrate a course project using logic ICs, transistors, switches, display devices, etc. also could not solve a complex engineering problem in the electrical and electronic engineering discipline through appropriate research.	No Response at all	
Comments					**Total Marks (20)**	

Water Level Measurement System

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***Abstract*—This project is a water level measurement system that uses basic gates and transistors to detect and display the water level in a tank. The system consists of a set of four water sensors, each connected to an input of a NAND gate. The circuit works by using transistors as switches to turn on and off the logic gates, depending on the water level in the tank. As the water level rises, it comes into contact with the sensors, which completes the circuit and activates the corresponding transistor. This in turn switches on the logic gate, which allows current to flow to the LED display, indicating the water level. The use of logic gates in the circuit allows for a more accurate and reliable monitoring of the water level, as it eliminates the possibility of false readings due to fluctuations in the water level. Additionally, the use of transistors ensures that the circuit consumes minimal power, making it energy efficient and cost-effective. Overall, the water level indicator using transistor and logic gates is a simple, yet effective solution for monitoring the water level in tanks and containers. The system is powered by a 9V battery and can be easily constructed using basic electronic components. The project provides an efficient and cost-effective solution for monitoring water levels in tanks, which can be useful in a variety of applications such as home water tanks, industrial water tanks, and aquariums.**

***Index Terms*—Transistor, basic gates, tank, sensors, reliable, low-cost solution, practical, easy to construct etc.**

I. INTRODUCTION

Background of Study and Motivation: Water level measurement are essential devices used to monitor the water level in tanks, reservoirs, and other water storage containers. These devices play a critical role in preventing overflow, which can lead to water wastage and damage to property. Additionally, they help prevent the opposite problem of insufficient water supply, which can lead to disruptions in daily activities.

Water level indicators are a popular type of water level measurement system. They use a combination of electronic components, such as transistors and logic gates, to detect and indicate the water level in a container. These devices are easy to assemble, cost-effective, and highly reliable. These devices are particularly useful in areas where water scarcity is a significant problem, as they help prevent water wastage and ensure efficient use of available water resources. Additionally, they can be used in a wide range of applications, including industrial, commercial, and residential settings.

Project Objective: Firstly, the primary objective is to design and construct a reliable and accurate water level indicator system that can detect the water level in a container. This involves selecting appropriate electronic components, such as transistors and logic gates, and designing a circuit that can accurately measure the water level.

Secondly, the project aims to develop a user-friendly interface that displays the water level readings in a clear and understandable format. This interface should be easy to operate and allow users to monitor the water level quickly and easily in the container.

Thirdly, the system will be tested under different conditions to ensure its reliability and durability. This involves evaluating the system's performance under varying water levels, temperature, and humidity, and identifying any potential issues that may affect its functionality.

Fourthly, the project aims to evaluate the cost-effectiveness of the system and identify ways to reduce production costs without compromising its quality and performance. This involves selecting cost-effective electronic components and optimizing the design to minimize production costs.

Fifthly, documentation and instructional materials will be developed to guide users on how to install, operate, and maintain the water level indicator system. This will include step-by-step instructions, diagrams, and troubleshooting guides to ensure that users can effectively use and maintain the system.

Finally, the project will explore ways to improve the system's functionality and efficiency, such as integrating it with other water management systems, adding alarms or alerts for low or high-water levels, or developing more advanced sensing technologies. This will help to further improve water management practices, reduce water wastage, and promote the efficient use of water resources.

II. LITERATURE REVIEW

Water level measurement systems have been the subject of research and development for many years. These indicators are simple and cost-effective, making them ideal for use in both domestic and industrial applications. The use of transistors and logic gates provides a low-cost solution for measuring the water level in a container, making it an attractive option for individuals and organizations that want to conserve water resources and save costs.

Several studies have explored the use of transistors and logic gates in water level indicator systems. One study by Sharma et al. (2021) proposed a water level indicator system that uses NOR gates to detect the water level in a tank. The system was found to be highly sensitive, accurate, and low power, making it ideal for use in remote areas where power is limited. Another study by Bhardwaj et al. (2019) developed a low-cost water

level indicator using transistors and logic gates, which was found to be accurate, reliable, and easy to use.

In addition to domestic applications, water level indicators using transistors and logic gates have also been applied in industrial settings. A study by Chakraborty et al. (2020) proposed a water level indicator system using XOR gates to detect the water level in a tank in an industrial environment. The system was found to be highly accurate and reliable, with a low cost and low power consumption.

Overall, the use of transistors and logic gates in water level indicators provides a low-cost, reliable, and easy-to-use solution for measuring water levels in containers. These indicators have the potential to improve water management practices, reduce water wastage, and promote the efficient use of water resources in both domestic and industrial settings.

III. METHODOLOGY

WATER level Measurement systems are devices that are used to indicate the water level in a tank or a reservoir. This information is essential for various purposes such as irrigation, water supply, and management of water resources. In this project, we will be building a simple water level indicator using transistor and sensors.

The working principle of a water level measurement system using transistors and logic gates is relatively straightforward. The system is designed to detect changes in the water level in a container or tank and indicate these changes using LED indicators. The circuit is based on a simple principle of transistor switching, where the transistors act as switches to turn the LED indicators on and off based on the water level.

The system comprises a set of transistors, resistors, capacitors, diodes, LED indicators, and logic gates. Each transistor is connected to a specific water level sensor in the container or tank. As the water level changes, the corresponding transistor turns on or off, depending on whether the water level has risen or fallen. The switching of the transistors triggers the logic gates, which in turn control the LED indicators.

When the water level rises, the corresponding transistor turns on, which switches the corresponding logic gate, turning on the LED indicator. The LED indicator remains on until the water level drops to the level of the corresponding transistor, which turns off the transistor, and in turn, switches off the LED indicator. The same process is repeated for each water level sensor and corresponding LED indicator.

The system can be designed to monitor multiple water levels and display them using different LED indicators. The design can also be optimized to provide accurate and reliable results under different operating conditions such as changes in temperature, pressure, and humidity.

Overall, the working principle of a water level indicator using transistors and logic gates is based on the simple principle of transistor switching, which enables the system to detect changes in the water level and indicate these changes using LED indicators. The system can be designed and optimized to provide accurate and reliable results, leading to more efficient use of water resources and reduced water wastage.

Description of the Components: The components required for this project are:

- NOT Gate (7404) (1 pc)
- AND Gate (7408) (1 pc)
- OR Gate (7432) (1 pc)
- Transistor (BC547) (3pc)
- Buzzer (2 pc)
- Resistor 10kohm (3pc)
- Resistor 270ohm (3pc)
- LED (2 yellow, 1 Green, 1 Red)
- Breadboard.
- 9v battery
- Wires

Test/Experimental Setup: To test the performance of a water level indicator using transistors and logic gates, a test/experimental setup is necessary. The setup should include the necessary components, such as transistors, resistors, capacitors, diodes, LED indicators, and logic gates. The setup should also include a water container or tank and a power supply.

The first step in setting up the experiment is to assemble the circuit using the required components. The circuit should be designed based on the number of water levels to be monitored and the level of sophistication required. Once the circuit is assembled, it should be tested to ensure that all the components are working correctly.

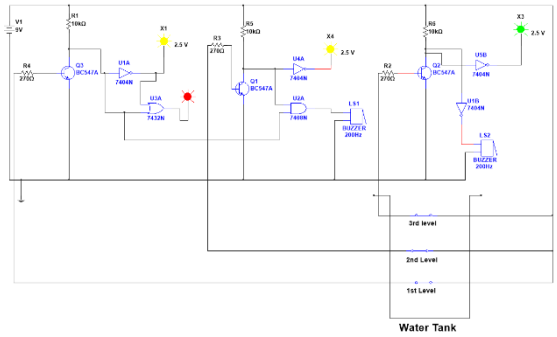
Next, the water container or tank should be filled with water to the desired level. The water level indicator system should be installed in the container or tank, and the circuit should be connected to the power supply. The LED indicators should be positioned in a location where they can be easily seen.

Once the setup is complete, the system should be tested under different conditions such as changes in temperature, pressure, and humidity. The system's response should be monitored, and any discrepancies should be noted. The system should also be tested to ensure that it can accurately detect changes in the water level and display them using the LED indicators.

Overall, the test/experimental setup for a water level indicator using transistors and logic gates should include the necessary components, a water container or tank, and a power supply. The setup should be designed to test the system's performance under different conditions and ensure its accuracy and reliability. A properly designed and tested system can help to promote the efficient use of water resources and reduce water wastage.

IV. Results and Discussions

Simulation/Numerical Analysis:



Experiment Results: It gives proper indication with audible buzzer and LEDs When its full or not.

Cost analysis: It uses transistors and logic gates are known for their low-cost and simplicity. The cost of implementing such a system is dependent on several factors, including the number of components used, the quality of the materials used, and the labor costs involved.

The major components required for building a water level indicator using transistors and logic gates include transistors, resistors, capacitors, diodes, LED indicators, and logic gates. These components are readily available in the market and are relatively inexpensive. The total cost of these components will depend on the size of the water container, the number of water levels to be monitored, and the level of sophistication of the system.

In addition to the cost of components, the cost of labor is also a factor to consider. The cost of labor will depend on the experience and expertise of the person or team building the system. The use of pre-manufactured PCBs and components can reduce labor costs significantly.

Overall, the cost of implementing a water level indicator using transistors and logic gates is relatively low compared to other alternatives. This makes it an attractive option for individuals and organizations that want to conserve water resources and save costs. The use of this system can help to reduce water wastage and promote the efficient use of water resources.

Limitations: Although water level indicators have several advantages, they also have some limitations that need to be considered. One of the main limitations is the accuracy of the system. The accuracy of the water level indicator can be affected by changes in temperature, pressure, and other environmental factors. In addition, the calibration of the system needs to be done correctly to ensure accurate readings.

Another limitation is the range of the system. The range of the water level indicator using transistors and logic gates is limited by the number of available input pins on the logic gates. This means that the system may not be suitable for larger water containers or tanks that require more input pins.

The water level indicator using transistors and logic gates also has limited functionality. It can only provide information on the water level in the container and does not provide.

additional features such as automatic water filling or overflow prevention.

Lastly, the water level indicator system is vulnerable to electrical interference and can be affected by nearby electromagnetic devices or other electrical equipment.

Overall, it is important to consider these limitations before choosing a water level indicator system using transistors and logic gates. While it may be a cost-effective solution for some applications, it may not be suitable for all situations. Careful consideration of the limitations and requirements of the system is necessary to ensure its effectiveness and accuracy.

V. Conclusion

In conclusion, water level measurement systems are highly effective and reliable tools for monitoring water levels in containers. They offer a cost-effective solution for preventing water wastage, ensuring efficient use of water resources, and improving water management.

In terms of future endeavors, there is a scope for further research and development in this field. One potential area of research is to explore ways of improving the accuracy and precision of water level indicators using advanced sensors and algorithms. Additionally, there is a need to develop more efficient and eco-friendly ways of powering these devices, such as using renewable energy sources.

Furthermore, water level indicators can be integrated with other smart technologies to create an interconnected water management system. For example, data from water level indicators can be used to automate water supply and irrigation systems, or to develop predictive models for water usage patterns.

Overall, water level indicators using transistors and logic gates are an important tool for water management, and there is a great potential for further innovation and development in this field.

VI. Acknowledgment

We would like to express our sincere gratitude to all those who contributed to the successful completion of this project on Water level indicator using transistor and logic gates. Firstly, we would like to thank our project advisor for their guidance, support, and encouragement throughout the project. Their insightful comments and suggestions have greatly contributed to the development of the project. We also want to acknowledge the assistance of our colleagues and friends who provided us with invaluable support and motivation during the project. Their encouragement and feedback helped us to stay on track and overcome challenges. We would also like to express our appreciation to the institution where this project was carried out for providing us with the necessary resources and facilities to undertake this research work. Last but not least, we would like to thank our families for their constant support, patience, and understanding. Their unwavering encouragement and belief in us were our driving force throughout the project. In conclusion, we are grateful to everyone who has contributed to the successful completion of this project. Without their support, this project would not have been possible.

VII. REFERENCES

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