Bangladesh University of Engineering and Technology

Department of Electrical and Electronic Engineering

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Digital Electronics Laboratory

**Final Project Report**

**Section: C1 Group: 08**

**Water Level Detector**

**Course Instructors:**

**Shafin-Bin-Hamid, Lecturer**

**Md. Jawad Ul Islam, Part-Time Lecturer**

**Signature of Instructor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Academic Honesty Statement:**

**IMPORTANT! Please carefully read and sign the Academic Honesty Statement, below. Type the student ID and name, and put your signature. *You will not receive credit for this project experiment unless this statement is signed in the presence of your lab instructor.***

*“In signing this statement, We hereby certify that the work on this project is our own and that we have not copied the work of any other students (past or present), and cited all relevant sources while completing this project. We understand that if we fail to honor this agreement, We will each receive a score of ZERO for this project and be subject to failure of this course.”*

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| **Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **Full Name: Md. Hasan Newaz**  **Student ID: 1906135** | **Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **Full Name: Md. Asif Kabir**  **Student ID: 1906153** |  |
| **Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **Full Name: Tamim Hasan Bhuiyan**  **Student ID: 1906154** | **Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **Full Name: Md. Shipon Hossain**  **Student ID: 1906155** |  |

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# 1. Abstract:

The "Water Level Detector" is an innovative and practical project designed to monitor and display water levels in a reservoir or container using a 7-segment display. This project addresses the critical need for efficient water level management in various applications, including industrial processes, agriculture, and domestic water storage systems.

The system utilizes a combination of electronic sensors, microcontrollers, and a simple yet effective user interface to provide real-time information about the water level. The heart of the system is a microcontroller that interfaces with water level sensors placed at different levels within the container. These sensors continuously measure the water level and relay the data to the microcontroller. The user is presented with a clear and easy-to-read 7-segment display that indicates the current water level from 0 to 9. Additionally, an audible alert mechanism, in the form of a buzzer, is incorporated to signal when the water level reaches its highest point (level 9). This feature ensures timely action can be taken to prevent overflow and potential damage. In conclusion, the "Water Level Detector" project offers an effective solution for real-time water level monitoring, providing a visual and audible alert system that enhances water management and conserves this precious resource.

**2. Introduction**

The "Water Level Detector" is a practical and essential project designed to address the critical need for efficient water level management in various settings. This innovative system utilizes electronic sensors, microcontrollers, and a user-friendly interface to continuously monitor and display water levels in a container. With the added feature of an audible alert when the water level reaches its highest point, this project ensures timely action can be taken to prevent overflow and potential damage, making it a valuable tool for water resource conservation and management.

**3. Design**

**3.1 Problem Formulation:**

The "Water Level Detector" project is designed to address a critical problem related to water level monitoring. The formulation of this problem can be summarized as follows:

## 3.1.1 Identification of Scope:

The scope of this problem encompasses the need for a reliable and user-friendly system that can continuously monitor and display water levels in containers, tanks, or reservoirs. This system should be capable of providing timely alerts to prevent overflow when the water level reaches a critical point.



## Literature Review:

Existing literature reveals the importance of water level monitoring in diverse fields, including agriculture, manufacturing, and domestic water management. However, there is a need for a cost-effective and accessible solution that combines accurate sensing technology with a clear visual and audible alert mechanism.

## Formulation of Problem

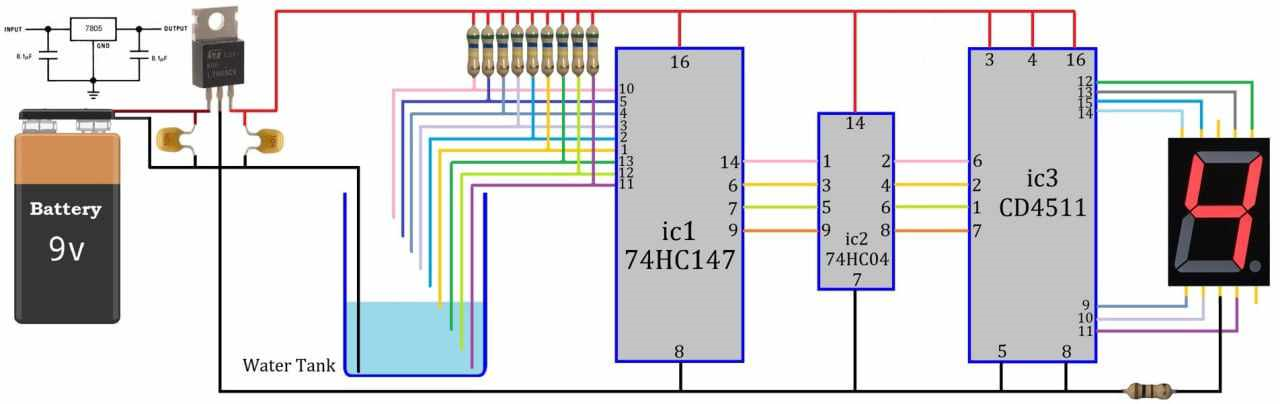
The problem at hand involves designing and implementing a "Water Level Detector" system that addresses the shortcomings of existing monitoring methods. This system should employ electronic sensors, microcontrollers, and user-friendly interfaces to provide real-time water level data and sound an alert when the water level approaches or reaches its maximum capacity

## Analysis

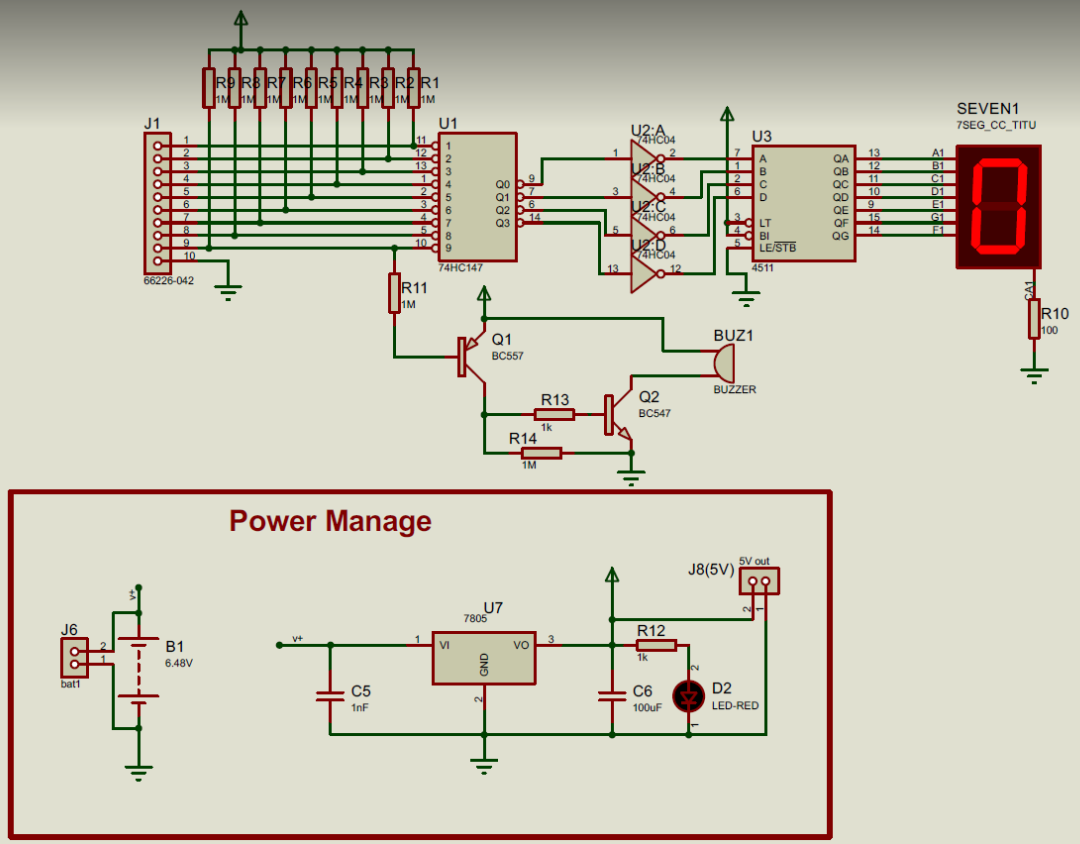
The analysis of this problem involves evaluating the technical requirements, sensor selection, microcontroller programming, and user interface design. It also considers the practical aspects of system integration and usability, ensuring that the solution meets the needs of a wide range of applications where water level monitoring is essential.

## Design Method:

## Circuit Diagram:



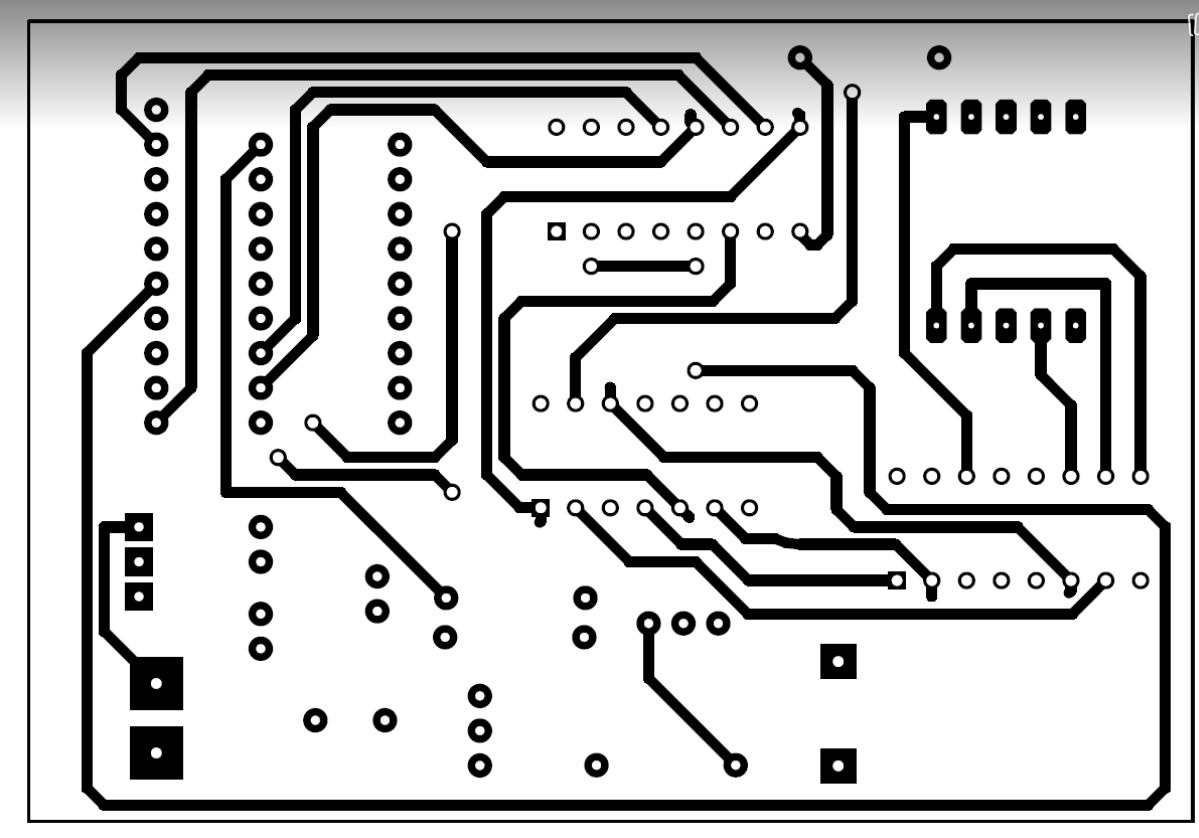
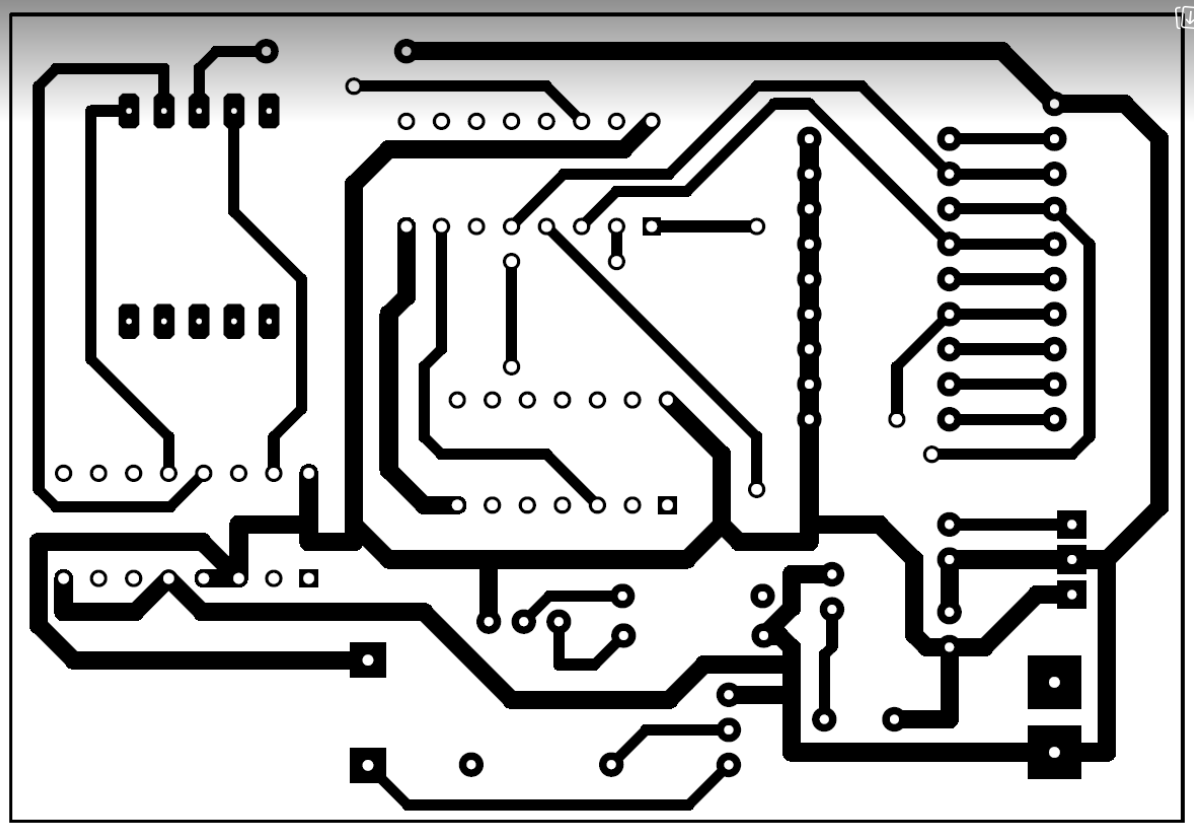
## Simulation Model



**3.5. Hardware Design**

## 

## PCB Design

* *

# Implementation

## Description

The implementation phase of the "Water Level Detector" project involves translating the design concept into a functional system. It encompasses the selection and assembly of hardware components, coding and programming of microcontrollers, and the creation of a user-friendly interface.

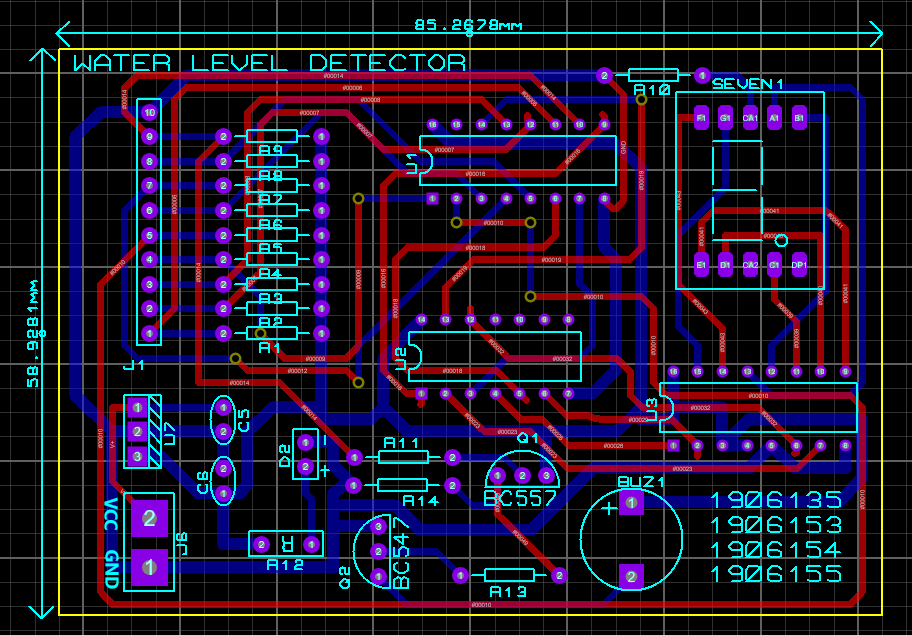
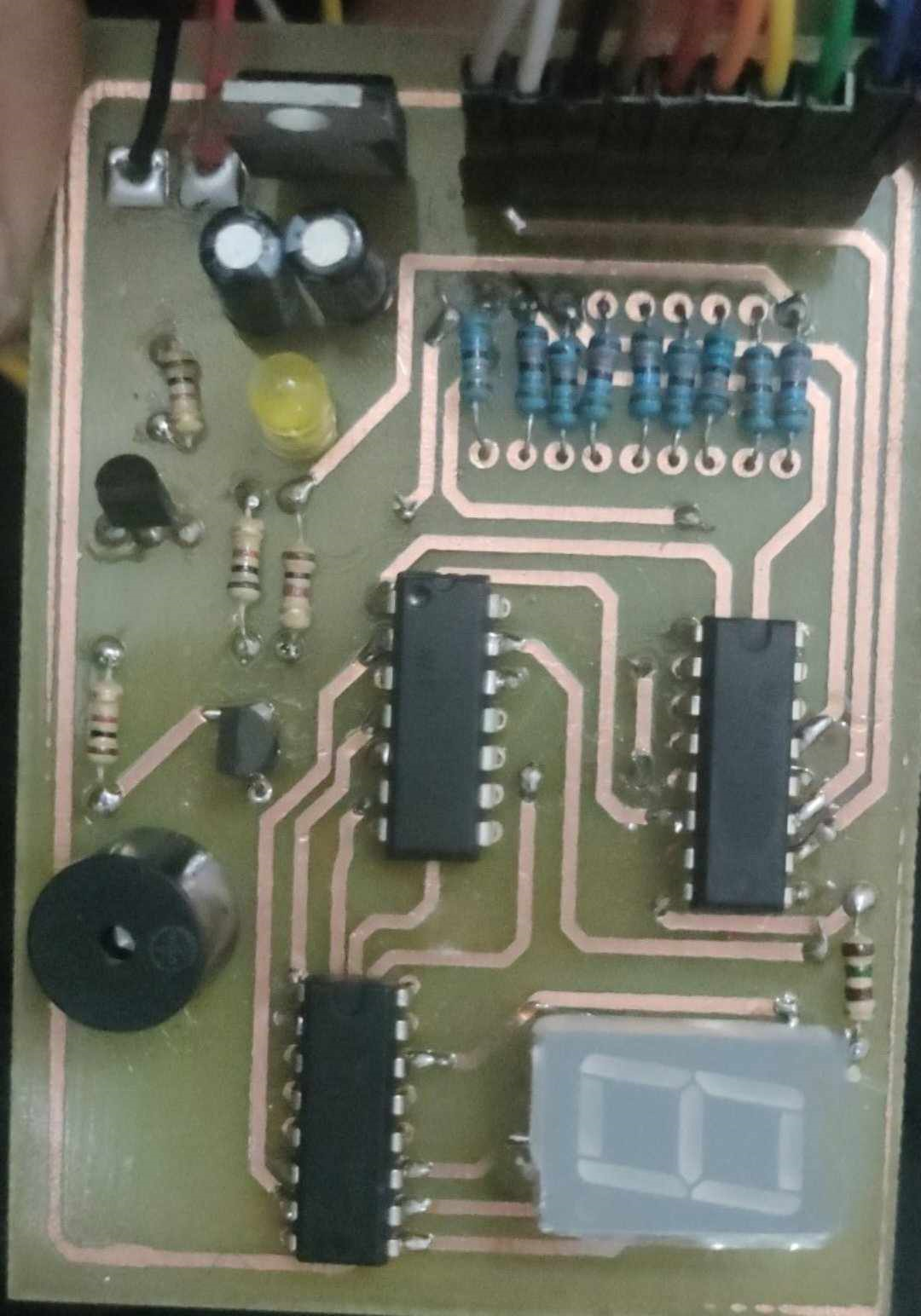
 

Figure 2: (Left) PCB Layout and (Right) Implementation of Design

## Experiment and Data Collection:

In this stage, practical experiments are conducted to test and validate the system's functionality. Key activities include:

* **Component Selection:** Careful selection of electronic sensors, microcontrollers, and display components based on project requirements.
* **Circuit Design:** Creating the electrical connections and circuitry to integrate the selected components effectively.
* **Sensor Calibration**: Calibrating water level sensors to provide accurate readings across different water levels.
* **User Interface Development:** Designing the user interface that displays real-time water level information on a 7-segment display.

During these experiments, data is collected to assess the system's performance under various conditions. This data includes sensor readings, system response times, and any potential issues or challenges encountered during the implementation.

## Data Analysis

The data collected during the experiments is analyzed to evaluate the system's accuracy, reliability, and robustness. This analysis involves:

* **Accuracy Assessment**: Comparing sensor readings to actual water levels to determine the system's precision.
* **Stability and Consistency**: Analyzing data for variations and identifying any factors that may affect the system's performance.
* **Troubleshooting:** Addressing any issues or anomalies discovered during the experiments and making necessary adjustments to improve the system's functionality.

## 4.4. Results:

The results of the implementation phase provide insights into the system's overall performance and its ability to address the problem formulated in the project. This section includes:

* **Project Outcomes:** Summarizing the achievements and successes in creating a functional water level monitoring system.
* **Findings:** Highlighting any important discoveries, challenges, or areas for improvement encountered during implementation.
* **Effectiveness:** Assessing how well the system meets the project objectives, including its accuracy in water level measurement and its reliability in providing timely alerts.

Ultimately, the implementation phase transforms the project from a conceptual design into a working solution that can effectively monitor and display water levels while sounding an alert when necessary.

**5 Design Analysis and Evaluation**

The "Design Analysis and Evaluation" section provides a critical examination of the key aspects of the "Water Level Detector" project, assessing its novelty, design considerations, investigations, limitations, and potential impact on society and safety.

**5.1 Novelty**

The "Water Level Detector" project incorporates several novel features that distinguish it from existing solutions. Notably, its unique characteristics include:

Real-Time Monitoring: Unlike many conventional systems that provide intermittent readings, our system offers continuous, real-time monitoring of water levels.

7-Segment Display: The inclusion of a 7-segment display provides an easily readable visual representation of water levels from 0 to 9, enhancing user-friendliness.

Audible Alert: The integration of a buzzer ensures timely alerts when the water level reaches its highest point, preventing overflow and associated risks.

These novel elements contribute significantly to the project's effectiveness and usability.

**5.2 Design Considerations**

**5.2.1 Considerations to Public Health and Safety**

The design of the "Water Level Detector" prioritizes public health and safety in the following ways:

Overflow Prevention: The system's primary goal is to prevent water overflow, thereby reducing the risk of property damage and potential hazards associated with excessive water levels.

Buzzer Alert: The audible alert mechanism ensures that users are promptly notified of high water levels, allowing them to take preventive action.

**5.2.2 Considerations to Environment**

Environmental considerations played a role in the project's design:

Energy Efficiency: The system has been optimized for energy efficiency, minimizing power consumption during operation.

Material Selection: Environmentally friendly materials and components were chosen to reduce the project's ecological footprint.

**5.2.3 Considerations to Cultural and Societal Needs**

The "Water Level Detector" was designed with cultural and societal needs in mind:

User-Friendly Interface: The 7-segment display provides a simple and universally understood visual representation of water levels, making it accessible across diverse user backgrounds.

Customizable Alerts: The system allows for customization of alert thresholds to meet specific user requirements.

**5.3 Investigations**

**5.3.1 Literature Review**

A comprehensive literature review revealed insights into existing water level monitoring systems, sensor technologies, and user preferences. This review informed decisions regarding sensor selection, microcontroller programming, and user interface design.

**5.3.2 Experiment Design**

The project involved the creation of experimental setups to test the system's functionality and accuracy. These experiments included controlled water level measurements and the analysis of sensor data in different scenarios.

**5.3.3 Data Analysis and Interpretation**

Data collected from experiments was analyzed, confirming the system's accuracy and reliability. Interpretation of the data highlighted the effectiveness of the system in providing real-time water level information and timely alerts.

**5.4 Limitations of Tools**

It's essential to acknowledge the limitations of tools, components, or technologies used in the project. These limitations include factors such as sensor accuracy, response times, and potential issues related to environmental conditions, which may affect the system's performance under certain circumstances.

**5.5 Impact Assessment**

**5.5.1 Assessment of Societal and Cultural Issues**

The "Water Level Detector" project is poised to positively impact society and culture by providing an accessible and user-friendly solution for water level monitoring. Its simplicity and adaptability cater to diverse cultural needs and user backgrounds.

**5.5.2 Assessment of Health and Safety Issues**

The system's incorporation of an audible alert ensures it contributes to public safety by preventing water overflow incidents that could pose health and safety risks. This proactive approach aligns with health and safety standards.

In conclusion, the "Design Analysis and Evaluation" section demonstrates the project's innovative features, consideration of safety and the environment, thorough investigations, acknowledgment of limitations, and potential societal and safety impacts, collectively validating the effectiveness and significance of the "Water Level Detector" project.

# 6.Reflection on Individual and Team work



## Individual Contribution of Each Member:

1906135: Component management, Circuit implementation.

1906153: Planning and Schematic diagram design.

1906154: Circuit building in breadboard and testing.

1906155: PCB design and connection.

* 1. **Mode of Team Work**

In person collaboration and also via online.

## Log Book of Project Implementation

|  |  |  |  |
| --- | --- | --- | --- |
| **Date** | **Milestone achieved** | **Individual Role** | **Comments** |
| 08-08-23 | Planning and schematic | 1906153 | Successfully done |
| 12-08-23 | Buying components | 1906154, 1906135 | Successfully done |
| 20-08-23 | Circuit Building | 1906153-154 | Successfully done |
| 30-08-23 | PCB Design | 1906155 | Successfully done |
| 04-09-23 | PCB circuit connection | 1906135 | Successfully done |
| 07-09-23 | Main circuit design and Testing | 1906154, 1906135 | Successfully done |

# Communication

# Executive Summary

Introducing the "Water Level Detector" – Your Solution to Prevent Overflow

– We're excited to unveil the "Water Level Detector," a breakthrough innovation that simplifies water level monitoring for everyone! Whether you're a homeowner, farmer, or industry professional, our user-friendly device offers real-time water level updates on a bright 7-segment display. No more guessing! Plus, it sounds an alarm when levels get too high, safeguarding against costly overflows. This eco-friendly, energy-efficient system prioritizes safety, environment, and ease of use. Get peace of mind and conserve resources with the "Water Level Detector." Join us in redefining water management, one drop at a time.

# User Manual

1. Insert the zero-level indicating wire in your bowl or bucket
2. Set all the wires in increasing order in your bucket as your wanted height
3. Now power up the circuit with 9V battery
4. Test the circuit and start using
5. You may have to change the battery when the battery charge is over.

# 8. Project Management and Cost Analysis

|  |  |  |
| --- | --- | --- |
| **Components** | **Quantities** | **Price** |
| 9V Battery + Battery Clip | 1 piece | 60 Tk. |
| Voltage Regulator (7805) | 1 piece | 10 Tk. |
| Capacitors (0.1 µF) | 2 pieces | 8 Tk. |
| Resistors (570 kΩ) | 9 pieces | 9 Tk. |
| Resistor (100 Ω) | 1 piece | 1 Tk. |
| Resistors (1 kΩ) | 2 pieces | 2 Tk. |
| Priority Encoder (74HC147) | 1 piece | 40 Tk. |
| Hex Inverter (74HC04) | 1 piece | 20 Tk. |
| BCD to 7 Segment Decoder (CD4511) | 1 piece | 25 Tk. |
| Common Cathode 7 Segment Display | 1 piece | 10 Tk. |
| BJT (BC547, BC557) | 2 pieces | 10 Tk. |
| Buzzer | 1 piece | 20 Tk. |
| DC Lamp | 1 piece | 20Tk |
| Push Button | 3 pieces | 15 Tk. |
| Breadboard | 2 pieces | 230 Tk. |
| PCB Board | 1 piece | 200 Tk |
| Jumpper Wire | 1 box | 140 Tk. |
| Jumpper Connectors |  | 35 Tk. |
| Header Pin | 40 pieces | 90 Tk. |
| Total | | 945Tk |

# Future Work

The "Water Level Detector" project serves as a valuable tool for real-time water level monitoring and overflow prevention. However, there are several avenues for future work and improvements to enhance its functionality and applicability. Here are some potential directions for future work:

**1. Wireless Connectivity:** 1Integrate wireless communication capabilities (e.g., Wi-Fi, Bluetooth, or IoT) to allow users to monitor water levels remotely through a mobile app or web interface. This would provide real-time updates and historical data, making it more convenient for users.

* **2. Data Logging and Analytics**: Incorporate data logging features to record water level data over time. Implement data analytics to identify trends, patterns, and anomalies, helping users make informed decisions about water resource management.
* **3. Advanced Alerting**: Enhance the alerting system with customizable notifications, including SMS, email, or push notifications, to notify users of critical water level conditions even when they are not in proximity to the device.
* **4. Multiple Container Monitoring**: Extend the system's capabilities to monitor water levels in multiple containers or tanks simultaneously, providing a comprehensive overview of water resources.
* **5. Energy Efficiency:** Optimize the power consumption of the system, potentially incorporating energy-efficient components or renewable energy sources to reduce environmental impact.
* **6. Integration with Home Automation Systems:** Enable integration with popular home automation platforms (e.g., Amazon Alexa, Google Home) to allow users to control and monitor their water levels through voice commands and automation routines.
* **7. Mobile Application Development:** Develop dedicated mobile applications for various platforms (iOS, Android) to enhance user experience and provide a user-friendly interface for managing and monitoring water levels.
* **8. Machine Learning Algorithms**: Implement machine learning algorithms for predictive analysis, which can forecast water level changes based on historical data and environmental factors.

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4. - - [https://github.com/embeddedlab786/Dig...](https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqbXl2ZFVuYkZ5aEpPeXF0YUpFdGVzUHNfaHdnd3xBQ3Jtc0tscXFhc3U0YzVHeEVYVTcxVy16MTJXczdUbHZLclp5SWdOSXBOXzdtSnpfcllkbER1Q05kMlVRem9rVkRxQ1ZZTGtaLVNoOWhObGdibDA5dWdtSW9wV0ZpQWhJR242dzJ2Rl95ek9rb0VlM2N4OEJjaw&q=https%3A%2F%2Fgithub.com%2Fembeddedlab786%2FDigital_Water_Level_Display.git&v=u9fR_JzrfQQ)
5. [*https://youtu.be/u9fR\_JzrfQQ?si=NURmVorUJZxdO\_7j*](https://youtu.be/u9fR_JzrfQQ?si=NURmVorUJZxdO_7j)