Polytechnic University of the Philippines
Parañaque City Campus
Bachelor of Science in Computer Engineering

CMPE 30121

Introduction to Hardware Description Language (HDL-PUPPQ)

Water Level Indicator Using ULN2003

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Introduction

In the Philippines, the peak of the typhoon season is July through October, with rainfall already starting in June. As the wet season rolls in, floods are the most experienced disaster during storms and monsoons, often resulting in destroyed communities and numerous killed. Floods always have economic, social, and environmental impacts to countries. Due to the geographical location of the Philippines, floods are inevitable occurrences for Filipinos (Alcantara, 2019).

As said by Alfonso et al. (2019), there are about 20 tropical cyclones that enter the Philippine Area of Responsibility (PAR) annually. About 8 to 9 of these tropical cyclones cross the country, and 5 of them are deemed potentially disastrous. The country is also surrounded by various and extensive river basins that can easily spill over with excessive rainfall. This in turn will lead to floods that damage the environment and disrupt human activity and livelihood.

By making a prototype that will indicate a river's water level, officials and population living nearby can be alerted and can act accordingly to the signal being put out.

Rationale

As the students of Computer Engineering, we would like to make a prototype that will help in monitoring a river basin's water level. A water level monitoring system that will be used on rivers, where most floodwater comes from, can aid in alerting residents living in or near flood-prone areas. With prompt response alongside the water monitoring system, this can help in decreasing the number of casualties and damage from recurring floods.

Features and Limitations

The project's features include:

- A water level monitoring or warning system that will emit a sound when a river is about to overflow.
- The prototype has LEDs that signify the water level of a river. Each color corresponds to a certain water level: Green for the first level, Orange for the second level, and Red for the third level.

The project's limitations include:

- The project is only done on a prototype scale.
- The prototype won't work if the battery runs out.

Significance

Flood warning systems can be beneficial to communities, especially to areas that are prone to flooding. Fatalities, property damage, economic costs can be reduced if communities are alerted earlier on.

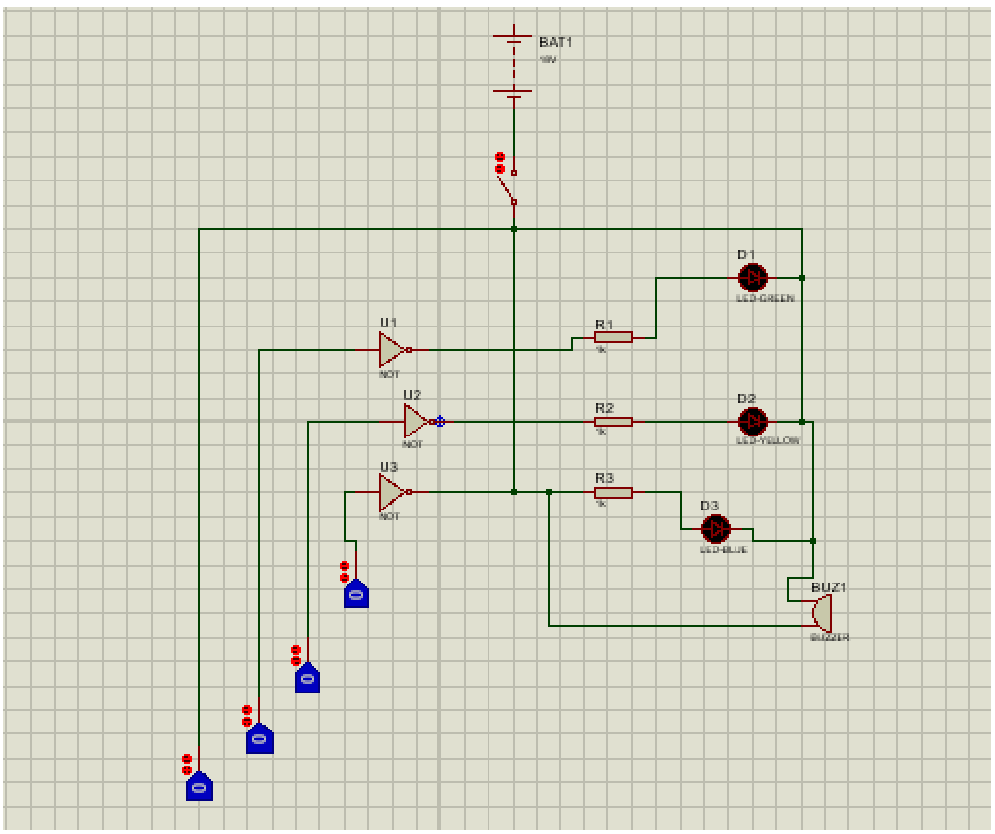
Components

The components used for this prototype are:

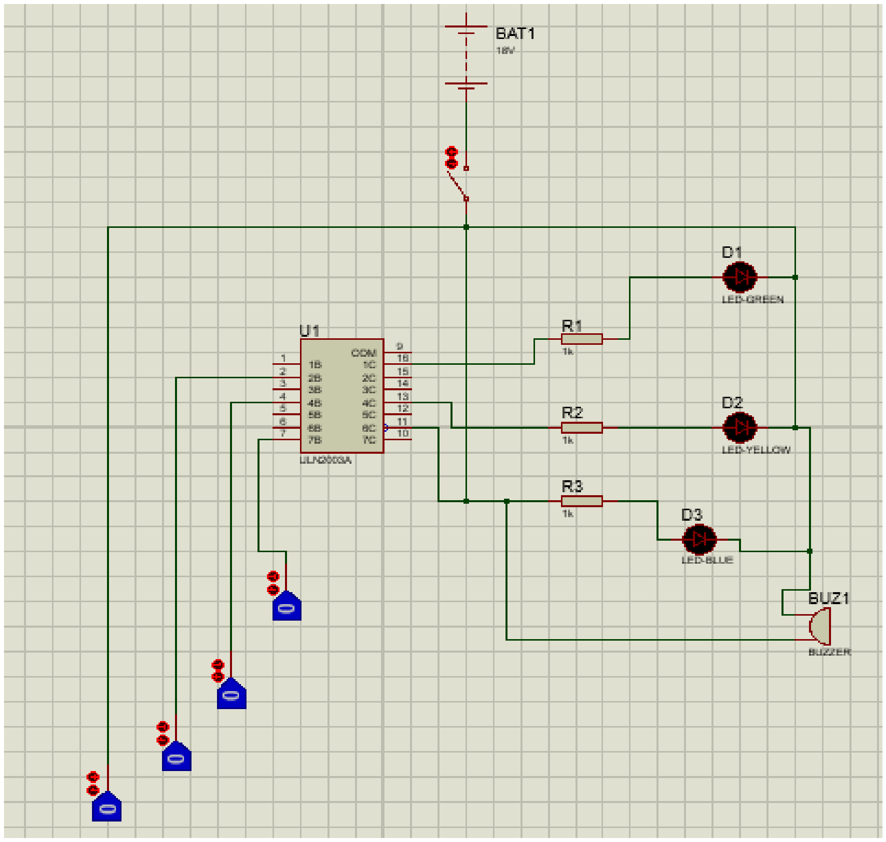
- 3 LEDs
- 3 1k-ohm Resistors
- 4 Metal Contacts
- 2 Breadboards

- 18v Battery
- Jumping Wires
- 1 Buzzer
- 1 ULN2003 IC

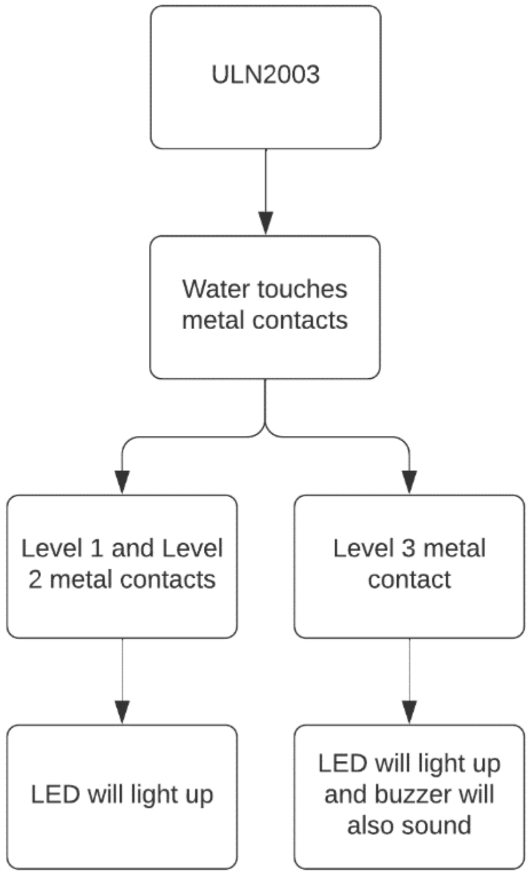
Circuit Diagram



Schematic Diagram



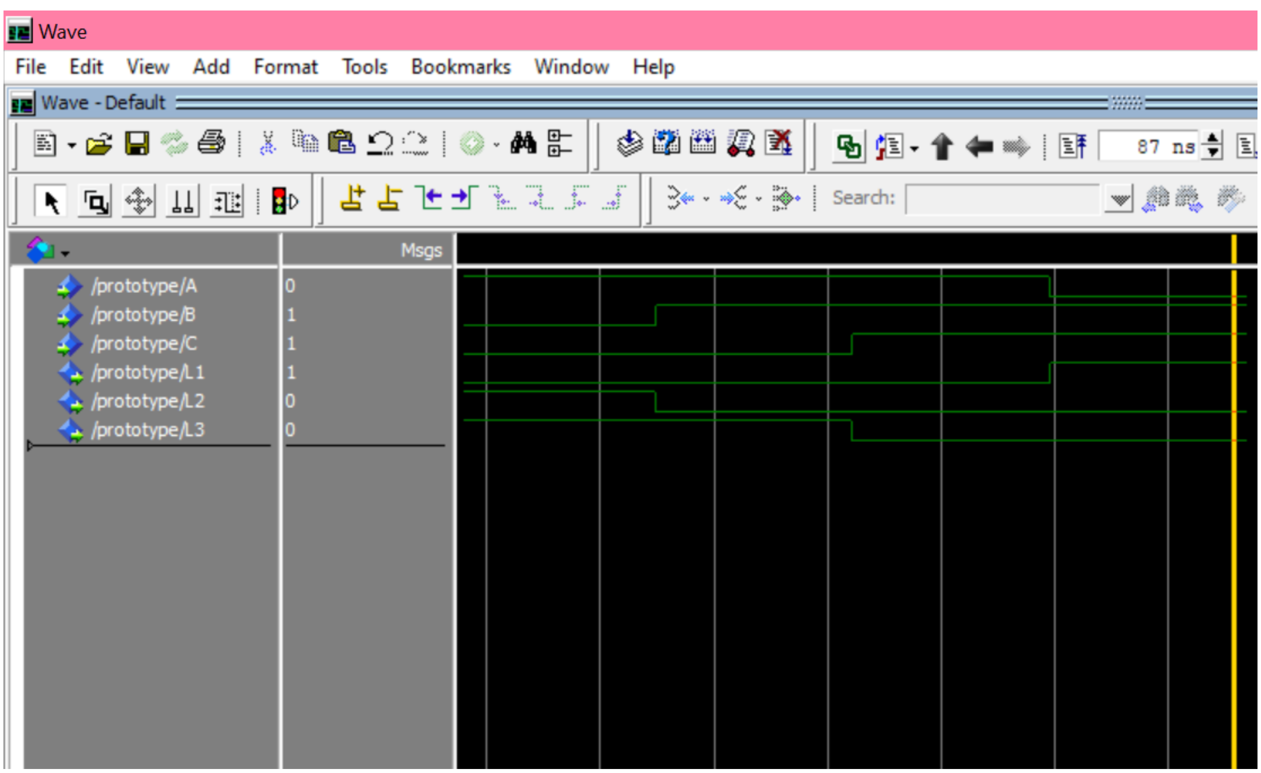
Block Diagram



VHDL Program & Simulation

C:/modeltech64_10.7/examples/PROTOTYPE.vhd (/prototype) - Default

```vhdl
library ieee;
use ieee.std_logic_1164.all;

entity prototype is
port( A, B, C: in std_logic;
L1, L2, L3: out std_logic);
end prototype;

architecture behavior of prototype is
begin

L1 <= not A;
L2 <= not B;
L3 <= not C;

end behavior;

```



Results

The prototype done worked properly. The prototype has metal contacts that act as levels. Three metal contacts are connected to LEDs that will light up accordingly to the water level being detected, green for the first level, orange for the second level, and red for the third level. The buzzer will also emit a sound if water reaches the metal contact on the highest level.

An issue encountered while making the prototype is that if components are added, the buzzer's sound will weaken. If components are to be added to the prototype, a higher battery voltage is needed to maintain the sound of the buzzer on an audible level.

REFERENCES

- Alcantara, J. C. (2019). Overview of the Societal Impacts of Floods in the Philippines. from https://www.pic.org.kh/images/2019Research/20191014_Overview%20of%20the%20Societal%20Impacts%20of%20the%20Philippines.pdf
- Alfonso, C. D. Q., Sundo, M. B., Zafra, R. G., Velasco, P. P., Aguirre, J. J. C., & Madlangbayan, M. S. (2019). *FLOOD RISK ASSESSMENT OF MAJOR RIVER BASINS IN THE PHILIPPINES*. Flood Risk Assessment of Major River Basins in the Philippines. from https://geomatejournal.com/geomate/article/view/488/1476