Project 3
(Buzzer Alert for Visually Impaired Individuals)

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Project Due: December 10, 2020, 11:59 pm

Project Closes: December 11, 2020, 11:59pm

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Introduction

This system is designed for accessibility support and it specifically targets visually impaired individuals. It helps in that area by detecting barriers and alerting the visually impaired person. The ultra sonic component of the system calculates the distance between the person and the object by emitting ultrasonic sound waves and converting the reflected sound into an electrical signal. When the object is within 50 centimeters, the buzzer gets triggered and alerts the individual. The range of detection could also be altered depending on the person's preference. The system could either be placed on the person or a white cane to maximize the distance.

Project Requirements

Features:

- LEDs when object is detected.
- Buzzer alert when object is detected.
- Onboard button to reset watchdog.

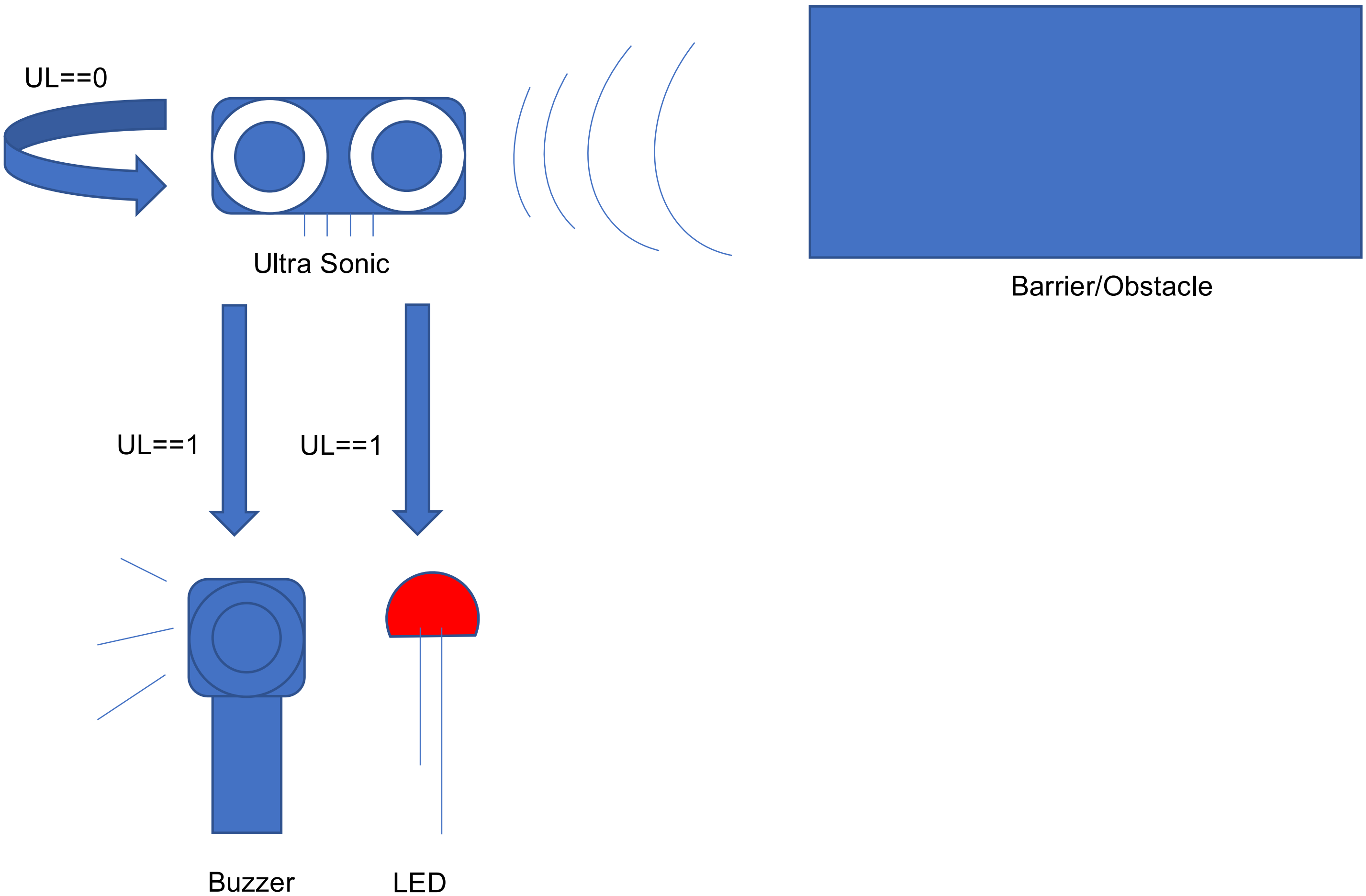
Specification:

- Inputs:
  - Ultra Sonic transducer.
  - Onboard button.
- Outputs:
  - Buzzer (gets triggered when an object is detected).
  - LED (turns on when an object is detected).
- Functions:

  The ultra sonic detects an object and triggers the buzzer. An LED also goes on when an object is detected.

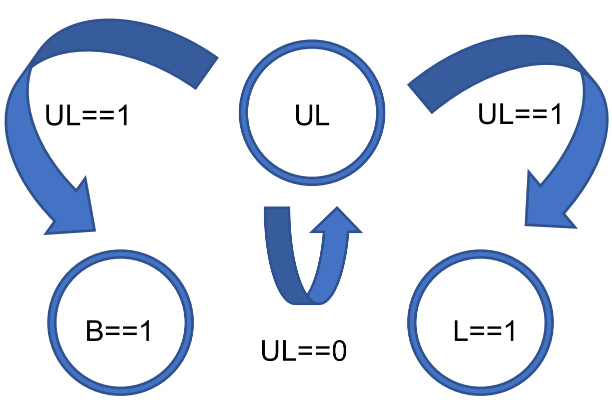
Solution Development

Block Diagram:



When the ultra sonic detects a barrier, the LED goes on and the buzzer gets triggered.

System Diagram:



Variables:

- LED (L)
- Buzzer (B)
- Ultra Sonic (UL)

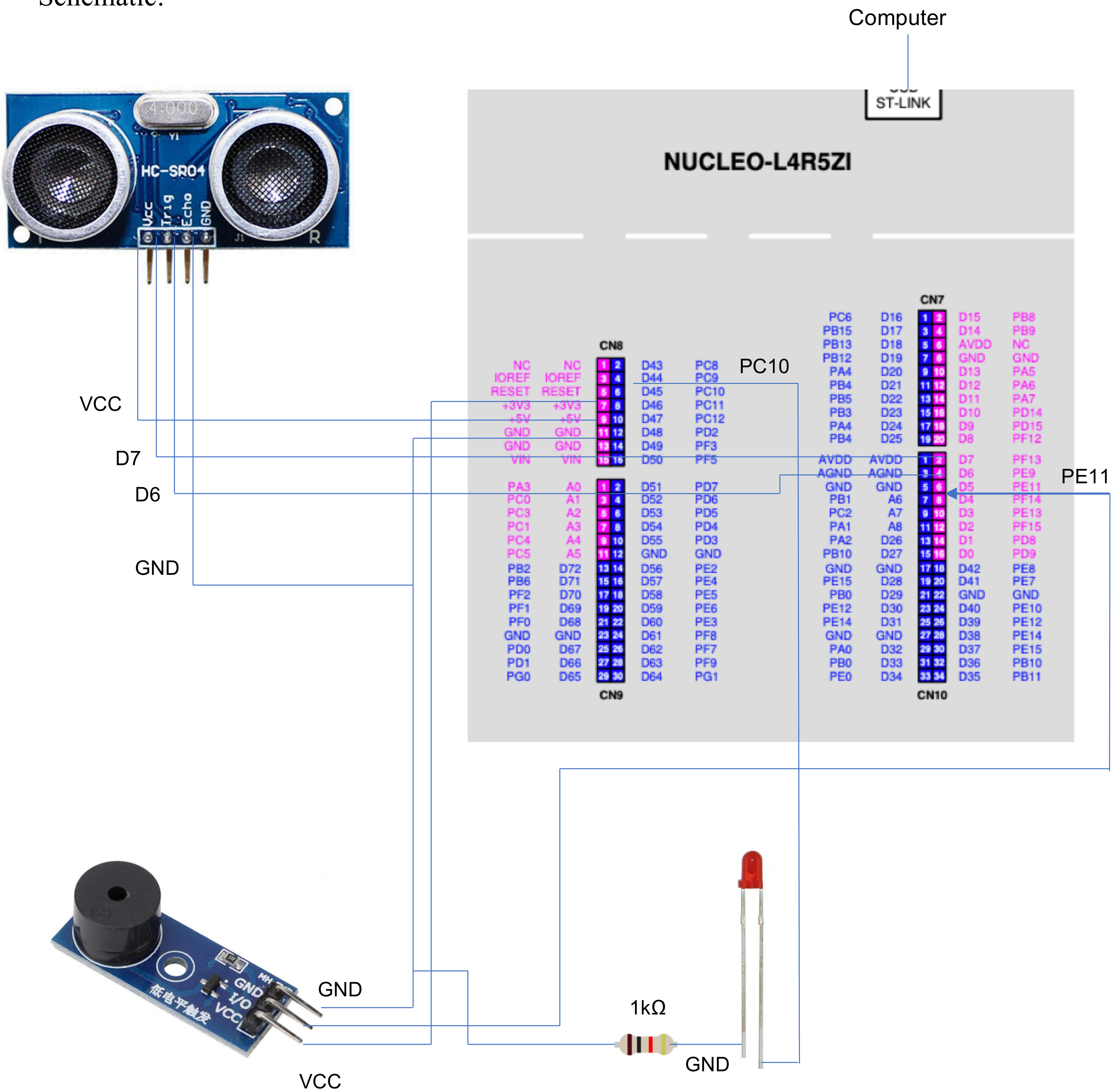
When the ultra sonic detects a barrier(UL==1), the buzzer gets triggered(B==1) and the LED goes on(L==1). When UL==0, B==0 and L==0.

User Instructions

Bill of Materials:

- Nucleo-L4R5ZI
- Ultra Sonic Transducer (HC-SR04)
- Buzzer (ARCELI DC 3.3-5V)
- USB cable (to connect the Nucleo)
- LED
- Circuit board
- Resistors
- Jumper wires

Schematic:



Buzzer VCC = +3.3V
Ultra Sonic VCC = +5V

Setup Instruction:

1. Prepare a USB cable to connect your computer to the Nucleo-L4R5ZI (where it says USB PWR not User USB) to provide power.
2. Create a mbed_app.json file under your project and copy/paste the following code:

```
{"target_overrides":{
    "*":{
        "platform.callback-nontrivial":true
    }
}}
```

3. Place your ultra sonic, buzzer and LED on the breadboard and connect the pins by following the schematic. Each wire is labeled with a pin number. Make sure it's the right one.

4. Connect the USB cable that you prepared in step 1 to your computer.

Guide to use the system:

First, build and run the code to see if there are any errors. If there aren't any errors, that means the system is working. Make sure the breadboard is placed on a flat surface and the ultra sonic has a measuring angle of 15 degrees before you test the system. After running the system, place an object in front of the ultra sonic. Once an object is placed in front of the ultra sonic, the buzzer has to make a sound and the LED has to turn on. The buzzer and LED don't go off until the object is removed. The distance of the object gets printed on the serial monitor.

Test Plan:

- Test the LED to make sure that it's working before running the system.
- Test the buzzer to make sure that it's working before running the system.
- After building and running the code, place an object in front of the ultra sonic and move it back and look at the serial monitor to see if the distance is increasing.
- After following the steps above, setup the whole system and run it.
- Put the object in front of the ultra sonic and check to see if the LED is on while the object is in front of the ultra sonic.
- Likewise, make sure the buzzer is making sounds while the object is in front of the ultra sonic.
- Double check to make sure the distance is getting printed on the serial monitor.

Revision History

Date	**Revision**	**Changes**
31-Oct-2020	Initial Definition of Problem/System	Initial Start
1-Nov-2020	Stage 2 Close Out	- Came up with an idea for the project. - Completed Constraints and specifications. - Ordered the necessary components.
8-Nov-2020	Stage 3 Close Out	- Improvised constraints and specification. - Conducted a research to learn more about the external peripherals. - Made a list of BOMs. - Designed a block diagram for the system.
15-Nov-2020	Stage 4 Close Out	- Conducted more research to learn about the external peripherals.
22-Nov-2020	Stage 5 Close Out	- Received the necessary components to build the system. - Implemented some parts of the code.
10-Dec-2020	Final Submission Deadline	- Finalized the project after gathering resources from the research conducted. - Commented the code. - Finalized the documentation of the system.

Future Consideration

Shortfalls for System Design:

This system did meet the objective design criteria as planned. However, it could've been better if it was placed on a white cane to maximize the distance. This system is designed to benefit the accessibility support area, but it could also be utilized for other purposes. For instance, it could be used for social distancing by altering the distance to 6 ft. If a person is not 6 feet apart the buzzer get triggered. In addition, It could also be used for environmental purposes by targeting a specific task.

Communication Feature:

Initially, the goal was incorporating I2C to utilize an internal clock for the project. However, due to timing issues, there wasn't enough content and examples to implement it. However, the method used for this system is much more simpler because it doesn't require enabling an internal clock and defining a function for a delay. Using I2C is better because the distance calculated is much more accurate when an internal clock is utilized.

Memory Management:

I did include "return 0" at the end of my functions to avoid memory leak. Other than that, there's really no more spots for improvements.

Direct Memory Access:

For example, if an array was utilized for a specific reason in this project, it would've been better to access the memory directly because sometimes the processor takes more than enough time to process the data and limits the performance of a function by taking too much time.

Improvement Recommendation:

I'd recommend placing the ultra sonic and the buzzer on top of a hat, with some sort of rotating object to get a get a 360 degrees view. The ultra sonic would spin and check all directions.

References

Resistor Picture:
https://www.google.com/search?q=1+kohm+resistor&tbm=isch&ved=2ahUKEwjOjMfM98HtAhVMMN8KHWoeC4EQ2-cCegQIABAA&oq=1+kohm+resistor&gs_lcp=CgNpbWcQAzIECAAQQzICCAAyBAgAEBg6BQgAELEDOggIABCxAxCDAToECAAQHjoGCAAQBRAeOgYIABAIEB5QyN0BWMqMAmD_jQJoAXAAeACAAUqIAf4IkgECMTeYAQCgAQGqAQtnd3Mtd2l6LWltZ7ABAMABAQ&sclient=img&ei=z03RX47pN8zg_AbqvKyICA&bih=709&biw=1290&rlz=1C5CHFA_enUS782US784#imgrc=g7X-O5P30lg9IM

Ultra Sonic Picture:
https://www.walmart.com/ip/Cusimax-HC-SR04-Ultrasonic-Sensor-Distance-Measuring-Module-For-Arduino-Microcontroller/258116936?wmlspartner=wlpa&selectedSellerId=18988&&adid=22222222227372869428&wl0=&wl1=g&wl2=c&wl3=471957258211&wl4=pla-977295810471&wl5=9005550&wl6=&wl7=&wl8=&wl9=pla&wl10=125210027&wl11=online&wl12=258116936&veh=sem&gclid=CjwKCAiAiML-BRAAEiwAuWVggkSFPvazIvcChEneWpiOR3SF8Dgy1MJfrV4nJGE4DICEHtZK_7sVohoCVowQAvD_BwE

Buzzer picture:
https://www.amazon.com/ARCELI-3-3-5V-Passive-Trigger-Arduino/dp/B07MPYWVGD

LED picture:
https://www.alliedelec.com/product/vcc-visual-communications-company-/vaol-3lae2/70052929/?utm_source=google&utm_medium=cpc&adpos=&scid=scplp70052929&sc_intid=70052929&gclid=CjwKCAiAiML-BRAAEiwAuWVggl0jset86FVZVHn3e13ROtFJYwVbe_qZP7NcNQo3QH7uDqWL2x1ztRoCzYQQAvD_BwE&gclsrc=aw.ds