Polytechnic University of the Philippines

Parañaque Campus

Bachelor of Science in Computer Engineering

Introduction to Hardware Description Language

CMPE 30121

DistanceSiya: Social Distancing Device Using Ultrasonic Distance Sensor

Researchers:

1. Ambonan, Rhica Mei B.

2. Bautista, Jestelle Fae V.

3. Camarig, Jhon Rafael M.

3. Francia, Cloie C.

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Submitted to:

Doc. Arvin R. Dela Cruz

Introduction

On January 30, 2020, the first case of the novel Corona Virus was reported in the Philippines. The virus has been rapidly spreading since then, with local transmissions and new confirmed cases spiking across the country. The Philippine government declared a health emergency and a state of calamity, resulting in local lockdowns and a travel ban. Despite the country's current lockdowns, the Covid-19 cases continue to emerge as months pass by. The rising number of COVID-19 cases frightened the entire country, particularly healthcare employees. Even though a year has gone by, there is still no certainty as to when the pandemic will end.

Social distancing is one method of preventing the transmission of COVID-19, and people should constantly maintain a one-meter distance wherever they go to be able to protect themselves and others. According to the Centers for Disease Control and Prevention, social distance is defined as; a.) keeping as far away from "congregate settings" as feasible, b.) avoiding large crowds, c.) when feasible, keeping a distance of around 6 feet from people. In order to avoid the transmission of contagious diseases like COVID-19, social distance is essential. We can lower our chances of contracting the virus and transmitting it to our loved ones and community by limiting our close contact with others.

The device that has been made is called DistanceSiya. Basically, it is a device that monitors the user’s distance from other people and ensures that they are following a one-meter space. It will let the users know when they are in a safe zone, caution, warning, and danger zone. When the users are already in a danger zone, the application will start to alarm for the users to be notified of their current situation.

Such kind of device is very important in today’s pandemic to be able to ensure one’s safety and others as well. Ensuring that people follow strict social distancing could also help flatten the curve. The term "flattening the curve" refers to the process of minimizing the number of persons who are sick at the same time. If the number of COVID-19 patients increases dramatically all at once, health-care systems and resources may be overwhelmed. Efforts to prevent COVID-19 from spreading quickly, such as social distancing, help reduce the number of patient’s sick at any given time as low as possible. So, the proponents have come up with a social distancing device to encourage all people to follow social distancing to be able to help lessen and flatten the curve. If

this happens, the whole country can go back to normal, students will be having their face-to-face classes, and business will go back to operation.

Rationale

DistanceSiya is a device made for social distancing. It is a device that monitors the user's distance from other people and ensures that they are following a one-meter distance. When the users are already in a danger zone, the application will start to alarm for the users to be notified of their current situation. This device will help people to be safe from the virus, and the people who have the virus. This can also help lessen the number of Covid-19 cases in the country.

Features and Limitation

Features

- The device will let the users know if they are safe or not while they are outside by maintaining social distancing.
- The device emits colored light, and each has a specified role. The green light means that the user is in a safe zone and maintains social distance from the crowd. The yellow circle means that the users should be cautious because they are in a caution zone wherein some people are getting a bit close. The orange light means that the users are given a warning because they are in a warning zone wherein people are getting crowded near them. Lastly, the red light means that the user is in a danger zone, and this means that they are very near to the crowd.

Limitation

- The device can only detect from a range of 4 meters from the person holding the device. Movement beyond 4 meters can no longer be detected.
- The device will stop working if the battery runs out.

Significance

The device will help people maintain their physical distances with other individuals by strictly monitoring that they follow the standard one-meter distance to avoid any physical contact and to ensure that they are safe from the virus. It can benefit the following individuals specifically:

a. **Employees and Workers.** This device will benefit all employees and workers who go out every day. Government employees, healthcare workers, front-line workers, school personnel, private and public company employees, construction workers, self-employed workers, and others make up the workforce. They are more likely to get the virus because they are always out, especially when they are exposed to many individuals on public transportation and at work. They will be able to check and monitor social distancing with other people with the use of this device.

b. **Customers.** This device will assist all customers who go out to purchase goods and necessities for their daily lives. They will be alerted with the device's alarm if they are no longer within one-meter distance with other individuals. It will also help them in being mindful of the crowd wherever they are.

c. **Students.** All students will benefit from the device. Some universities have already held face-to-face classes in particular areas. Students in the medical sector, engineering, and information technology are the ones who must perform laboratories; thus, they must be present at school. As a result, students are at risk of getting the virus at school and while on public transportation. With the help of this device, they will be able to check and monitor if other people are already close to them and not following social distancing. It will also secure their safety while giving them opportunity to study hands-on, ensuring that future professionals are of high quality.

d. **Tourists.** Tourists will benefit from this device as well. Some provinces and tourist spots have already reopened to the public after being quarantined for a few months. As a result, some tourists used this as an opportunity to get away from the stress brought by the pandemic. The researchers noticed a lot of people visiting various tourist attractions during the pandemic. In this instance, they will be engaging with new people without knowing whether they are infected with the virus. They have the option of maintaining social distance and adhering to safety standards. They can use this device to see if they have been keeping a one-meter distance from other people to avoid getting the virus.

e. **Whole Community.** Most significantly, this device will be beneficial to the whole community. People in the community still need to interact with one another through purchasing goods from supermarkets, "tiangge", water-refilling stations, street vendors, and other sources. Even if they do not leave their barangay, there is still a chance that they will become infected with the virus. If one person has been infected, it will quickly spread across

the members of the community especially that houses are near each other. Thus, this device is important for maintaining social distancing among people inside the community.

Components

- **5V Battery**

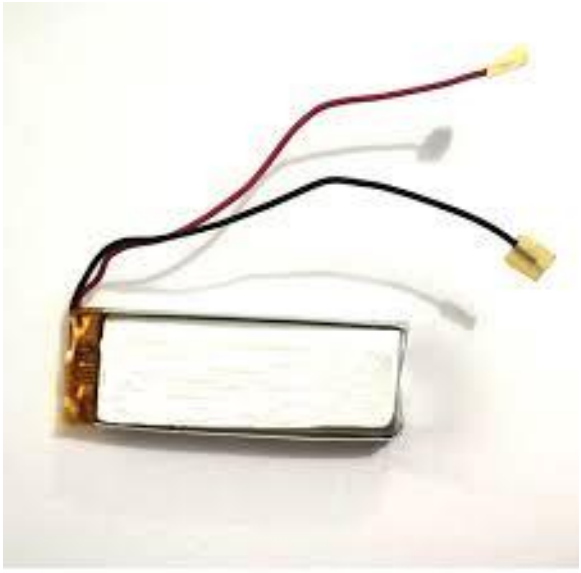

Figure 1. 5V Battery

- **Buzzer**

Figure 2. Buzzer

- **Ultrasonic Distance Sensor**

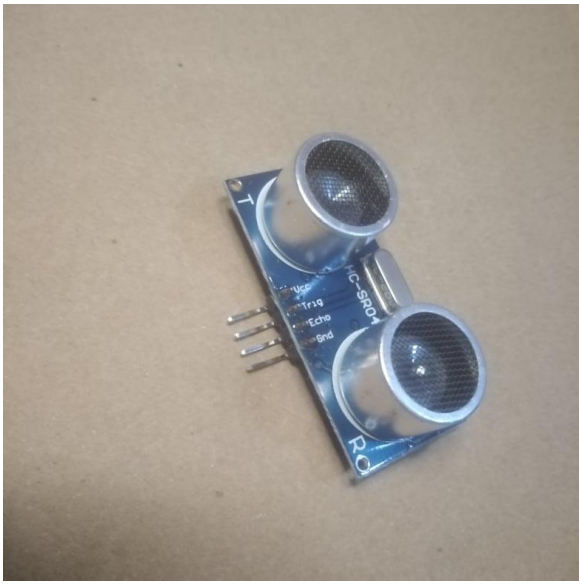

Figure 3. Ultrasonic Distance Sensor

- **Arduino nano**

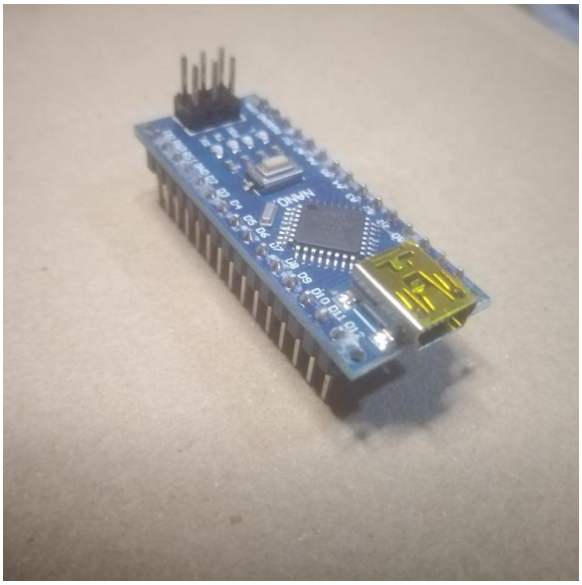

Figure 4. Arduino nano

- **LED Yellow, Green, Red, Orange**

Figure 5. LED Yellow, Green, Red, Orange

- **Resistor**

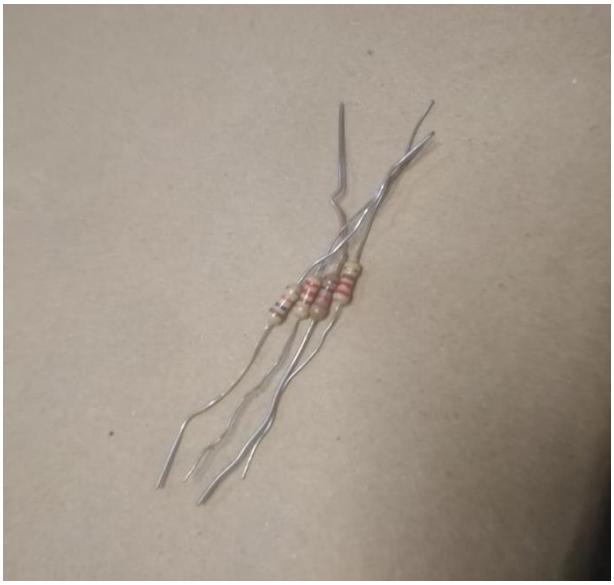

Figure 6. Resistor

- **Jumping Wires**

Figure 7. Jumping Wires

Circuit Diagram

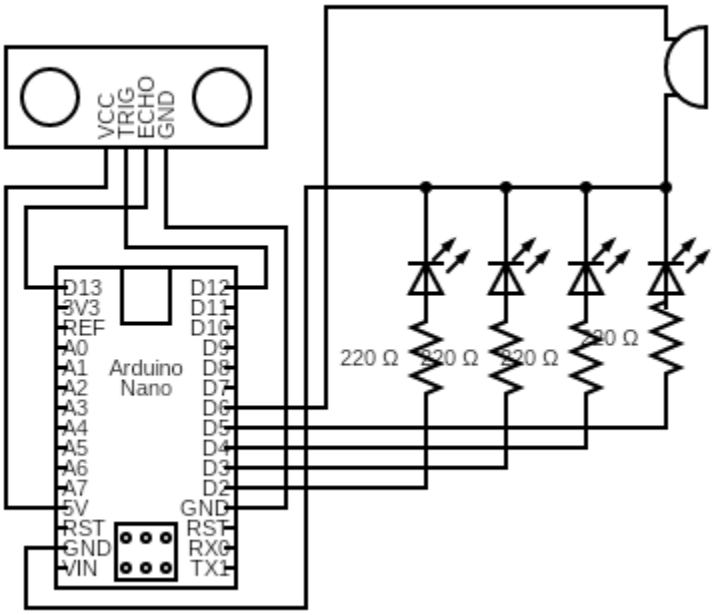

Figure 8. Circuit Diagram

Block Diagram

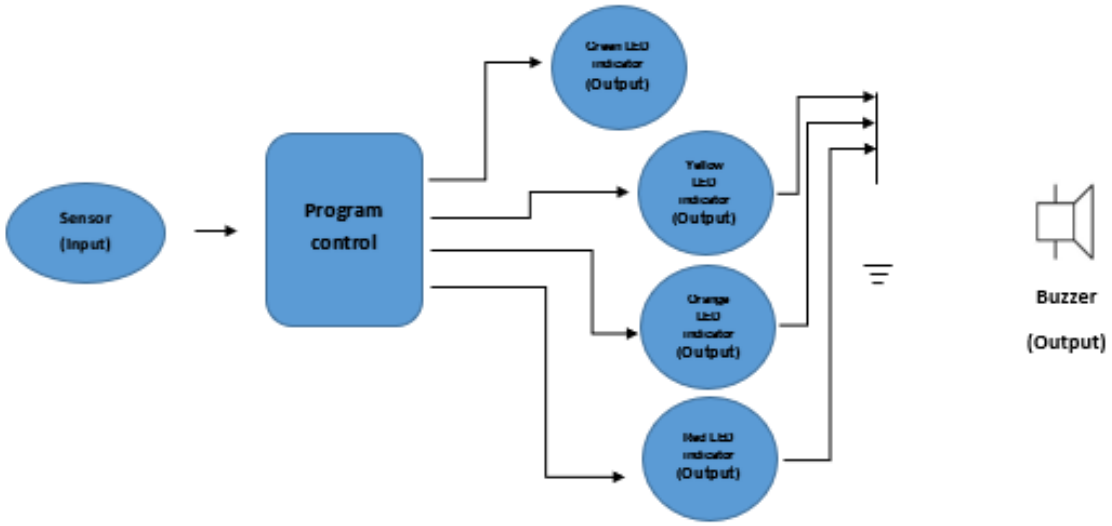

Figure 9. Block Diagram

Schematic Diagram

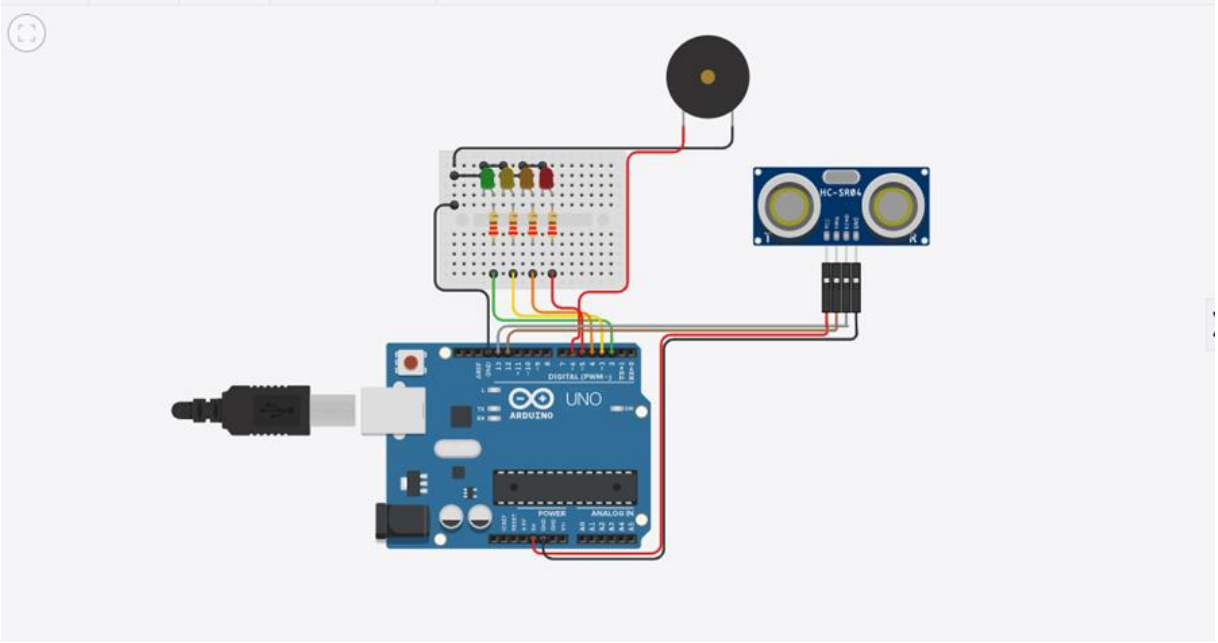

Figure 10. Schematic Diagram

VHDL Simulation

C:/modeltech64_2020.4/examples/research.vhd (/research_ent) - Default *

```
Ln#
 1  library ieee;
 2  use ieee.std_logic_1164.all;
 3
 4  ------------------------------------
 5
 6  entity research_ent is
 7  port(   A, B, C, D: in std_logic;
 8          F: out std_logic
 9  );
10  end research_ent;
11
12  ------------------------------------
13
14  architecture behv of research_ent is
15  begin
16
17     F <= ( A xor B xor C xor D);
18
19  end behv;
20
```

Figure 11. VHDL Simulation Program Code

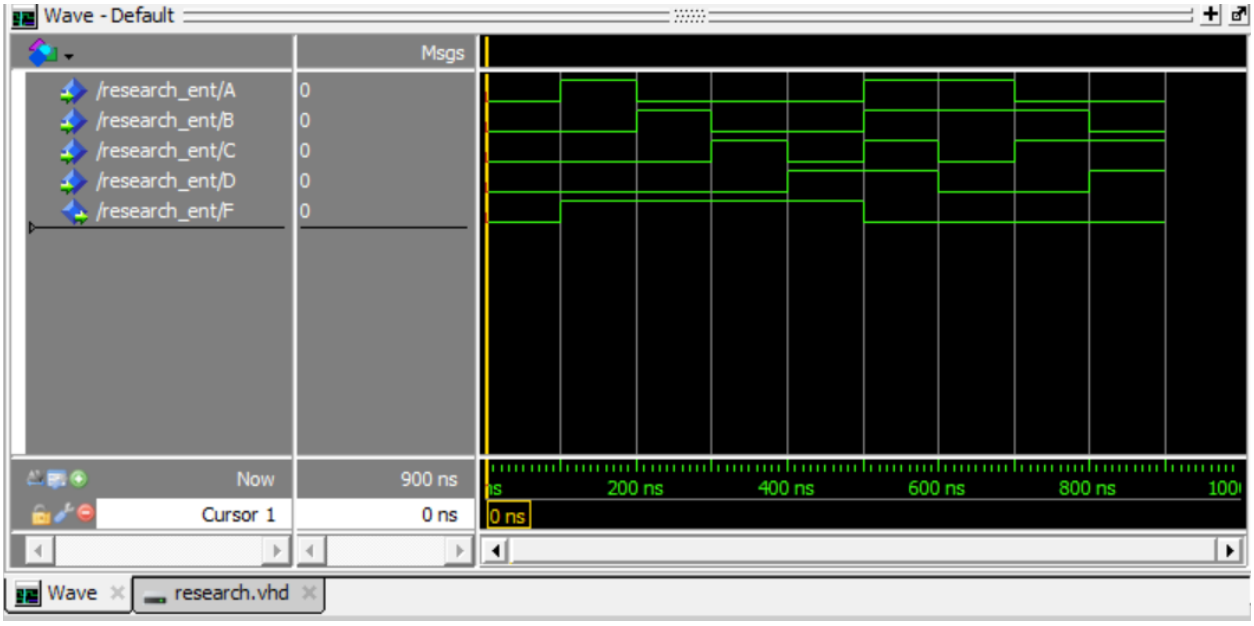

Figure 12. VHDL Simulation Wave Form

Prototype


Figures 13 and 14. Prototype

Results

The device that has been made is a lapel style, for it is handy and you can carry it wherever you go. It was designed and enclosed with an Arduino acrylic case to make it easier for people who use it in recognizing the LED color whenever it lights up.

Once a person entered within 400cm range, the green led light will light up. If there are multiple persons detected within the range, the one who is nearest will be the one detected and the designated led will light up. The range starts from:

LED	Range	Description
Green	151cm-400cm	Safe zone
Yellow	101cm-150cm	Alert zone
Orange	51cm-100cm	Warning zone
Red	0-50cm	Danger zone

Figure 15. Table

Conclusion

After making the device and seeing how successful it has been made, the researchers conclude that this device is indeed helpful in dealing with the pandemic. This could help the people in maintaining social distancing from other people especially when they are outside of their comfort zones. This can also help lessen the number of Covid-19 cases in the country, as well as the people who are experiencing communicable diseases.

Recommendation

The researchers recommend to future researchers and developers to innovate the device and to make it smaller than what the researchers made. Also, to add some functions that are also useful like for example giving a warning to the user when a person close to him have symptoms of the virus or not. Finally, the device can also be used even after the pandemic has ended so it could help people maintain distancing to people who has communicable diseases.