Ultrasonic Sensor as Security

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Introduction:

The purpose of this project is to detect motion and obstruction. This problem was chosen due to the relatability and accessibility to motion detect as a means to solve numerous situations a person may have. One could use motion detection to notify when a customer enters a store to provide service to them as an example.

In order to utilize the motion detection, this project will give an audible que that motion was detected. Specifically, so long as an obstruction exists the audio will continue to play. This decision was made to explore the idea of a guard-esque robot that does not want anything to cross or remain in front of it.

Initial Thoughts:

The beginning of the project included a robot that would scan a perimeter via servos and halt when something obstructs its view. When not moving, the robot would then play audio stating to leave the premise. The initial idea to detect obstructions was to use a video camera and have it monitor a specified area. This approach was influenced by security cameras and those that observe the footage real-time. The idea was to focus

on a mostly stagnant image and flag any time the image appeared any different. If any movement was detected it would trigger the sound to play. The audio que would play via a speaker, as verbal commands to vacate the area would echo.

Second Thoughts:

After beginning to research how to detect obstacles from a given point, it was quickly decided that using a camera would lead to more work being done for potentially minimally better results. The Passive Infared (PIR) sensor that would be used as the camera posed problems as the detection could be affected by ambient temperature situations (Ada, Lady). An ultrasonic sensor however, detects distance via sound waves. The time it takes from the waves being emitted to hitting an object and returning to the sensor is used to determine distance (Jost, Danny). This is deemed more useful in the circumstance since a static variable, the area being monitored, will have a constant distance for the sound waves to travel. Anything that obstructs the sensor will then return a shorter distance, thus returning a shorter time. The Ultrasonic sensors also are not affected by light, dust, smoke, etc. whereas infrared sensors hold the potential to return false positives (Burnett, Roderick).This can then be used to measure movement and obstructions more accurately than the PIR sensor. Instead of a speaker, an active buzzer was used for the clear sound that it provided. This could also be used in quick succession, and is clearly discernible as a negative noise.

Set-up:

The following equipment was used:

-Arduino

-Ultrasonic Sensor

-Cardboard Box & Duct tape

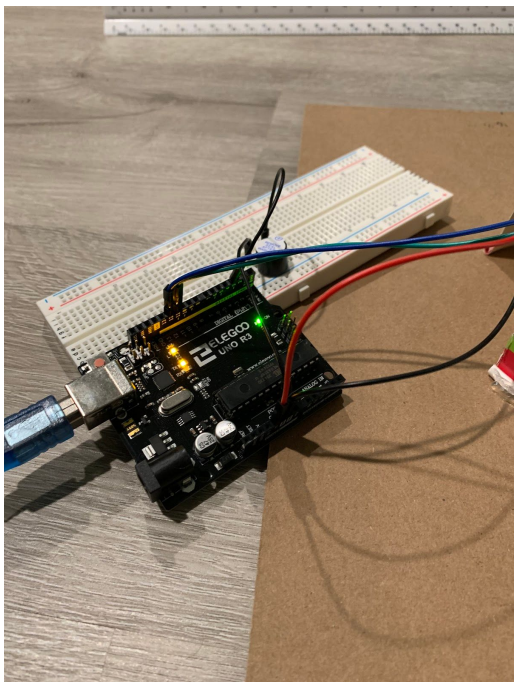
-Bread board

-Active buzzer

-Female to Male Dupont wire

-Jumper wire

Ultrasonic sensor was set up approximately 16.5 inches away from the backboard. The program was designed to return the distance every second and if it fell below a threshold, it would ring the alarm.



Conclusion:

The arduino motion sensor set-up was tested both in a dark and lit room and yielded the same results. Regardless of lighting, the sensor was able to detect any obstruction and ring the active buzzer immediately. This was also useful as any inanimate object passing would also flag for the alarm to sound. The project was tested using both a person’s hand, as well as multiple objects being placed in front of it. The Ultrasonic sensor proved to be valuable in its flexibility in multiple situations and reliability to produce valid alarms.

Works Cited

Burnett, Roderick. “Ultrasonic vs Infrared (IR) Sensors - Which Is Better?” *MaxBotix Inc.*, Publisher Name MaxBotix Inc.Publisher Logo, 15 July 2020, www.maxbotix.com/articles/ultrasonic-or-infrared-sensors.htm.

Ada, Lady. “IR Sensor.” *Adafruit Learning System*, learn.adafruit.com/ir-sensor.

Jost, Danny. “What Is an Ultrasonic Sensor?” *FierceElectronics*, 7 Oct. 2019, www.fierceelectronics.com/sensors/what-ultrasonic-sensor.