Electronic Seeing Eye Dog (D8)

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Phase 1:
1 sensor object detection within 50 cm with buzzer alerts
- Set up 1 ultrasonic sensor with an Arduino Uno and a buzzer to measure distance within 50cm
- Buzzer alerts when there exists an object within 10cm

Phase 2:
3 sensors object detection within 50 cm with buzzer alerts
- Improved the previous phase by adding 2 more ultrasonic sensors
- Modified the program to compare distance outputs from 3 sensors and display the distance of the closest object
- Allowed one single buzzer to generate different tones based on the direction of the closest object

Phase 2. 1:
Sensor Functionality testing and evaluation
- Tested ultrasonic sensor's functionality by verifying distances measured, by placing objects at different distances and checking distance computed by program
- Concluded that ultrasonic sensors can measure distances with high accuracy, within 5% error
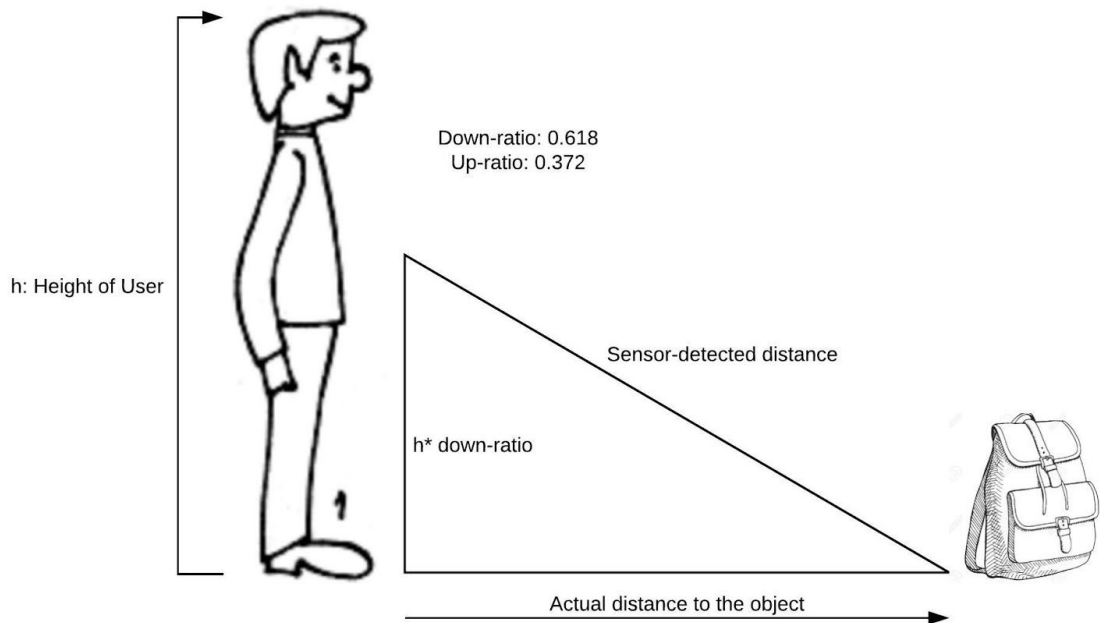- Dot plot actual dist vs. measured dist for one sensor

Phase 3:
3 sensors + alert threshold changed to 2 meters
- Verified that sensors can measure objects at 2 meters with reasonably high accuracy
- Tested the circuit in an empty corridor, but buzzer keeps beeping
- Concluded that sensor setup is not robust to noisy environments
- Current setup does NOT detect objects that are not on the same horizontal level of the sensors

Phase 4:
Incorporate Pythagorean theorem, multi-directional detection

- Solved the problem of detecting objects beyond the same horizontal level of the sensors by incorporating the Pythagorean theorem in algorithm
- Evaluated feasibility of using different threshold for different directions
- Algorithm visualization

Down-ratio: 0.618
Up-ratio: 0.372

h: Height of User

Sensor-detected distance

h* down-ratio

Actual distance to the object

$$Actual\_Distance = \sqrt{(Sensor\_Detected\_Distance)^2 - (h * down\_ratio)^2}$$

Phase 5:
Android interface Integration
- Configured Android and Arduino for serial communication
- Built an user interface with 4 buttons to start and stop connection with Arduino, read data from the serial port and display the distance on Android.

Next steps:
- Ordered portable batteries so Adruino devices can be used while moving around
- Implement bluetooth communication between Android device and circuit hardware
- Introduce vibrational feedback on top of sound feedback
- Improve sound feedback: language outputs instead of just buzzing sound
- Enable user input to customize experience (user's height, feedback preference etc)