Digital Guide Dog

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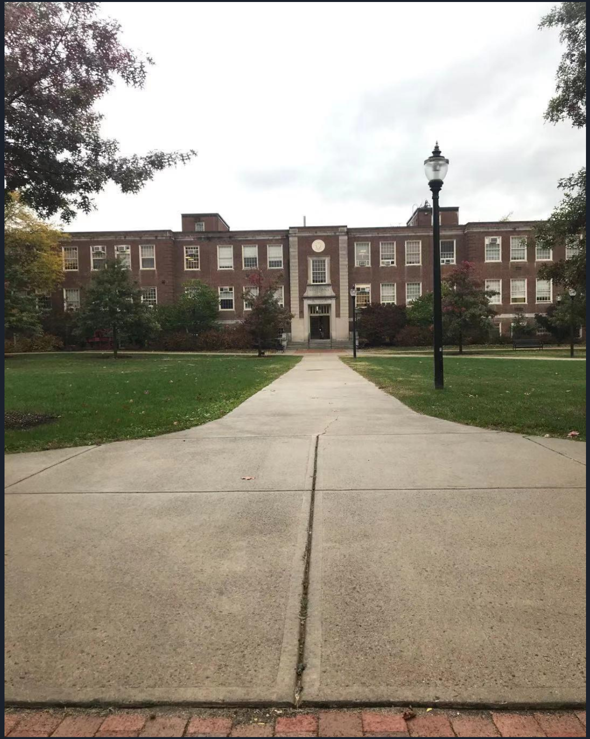
Problem Statement

There are about 10 million visually impaired people in the US. It always hard for them to go outside to fit in the world with all the inconveniences. They usually go out with guide dogs, but it’s not easy to train a dog to be a qualified dog. In this project, we would like to create a system called “Digital Guide Dog” to offer them an easier way to avoid hitting any obstacles in a path.

Use case for the product

A vision impaired person walking down the quad from Marston to Knowles Engineering Building.



Requirements & Specification

1. Required work during day time.
2. Long enough to finish a trip. Working time: 2 hours
3. Work for person with normal walking form.
4. Horizontal FOV: 90 deg
5. Detect range: 0.3~30 feet
6. Light enough for people to easily carry. Weight <= 1.5 lb
7. Detect obstacle that are large enough to stop people from walking. Detected object size >= 50 sq inches

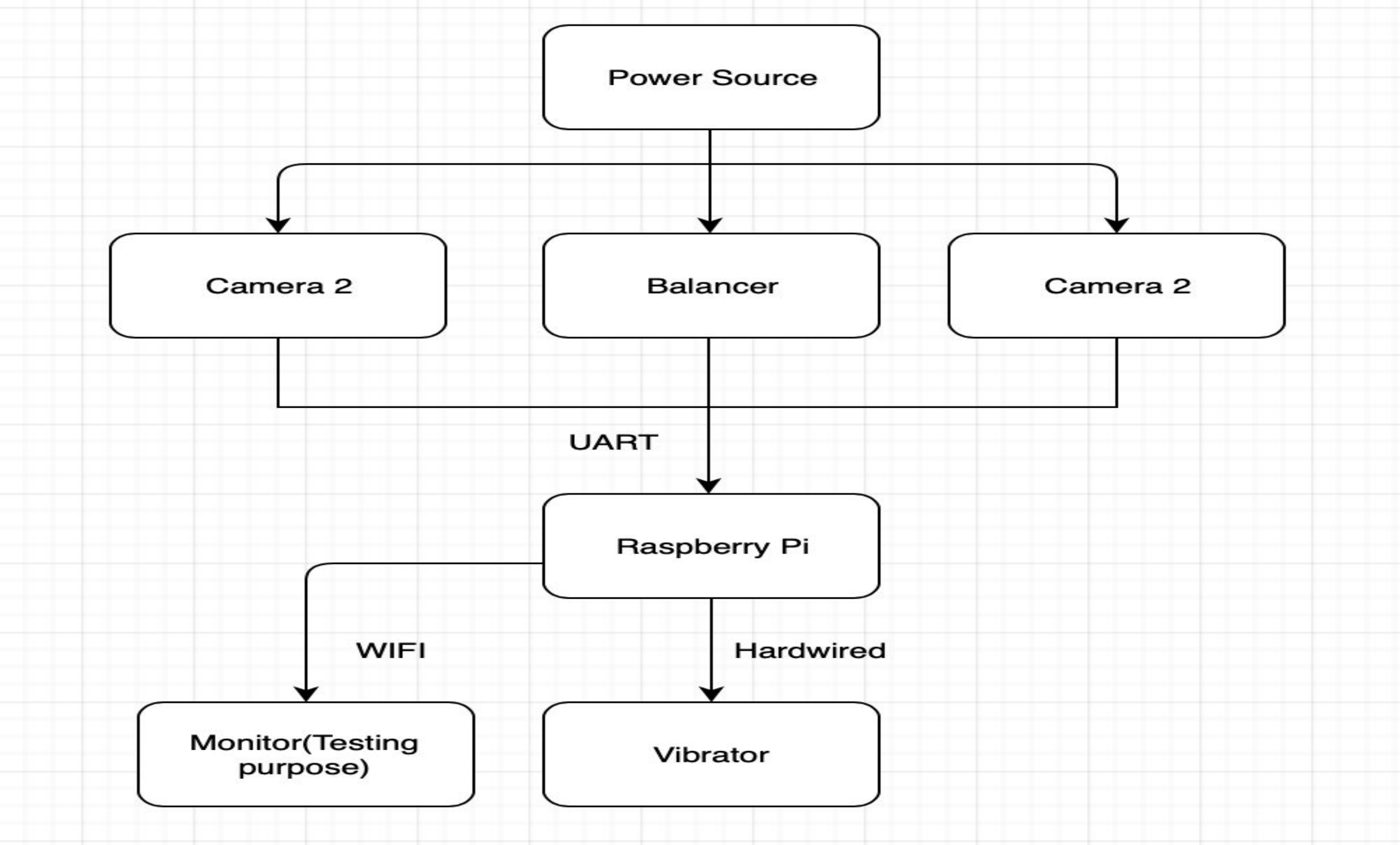
Altern #1: Guide Dog

Image by weapon_off_safe

Altern #2:

Compare with our design:
- Hands free
- More feedback
- Large detection range

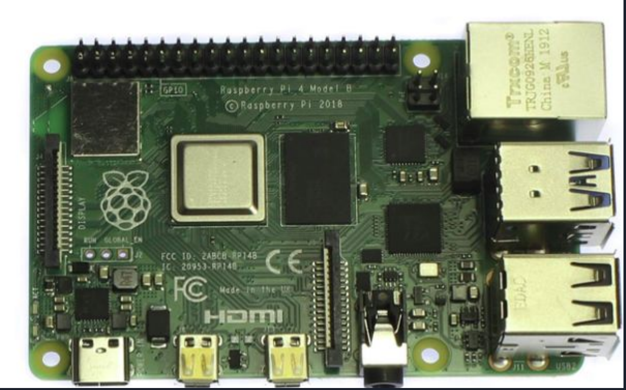
Block Diagram



Subsystem: Microcontroller

Raspberry Pi 4

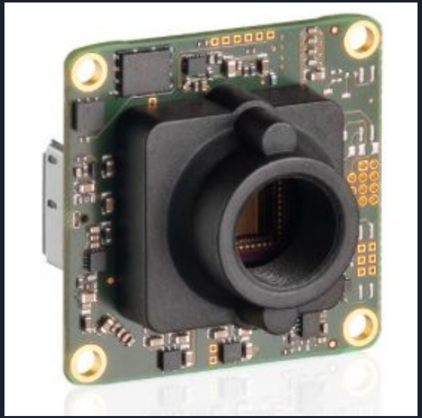
1. Computation
2. General-purpose input/output (**GPIO**) control sensors
3. Serial port transmits data
4. WIFI achieve remote control and communication
5. Include dual-band 2.4 / 5.0 GHz wireless LAN, Bluetooth 5.0



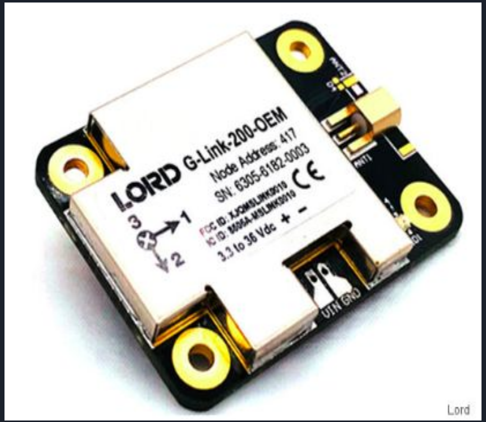
Subsystem

Camera, Vibrating, IMU sensor

Capture Photos



Vibration Warn

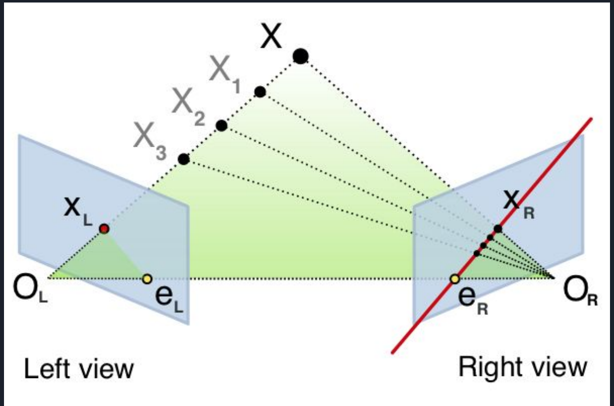


Measure Camera Pose

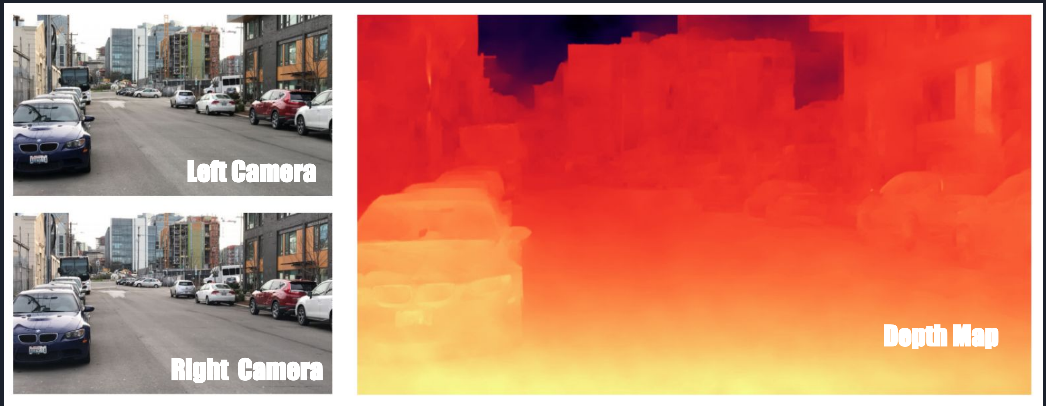
Computing depth from cameras

Camera Clibration → Capture Images → Depth Image → Denoise → V-Disparity Map → Removal Ground → Marking Pos & dist

Epipolar geometry



Depth map from stereo camera



MDR deliverable

Have Raspberry Pi process the pictures taken by camera.

Generate real time depth picture base on the the photos taken by the cameras.

Live deepth video shows on monitor.

Budget

- **Power Bank: $30**
- **Raspberry Pi 4 Model B: $70**
- **Intel RealSens D435: $180**
- **Jetson Nano: $99**
- **Vabirator * 2: 20 * 2 = $40**
- **Others: $30**
- **Totally: $449**

Thanks for your attention