

Robots for Disability

Final Project: Wearable Technology for
Visually Impaired

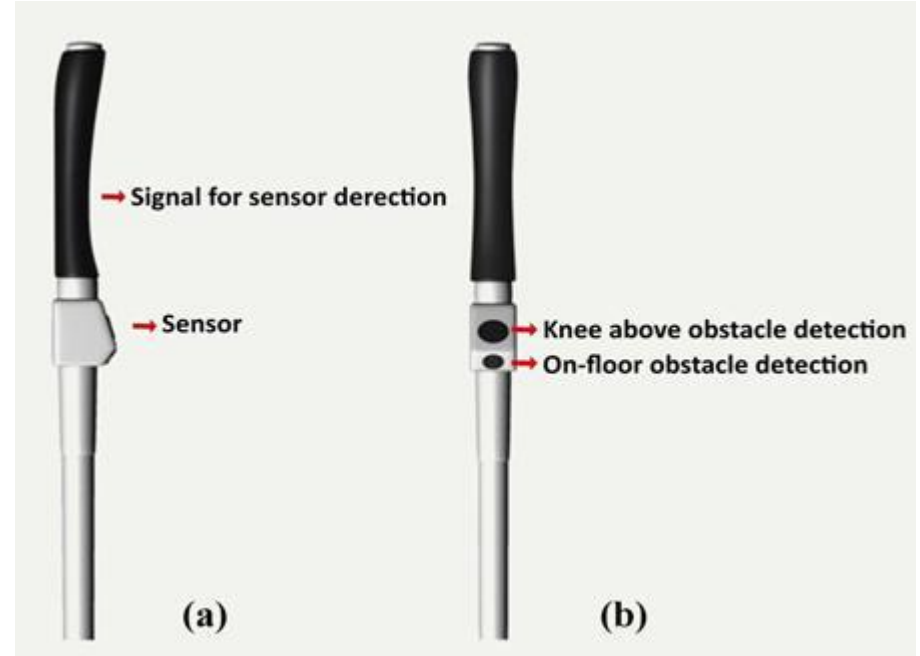
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Visual Impairment

- The human eye is like a camera that collects, focuses, and transmits light through a lens to create an image of its surroundings
- Causes:
Amblyopia, Cataracts, Diabetic retinopathy, Glaucoma, Macular degeneration, Trachoma
- Ophthalmology Evaluation:
Visual acuity test: Reading
Visual field test: Visuo-Spatial Orientation
Tonometry test: Eye Pressure
- The American Foundation for the Blind estimates that 10 million people in the United States are visually impaired

Widely utilized navigation for blind

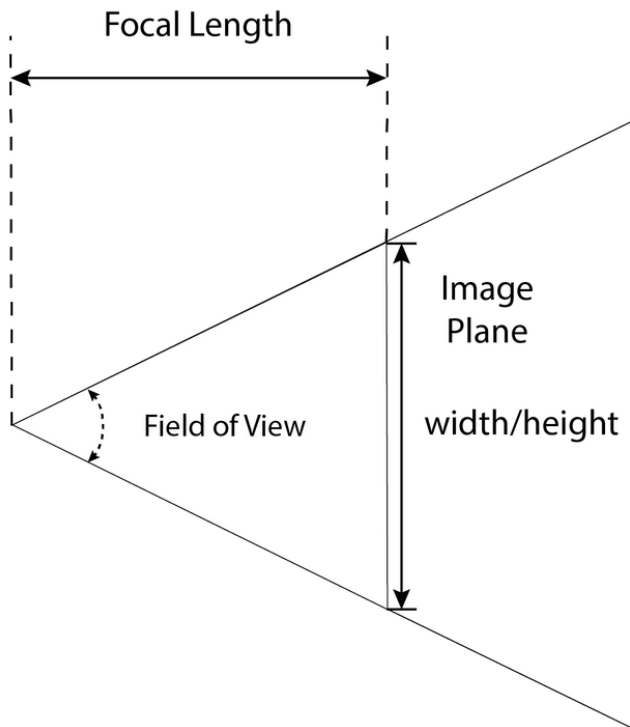
Cane and smart cane



Project Tango by Nvidia & Google



Tango Project-Pinhole camera



$$\text{Horizontal FOV} = 2 * \arctan(0.5 * \text{width} / F_x)$$

$$2 * \arctan\left(\frac{\text{width}/2}{F_x}\right) \quad 83 \text{ degrees}$$

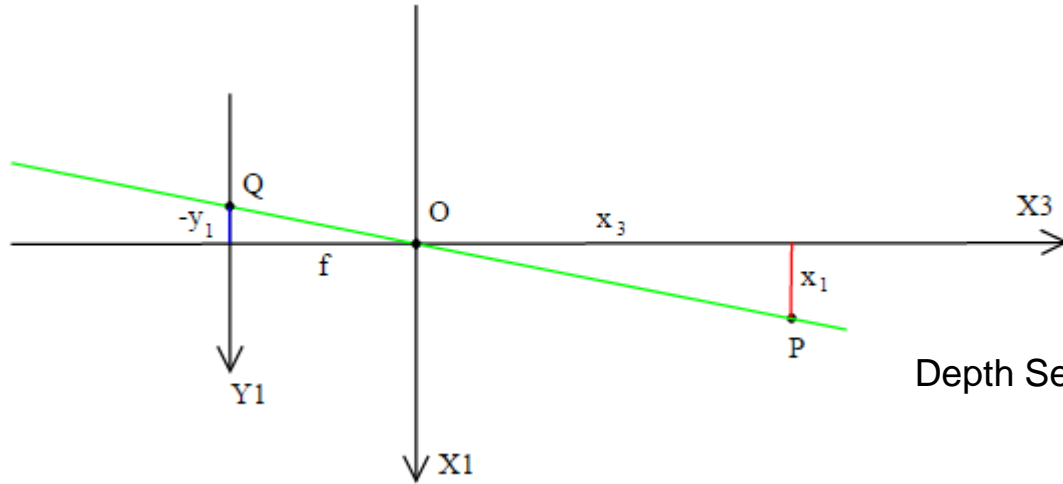
320 pixels

$$\text{Vertical FOV} = 2 * \arctan(0.5 * \text{height} / F_y)$$

$$2 * \arctan\left(\frac{\text{height}/2}{F_y}\right) \quad 39 \text{ degrees}$$

180 pixels

Depth processing



$$y_1 = -\frac{f x_1}{x_3}$$

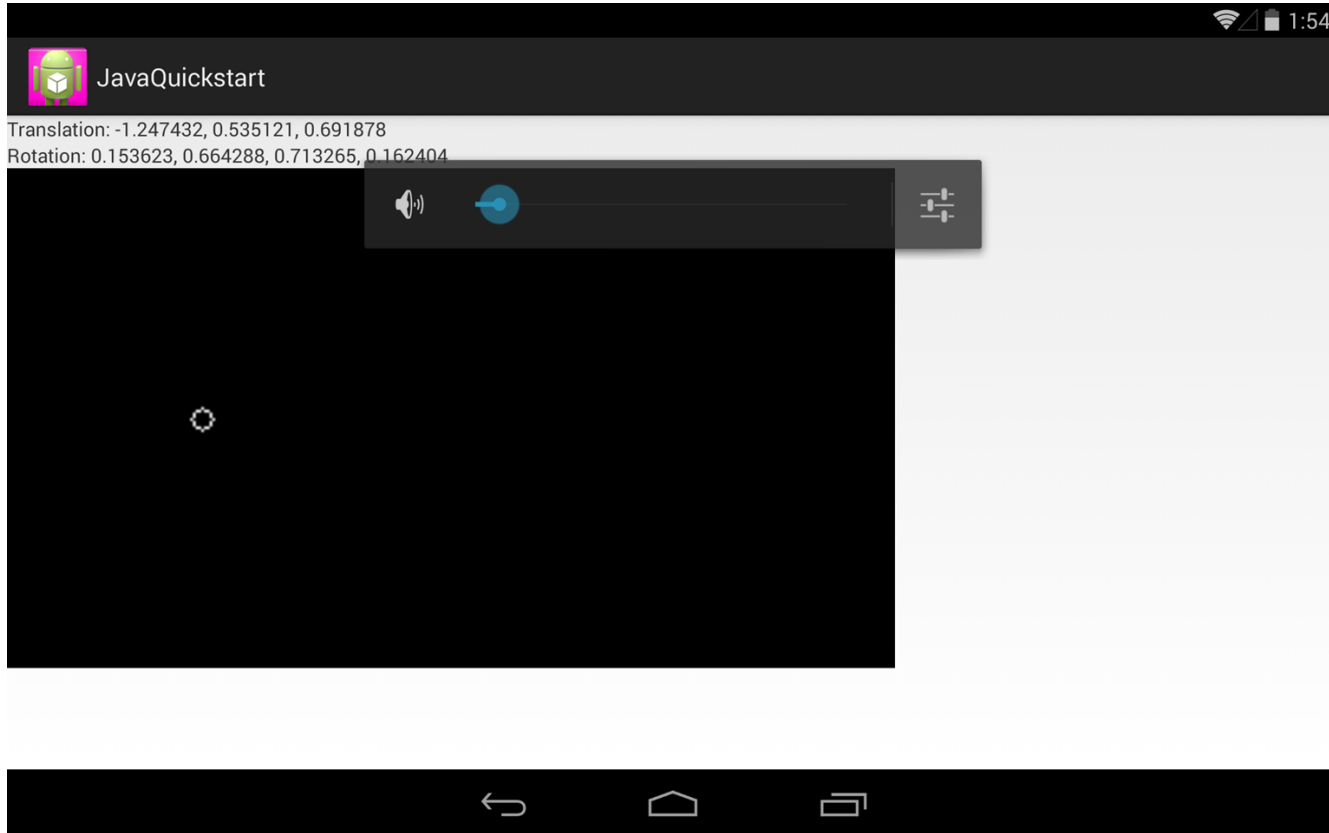
$$y_2 = -\frac{f x_2}{x_3}$$

Depth Sensing: Time of flight IR laser

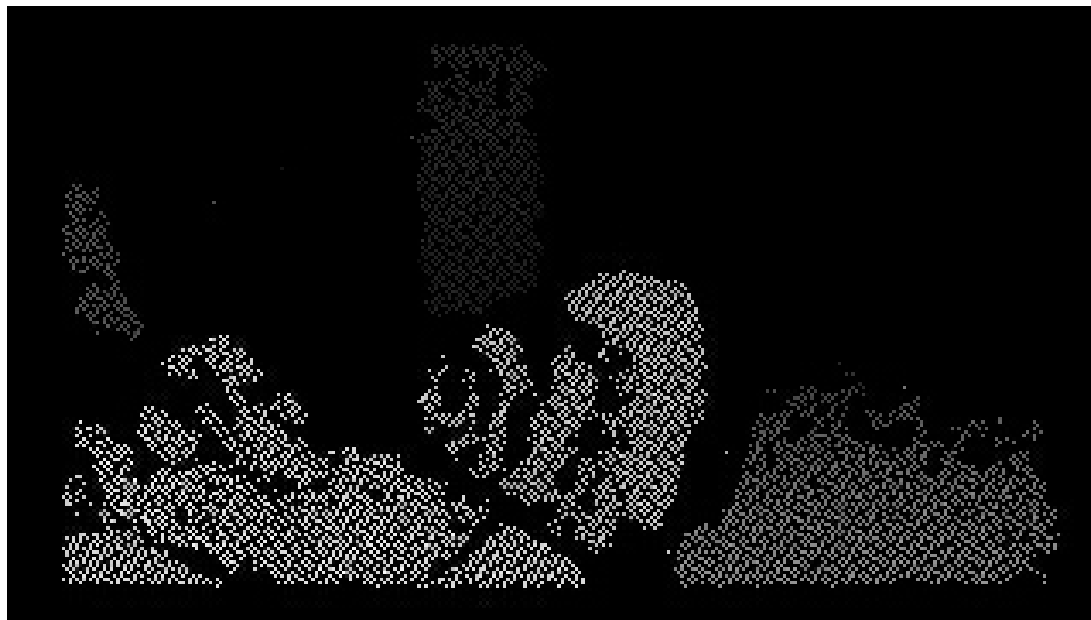
Android Application in Project Tango

- Android app in Project Tango is developed to compute the depth of objects
- The depth of objects is correspondingly scaled to the object location
- Algorithm finds the void areas in the environment from which user can walk through.
- Based on the location of this void space person is notified to align his/her direction towards the saame.

Android app Screenshot



Point Cloud to Depth Map



Hardware Implementation

- Arduino Wifly Shield communicates with Project Tango over WiFi
- Arduino controls two DC motors through L293D, that acts as Haptic feedback
- Based on this haptic feedback user can sense the direction he needs to walk in.

Circuit Diagram

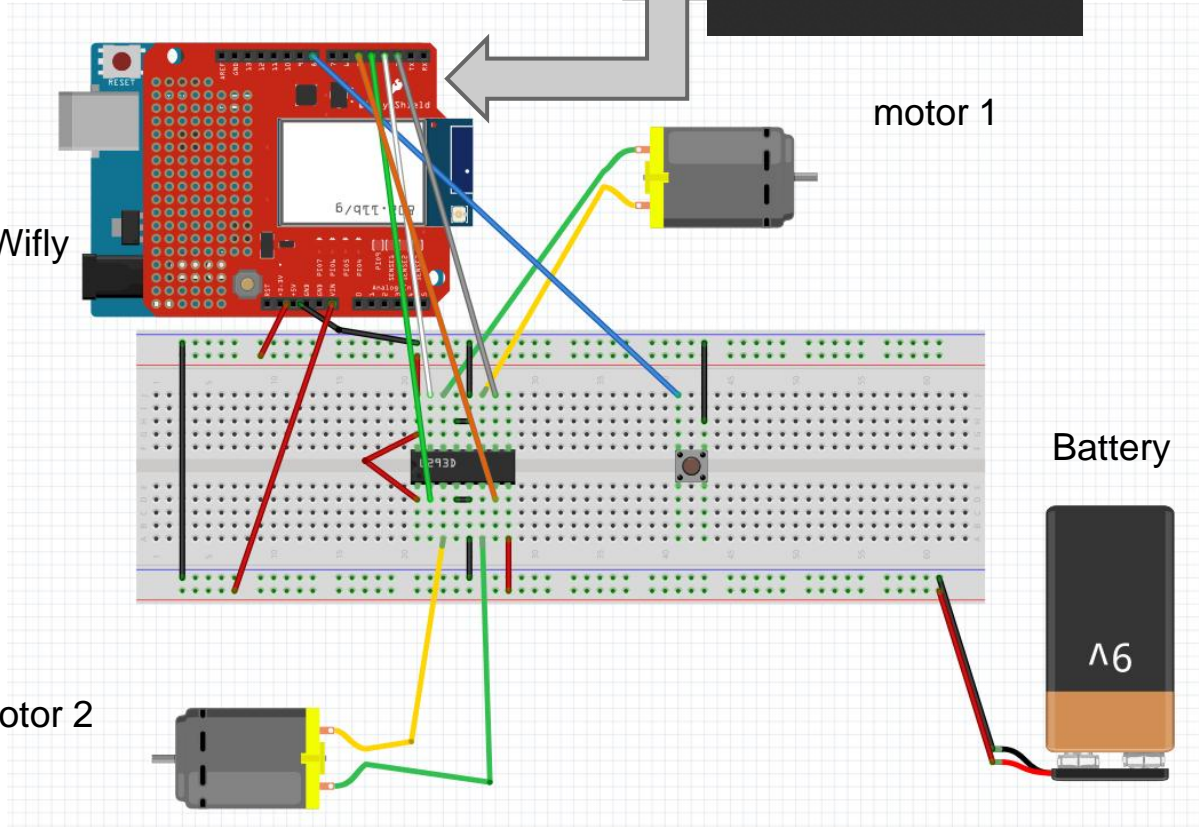


Arduino+Wifly

motor 1

Battery

motor 2



Project Cost

Bill of Materials	
Project Tango	557\$
Wifly Shield	60\$
Arduino Uno	20\$
DC Motor+comp.	20\$
Total	657\$

Future Work

