Safe Sidewalk Navigation

by group #7:

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Introduction

The navigation assistance technology for the visually impaired and the blind has been an active research topic for decades.In recent years, developers have begun to try to design robots or external devices to help blind people travel more conveniently and safely.

Objective

Optimize AI Technology Solutions has tasked us designing a solution to collect data and provide real-time support for low vision and blind people to safely navigate sidewalks and pathways independently.

Design Process

Short Term Work Plan

- Understand the challenge of Low Vision and Blind People
- Find hardware components
- Solution to function in all weather conditions

Long Term Work Plan

- Get all the electrical hardware
- Build the device in summer term
- Conduct detection test
- Adjust output signal
- Design AI calculator and training of AI

Week 1 Planning phase
Week 2 Case study
Week 3 Research on hardware, AI training
Week 4 Research: Visually impaired people
Week 5 Weather condition
Week 6 Periodic summarize
Week 7 Avaliable sensors
Week 8 Avaliable processor

Conclusion

- The use of lidar and millimeter-wave radar can collect more and more accurate environmental data, supplemented by ultrasonic radar can correct the error caused by the deviation of the laser reflection signal under rainy or other extreme weather conditions. The final inspection can be verified by comparing the image data collected by the video camera.
- Data processing is mainly divided into two stages. It will first be manually marked, such as adding a timestamp, etc., and then the marked data will be handed over to artificial intelligence for training. A well-trained AI will be well qualified for the navigation of the blind in the city.

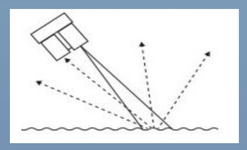

Figure 1.

Detials of design

- **Options Explored**

Performance	Infrared Sensor	Lidar	mmWave Radar	Ultrasonic Sensor	Video Camera
Cost	Mid	High (>$100)	Mid ($50)	Low (<$50)	Mid ($50)
Detection Angle	30-60 deg.	15-360 deg.	10-70 deg.	15-120 deg.	30-180 deg.
Night Detection	Strong	Strong	Strong	Strong	Weak
All-weather	Weak	Weak	Strong	Mid	Weak
Traffic signal Identification	×	×	×	×	√
Lane departure warning	×	√	×	×	√

- **Budget Summary**

	Sensors	Processor	Battary	Wearable device for fixation	Wiring
Budget(CAD)	300	TBD	50	50	50

- **System Architecture**

Data Collection Stage

Initial ideas:
- Lidars installed on the shoulder
- millimeter wave radar installed on the foot
- ultrasonic radar installed on the back
- image collection device (e.g. GoPro) installed on the head

Application Testing Stage:

Initial ideas:
- cancel the image collection device
- keep radars to continue the detection
- data processor should be used

- **Data Processing**

Store data that collected → **Mark the objects that appear in the record** → **Time stamp should be set** → **Marked data will be handed over to AI**

The collected data will be stored separately in an SD card, and during this process all the data will also be converted into numerical values.

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