Seeable

School Complex No. 6 named after John III Sobieski in Jastrzębie-Zdrój

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Young Inventors

TRL 7

E-NNOVATE International Innovation Show

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The Problems

01. Exclusion from society

02. No independence

03. Lack of affordable technology

In order to get some useful knowledge, we reached out to a blind wheelchair user. It helped a lot while developing the project.

The Solution

Solution 1

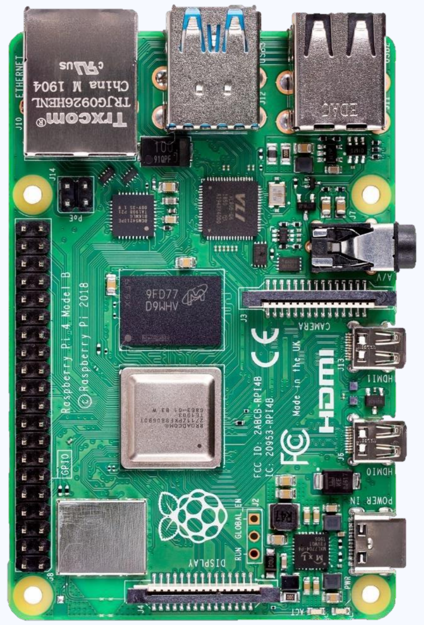
Thanks to building mapping, users can get nearly anywhere

Solution 2

We focused on making user interface accessible to blind people. It’s controlled with gestures and it has an audio description

Solution 3

Our project aims at using accessible low-cost parts



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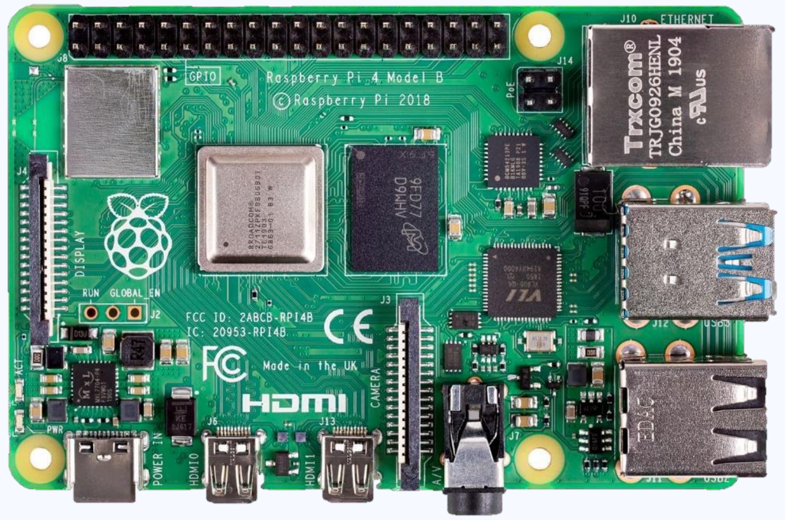
What is TRL?

Technology readiness levels (TRLs) are a method for estimating the maturity of technologies during the acquisition phase of a program. It has a scale of 1-9.

Our project is a prototype that is constantly tested by a blind person in a wheelchair. This makes it a TRL7.

How it works?

Our small system consists of two basic elements:



Raspberry Pi 4
(small, affordable and energy efficient single board computer)

AND

RPLIDAR A1M8
(360° laser distance sensor)

Role of Raspberry Pi

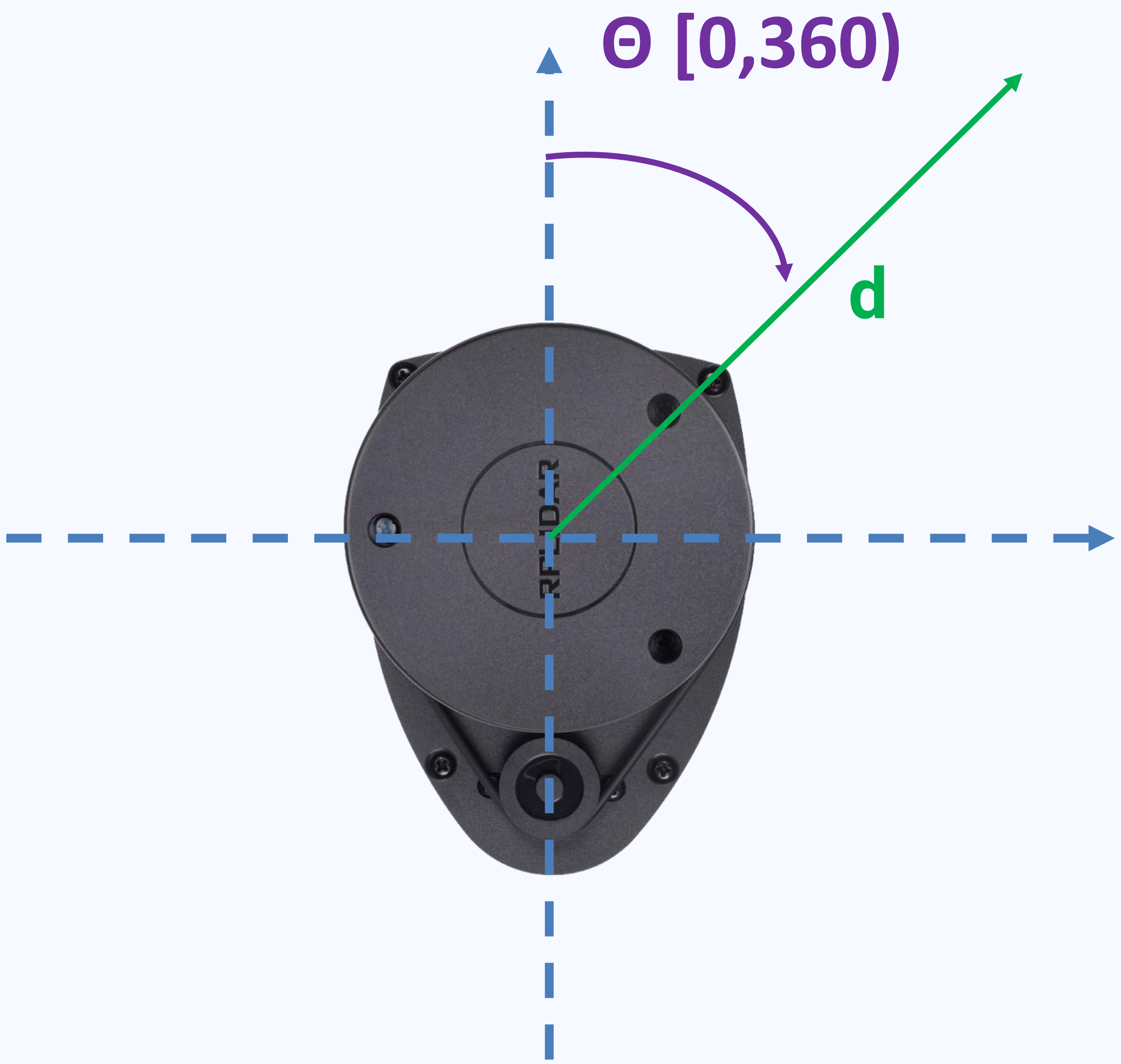
In the project, Raspberry Pi serves as the command center. It collects, processes and analyzes data from LiDAR, performs algorithms for mapping, route planning, navigation and obstacle detection in real time.

Individual microservices run in containers on Docker. A container is like a portable box that allows you to pack all your software along with what it needs to run.

How does LiDAR sensor work?

The method of operation is very simple. The sensor rotates and performs over 1,400 distance measurements with each rotation. This data is later sent to the Raspberry Pi via the UART interface. The rotation frequency is 5.5Hz.

Each measurement is assigned the angle for which it was made. This allows for further interpretation of the data.



Are there any limitations?

Not really. Here's why:

- We chose hardware that allows further development, such as adding camera for street sign recognition or additional sensors.
- Our software is very open in terms of changes and improvements.

The only real limitation is our imagination!

Where could it be used?

It can be used basically anywhere. We focused on making it as universal as possible. It has two modes:

- **Navigation mode**
- **Free mode**

Navigation mode is very simple – the user selects his destination point and the app will guide him, actively avoiding unexpected obstacles.

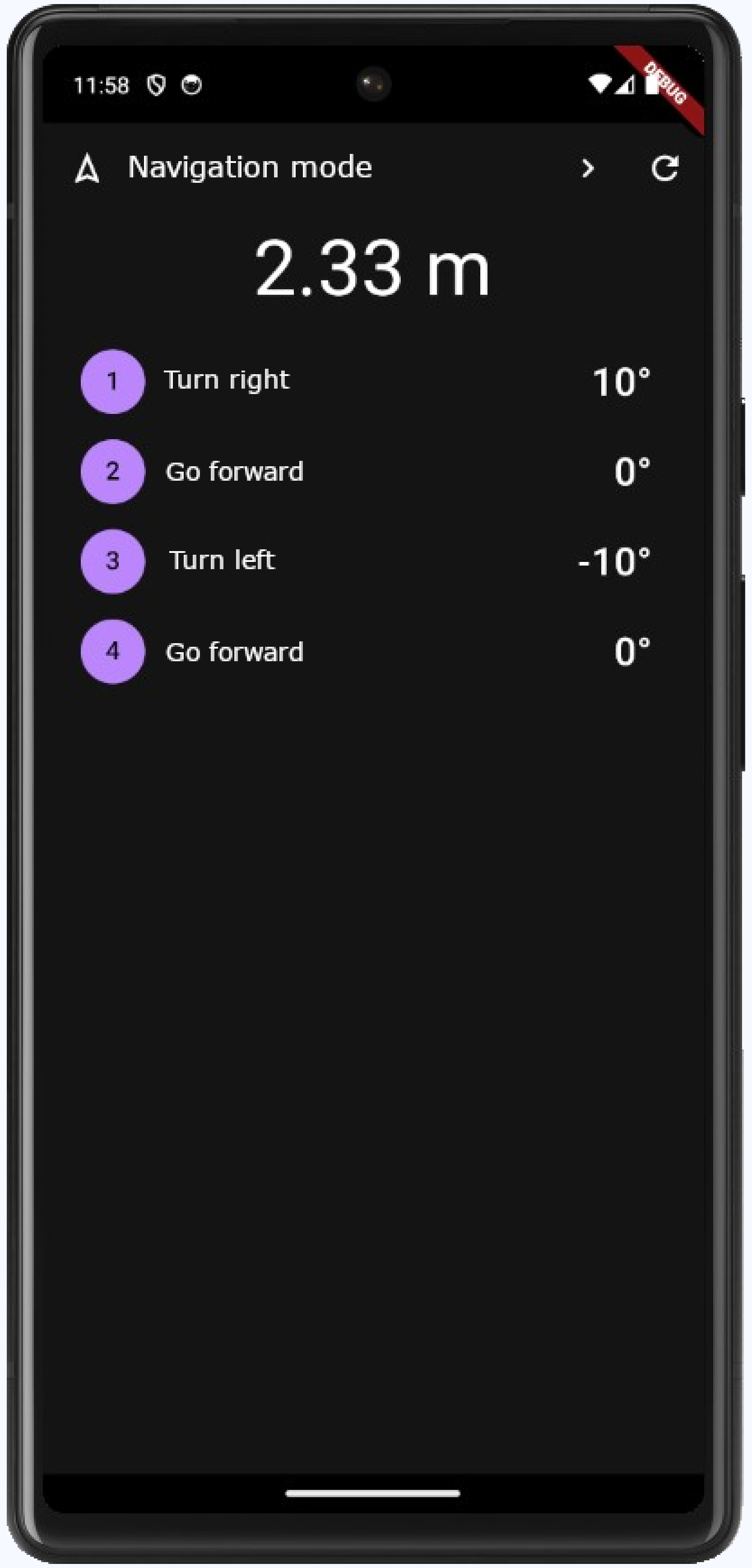
Free mode was made specifically for outdoor use, in unmapped areas. It detects obstacles and helps in avoiding them.

How does navigation mode work?

Initially, the system requires a virtual map to function properly. The user selects a destination point, and that’s all that is required of them.

The mobile app then provides voice messages according to the navigation path. If set up, the user will receive a brief description of the location upon arrival.

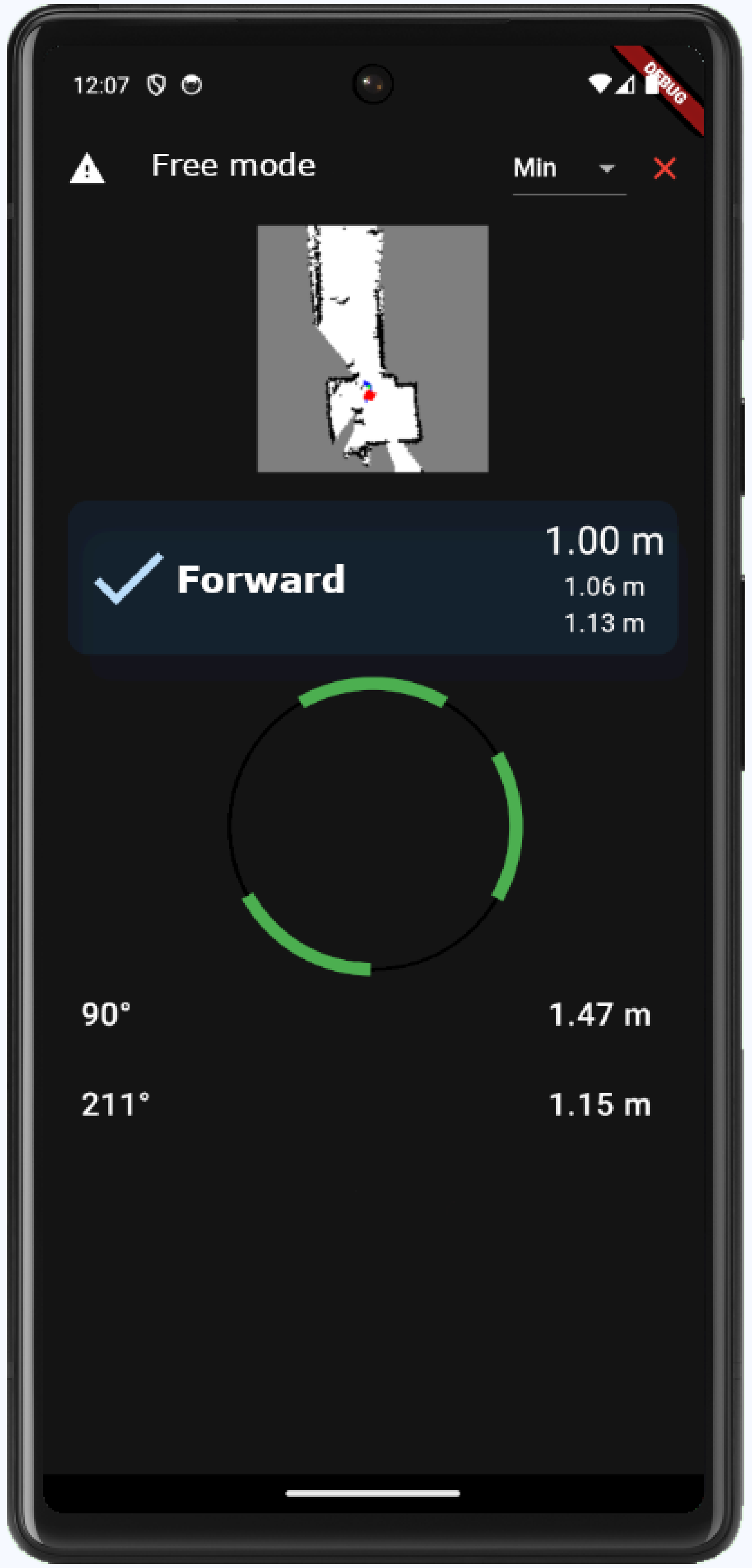
Additionally, the app suggests available maps when it detects a user's presence near a mapped building.



Using free mode

This mode is specifically designed for outdoor use, where navigating with a map is not available.
The user simply activates it, and the system will actively assist in avoiding obstacles.

Additionally, it informs the user about the surrounding free space, which is particularly useful for locating doors or passages in small, unmapped rooms.



„Get bearings” mode

Although this mode is not one of the main modes, it remains highly useful.
It offers users greater control over measurements by utilizing the smartphone's magnetometer to detect the direction in which it is pointed.

It works similar to a 'magic wand', this feature simply informs the user of the distance to any detected obstacles he points his phone at.

App accessbility

The app is designed with a focus on convenience and accessibility, making it highly suitable for users who are blind or visually impaired. Control of the application is entirely gesture-based, allowing for navigation without the need for visual cues. Additionally, the app features audio descriptions that provide real-time information about what is displayed on the screen. This audio feedback is crucial for assisting users in understanding the app layout and functionality, ensuring they can effectively interact with the app without visual input. Each function and button is clearly described, providing a smooth and accessible user experience.

Device portability

The device is engineered for portability and cordless operation, making it incredibly user-friendly and versatile. It is powered by built-in batteries, which can power the device for several hour. For longer periods of operation or in cases where charging facilities are not available, the user has the flexibility to connect an external power source, such as a power bank. This can easily be carried in a pocket or a backpack, allowing for extended use without the need for frequent recharging. This feature enhances the device's portability, ensuring it can be used effortlessly during longer outings or in environments where power access might be limited.

The value of the project compared to the current state of technology

Our project utilizes advanced Lidar technology previously used in aviation and automotive industries, now made accessible for wider use. It uniquely aids visually impaired individuals in navigating unknown terrains effectively. Despite its compact size, our device offers extensive functionalities like precise mapping and obstacle detection, enhancing the mobility and independence of users indoors and outdoors. Additionally, it is cost-effective, with a custom-designed 3D-printed Lidar sensor housing, and proprietary software for Raspberry Pi and mobile applications.

Current project development level

The project is actively maintained and developed, focusing on enhancing existing features and adding new ones. We continuously adjust the device behavior according to feedback from a blind wheelchair user, ensuring it meets the needs of visually impaired users. This approach has advanced our project to level 7 on the Technology Readiness Level (TRL) scale, indicating that our prototype has been tested successfully in operational environments and is nearing full development.

Our Team

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Thank You

Let's transform their darkness into a tapestry of empowerment, where every step is a testament to courage and resilience.

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