Department of Information Technology

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UNIVERSITY OF MUMBAI

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A Project Report on

Title of your project

Submitted in partial fulfillment of the degree of
Bachelor of Engineering(Sem-7)
in

INFORMATION TECHNOLOGY
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1.Project Conception and Initiation

Voice Based Smart Assistive Device for the Visually Challenged

1.1 Abstract

- The World Health Organization (WHO) Fact reported that there are 285 million visually-impaired people worldwide. Among these individuals, there are 39 million who are blind in the world. Unfortunately, all these numbers are estimated to be doubled by 2020.
- In this high tech era, technology has made it possible for everyone to live a comfortable life. But somehow the physically challenged people need to depend upon others in their daily life which ultimately makes them less confident in an unfamiliar environment.
- So, in this project, an intelligent device is represented, which is an amalgamation of various technologies, for the visually challenged people to help them travel around the college and similar premises safely without facing any difficulties and needing human help.

1.2 Objectives

- Build a device for travelling safely around the campus
- Overcome Environmental Challenges
- Overcome Technological Challenges
- Overcome Social Challenges

1.3 Literature Review

Sr No.	1
Title/Author	Chang, Y.-H., Sahoo, N., & Lin, H.-W, "An intelligent walking stick for the visually challenged people." in 2018, IEEE ICASI 2018- Meen, Prior & Lam (Eds)
Method used	Ultrasonic sound reflection (using ultrasonic sensor) Water detection (using water sensor)
Advantage	Location Tracking
Disadvantage	Cannot be used without the app. No Audio Feedback.
Extracted Methodology	The system has experimented inside their campus and the result is that the obstacles are detected in time, the difference between the real and recorded distance varies only 2 to 3cm.

1.3 Literature Review

Sr No.	2
Title/Author	Munteanu, D., & Ionel, R., "Voice-controlled smart assistive device for visually impaired individuals" in 2016,12th IEEE International Symposium on Electronics and Telecommunications (ISETC)
Method used	Ultrasonic sound reflection (using ultrasonic sensor) Audio commands and feedback
Advantage	Voice commands could be used
Disadvantage	Indicates only the distance of object, no other information about object
Extracted Methodology	The most accurate results were obtained with flat surfaces as obstacles at an angle of maximum 30° from horizontal. Surfaces with irregular shapes can reflect the signals in the vicinity of the ultrasonic sensor and the results of the measurement can be erroneous. This shortcoming can be suppressed by moving the hand both in the horizontal and vertical planes.

1.3 Literature Review

Sr No.	2
Title/Author	Yadav, A. B., Bindal, Namitha, K., & Harsha, H., "Design and development of smart assistive device for visually impaired people." in IEEE International Conference On Recent Trends.
Method used	Colour absorptivity index
Advantage	Variable Haptic Feedback
Disadvantage	No proper identification of upfront object
Extracted Methodology	Different objects were considered and the detection of their distances from the object were recorded. It is known that different colors have different absorptivity. Black is found to have the highest absorptivity and white the least. Due to this difference in absorptivity of light the range obtained for different colors vary.

1.4 Problem Definition

- To create an assistive device for visually impaired people which will let them get a better sense of the surroundings and environment of our college and similar premises and also give them audio feedback regarding the obstacles. The device can also classify the nearby objects and give a basic idea to the user about the object either by voice commands. The device can be fully operated by voice commands for easy usage.

1.5 Scope

- The device will make the use of various technologies in order to create a single device capable of assisting the huge number of people in need.
- The device will be making real time predictions without any human help, it will be an added benefit as the people using this device will be able to walk around the campus without any external human help

1.6 Technology stack

Hardware:

- Raspberry Pi 3B
- Pi Camera
- IR Sensor
- Server

Software:

- Python
- OpenCV
- Keras
- Tensorflow
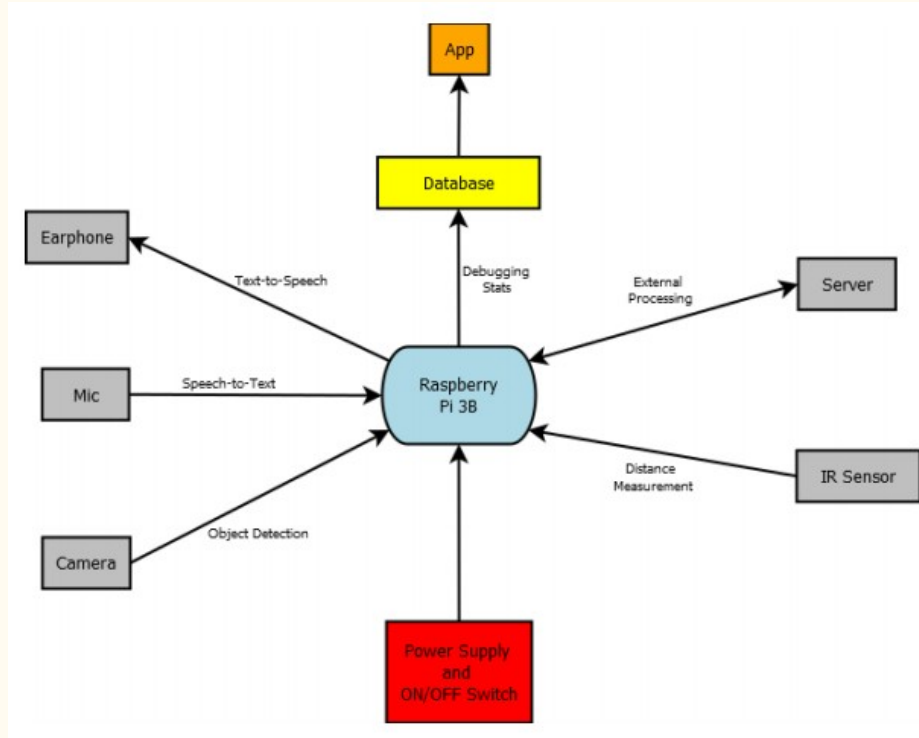- MySQL
- Android Studio

1.7 Benefits for environment & Society

- The device will make the use of various technologies in order to create a single device capable of assisting the huge number of people in need.
- The device will be making real time predictions without any human help, it will be an added benefit as the people using this device will be able to walk around the campus without any external human help
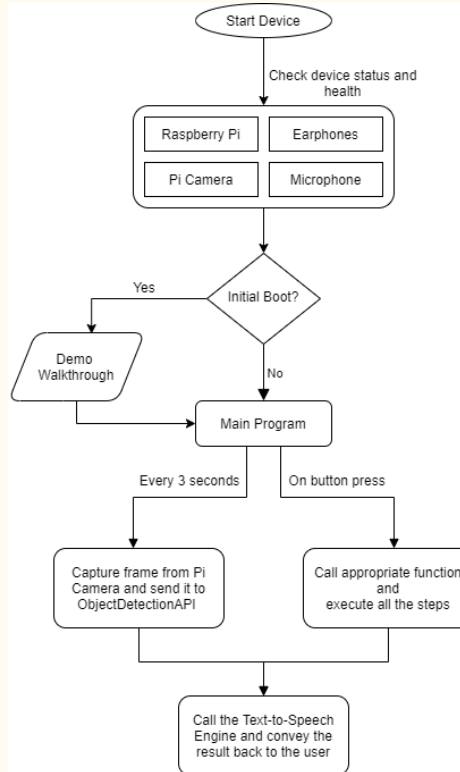
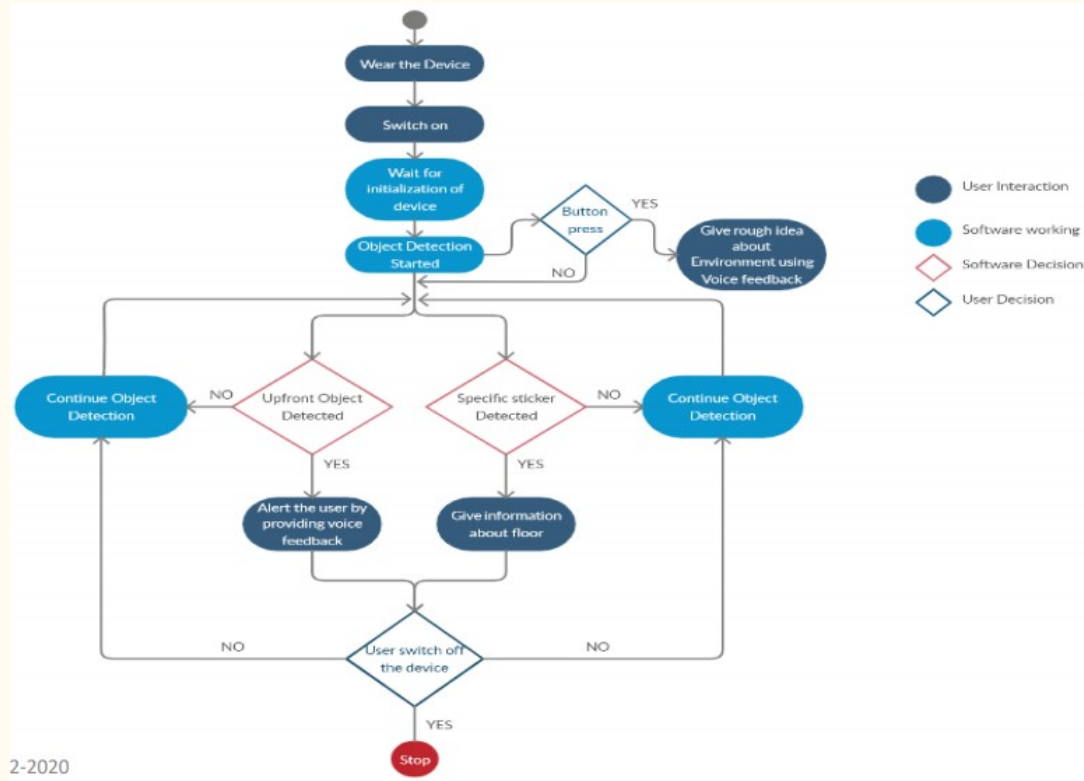# 2. Project Design

2.1 Proposed System

2.2 Design(Flow Of Modules)

Start Device

Check device status and health

| Raspberry Pi | Earphones |
| Pi Camera | Microphone |

Initial Boot?

Yes → Demo Walkthrough

No → Main Program

Every 3 seconds → Capture frame from Pi Camera and send it to ObjectDetectionAPI

On button press → Call appropriate function and execute all the steps

Call the Text-to-Speech Engine and convey the result back to the user

2.3 Description Of Use Case

2.4 Activity diagram

2.6 Camera Module

The camera module, with the help of the Object Detection model running on the server, will continuously try to detect obstacles in the user's path and on successfully detecting one it will generate a sentence that is now to be conveyed to the user after which the Text-to-Speech Engine will convey the information to the user in an audio format.

Environment Description Module

A dedicated button will be present which when pressed will trigger the camera module to capture the current frame and send it to the Environment Description Module, running on the server, which will generate a description of the frame and send it back to the Raspberry Pi which will in turn convey it to the user using the Text-to-Speech Engine.

Voice Recognition Module

There will also be another button to start the Voice Recognition module. It will listen for a period of 5 seconds and if it is unable to capture any voice or command then the mic will be shut and the rest of the program will continue its normal execution. The captured text will then be sent to Dialogflow via REST APIs, where we already have an agent running, for intent recognition. Based on the output of Dialogflow we then understand what the request of the user is and give the appropriate output for any given query.

2.7 References

[1] Chang, Y.-H., Sahoo, N., & Lin, H.-W. (2018). An intelligent walking stick for the visually challenged people. 2018 IEEE International Conference on Applied System Invention (ICASI)

[2] Yadav, A. B., Bindal, L., Namhakumar, V. U., Namitha, K., & Harsha, H. (2016). Design and development of smart assistive device for visually impaired people. 2016 IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT)

[3] Munteanu, D., & Ionel, R. (2016). Voice-controlled smart assistive device for visually impaired individuals. 2016 12th IEEE International Symposium on Electronics and Telecommunications (ISETC)

[4] Agarwal, R., Ladha, N., Agarwal, M., Majee, K. K., Das, A., Kumar, S., Saha, H. N. (2017). Low cost ultrasonic smart glasses for blind. 2017 8th IEEE Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON)

[5] Lee, C.-N., Chu, Y.-T., Cheng, L., Lin, Y.-T., & Lan, K.-F. (2017). Blind assistive device - Smart Lazy Susan. 2017 International Conference on Machine Learning and Cybernetics (ICMLC)

3. Future Additions

Planning

- The primary language currently is English but we can also add language support for Hindi and Marathi

- Implement this solution for areas other than our campus

Thank You