



An Artificial Intelligence of Things (AIOT) based Assistive Smart Glass for the Visually Impaired

Student Name: Mustapha Abdullahi Jimoh

Supervised by: Dr. H. Bello Salau

Department of Computer Engineering, Ahmadu Bello University Zaria, Nigeria

Abstract

The blind and visually impaired constantly face challenges interacting with the society and performing common tasks. This project aims to develop a functional and cost-effective assistive device to aid the blind and visually impaired improve their quality of life as well as independence. The AIOT Smart Glass (SG) consists of a camera module to capture images and feeds them to the raspberry pi for analysis such as screen description, object recognition, reading printed text, etc. The AIOT smart glass is controlled easily using the Respeaker 2-Mics Pi Hat for voice commands or button taps which is directly integrated with a conversational chatbot for seamless usage. It has an additional feature of facial recognition; assisting users to recognize the faces of their families and other close members. The output of the system is passed as audio response through an earphone to the user. Results shows that the AIOT smart glass take an average of about 5 secs to responds to query in the presence of good internet availability

Introduction

Imagine a world without images, there you would find your nightmares. This is what every blind and visually impaired individual usually faces. A world of despair. According to the Nigerian Optometrists Association (NOA), 42 out of every 1,000 Nigerians suffer from vision impairment. The blind and visually impaired especially in developing countries like Nigeria have been segregated from society due to their disability. This project aims to recognize scenes, read printed text, recognize faces and also browse the internet. Unlike similar projects, this uses a voice user interface and conversational chatbot for easy communication.

Innovation & Creativity

- **Face Recognition:** using state-of-the-art artificial intelligence, it can aid the blind to recognize the face of loved ones and friends without hearing their voices
- **Conversational chatbot:** The smart glass includes a highly conversational chatbot as a friend to help the user perform daily tasks
- **Simple and comfortable design:** The smart glass is designed to be simple and also elegant without causing much burden to the user. It is made to be detachable when not in use.

Potential for Product Commercialization

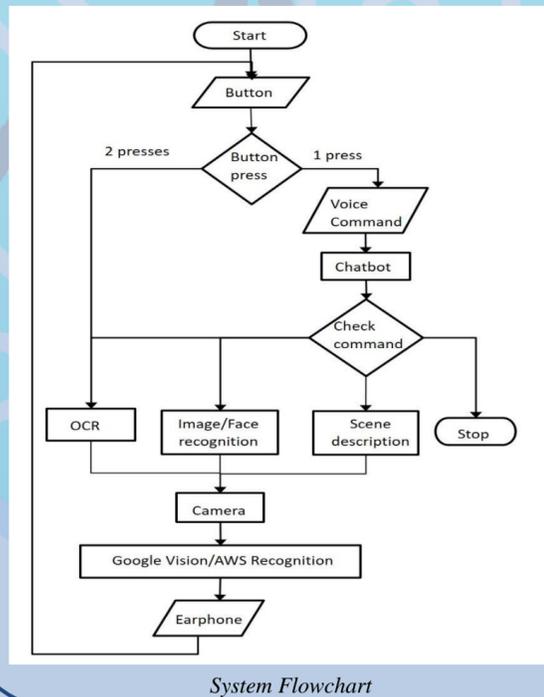
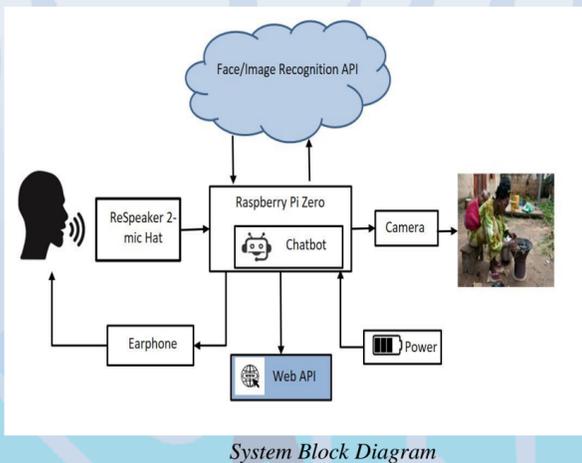
- **Market information:** This comprises of people such as students, workers, civilians etc. or volunteer organizations.
- **Product:** The final product will be a stand-alone device which can be handheld or attached to any glass of choice.
- **Pricing:** The final product of the smart glass can be bought at a relatively cheaper price in the range of the range of **₦25,000 – ₦30,000**
- **Sales:** The product will be sold either in pieces in or in bulk per request of corporations and organisations.

Acknowledgement

My utmost gratitude goes to the Almighty Who made all things possible. I would like to thank Prof. M. B. Muazu, Dr. H. Bello Salau, Dr. H. Zaharuddeen, Engr. E. Aliyu and the entire staff of Computer Engineering for their mentorship and technical support. Also, many thanks to Aliyu Abdul Jimoh and Musa Dibal for their technical assistance. Special appreciation to my parents Mr. & Mrs. Abdullahi and my siblings who are my inspiration to do great things and my comfort when I occasionally falter.

Methodology

The AIOT SG project utilizes hardware components such as raspberry pi zero, ReSpeaker 2-Mics Hat, raspberry pi camera module, earphone, and a battery pack. It also utilizes services such as Google Vision, Amazon Rekognition and Google Dialogflow. The system block diagram and flowchart is shown in the figure



Results



Smart Glass Prototype



Smart Glass Prototype



Person wearing the Smart Glass

Questions to ask the smart glass:

- What's around me?
- Can you read this out for me?
- Who is in front of me?
- What currency note is this?

Future Work

- Include local languages like Hausa, Igbo, and Yoruba etc.
- Use of high-resolution camera
- Connect the smart glass to interface with social media accounts and also to control home appliances

Conclusion

The smart glass has a significant potential of assisting the blind and visually impaired in carrying out some of their daily tasks with less assistance from other individuals. In the future, the smart glass will be an important device that shapes lives and restore hope to the blind and visually impaired.

References

- Ujumadu V. (2015). 42 out of every 1,000 Nigerians are blind – Optometrists. Retrieved from <https://www.vanguardngr.com/2015/10/42-out-of-every-1000-nigerians-blind-optometrists/>
- Suresh, A., Arora, C., Laha, D., Gaba, D., & Bhamri, S. (2019). Intelligent smart glass for visually impaired using deep learning machine vision techniques and robot operating system (ROS). *Advances in Intelligent Systems and Computing*, 751(May), 99–112.
- Abirami, R., Haarini, S., & Hari Prasanth, P. (2020). Customized Smart Glasses for Needy Blind People. *International Journal of Online and Biomedical Engineering*, 16(13), 33–44.