International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⸎ Peer-reviewed & Refereed journal ⸎ Vol. 13, Issue 11, November 2024
DOI: 10.17148/IJARCCE.2024.131140

SMART TACTILE TO AUDIO BRAILLE CONVERTER WITH ATTENTION-MECHANISM-MODEL

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Abstract: This project aims to create a portable assistive device for individuals with visual and hearing impairments, enhancing their independence and safety. The device captures text from the environment using a camera, processes it with Optical Character Recognition (OCR), and converts it into Braille using tactile push-pull solenoids. Users can also input Braille through tactile buttons, which is then converted into text for communication. In addition to its text-to-Braille and Braille-to-text functions, the device offers GPS-based turn-by-turn navigation, providing directions through the Braille pad. It also includes fall detection sensors and an SOS button to alert emergency services in case of accidents or falls. Powered by a Raspberry Pi, the system integrates a camera, solenoids, GPS, and an accelerometer, and is programmed with Python. This multifunctional device provides a comprehensive solution for improving accessibility, communication, and personal safety for individuals with visual and hearing impairments.

Keywords: Optical Character Recognition (OCR), Braille, Tactile, GPS module, Braille pad.

I. INTRODUCTION

This project addresses a critical need for accessibility solutions that empower individuals with disabilities to independently access written information, navigate their environment, and ensure their safety. The combination of reading assistance, navigation, and emergency features makes this a comprehensive solution.

With an increasing awareness of the challenges faced by individuals with visual and hearing impairments, the demand for innovative assistive technologies has grown significantly. Traditional methods of communication and navigation often fall short, limiting autonomy and participation in everyday activities. By integrating various functionalities into a single, portable device, this project aims to enhance the quality of life for its users, fostering independence and confidence.

II. METHODOLOGY

The system is divided into key components:
- Input Module: Camera for capturing text images.
- Processing Module: OCR using Tesseract, Braille conversion logic, and text-to-speech integration.
- Output Module: Braille solenoids, OLED display, and speakers.

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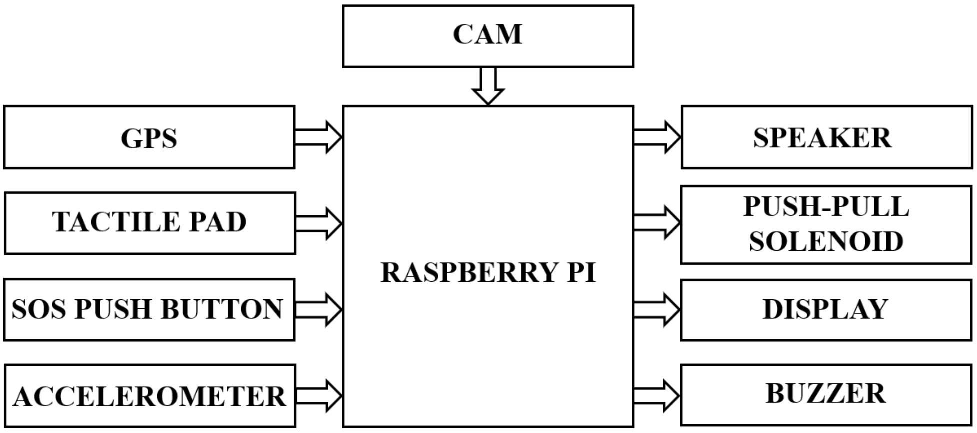

Figure1: Block Diagram of Smart Braille System Architecture

III. IMPLEMENTATION

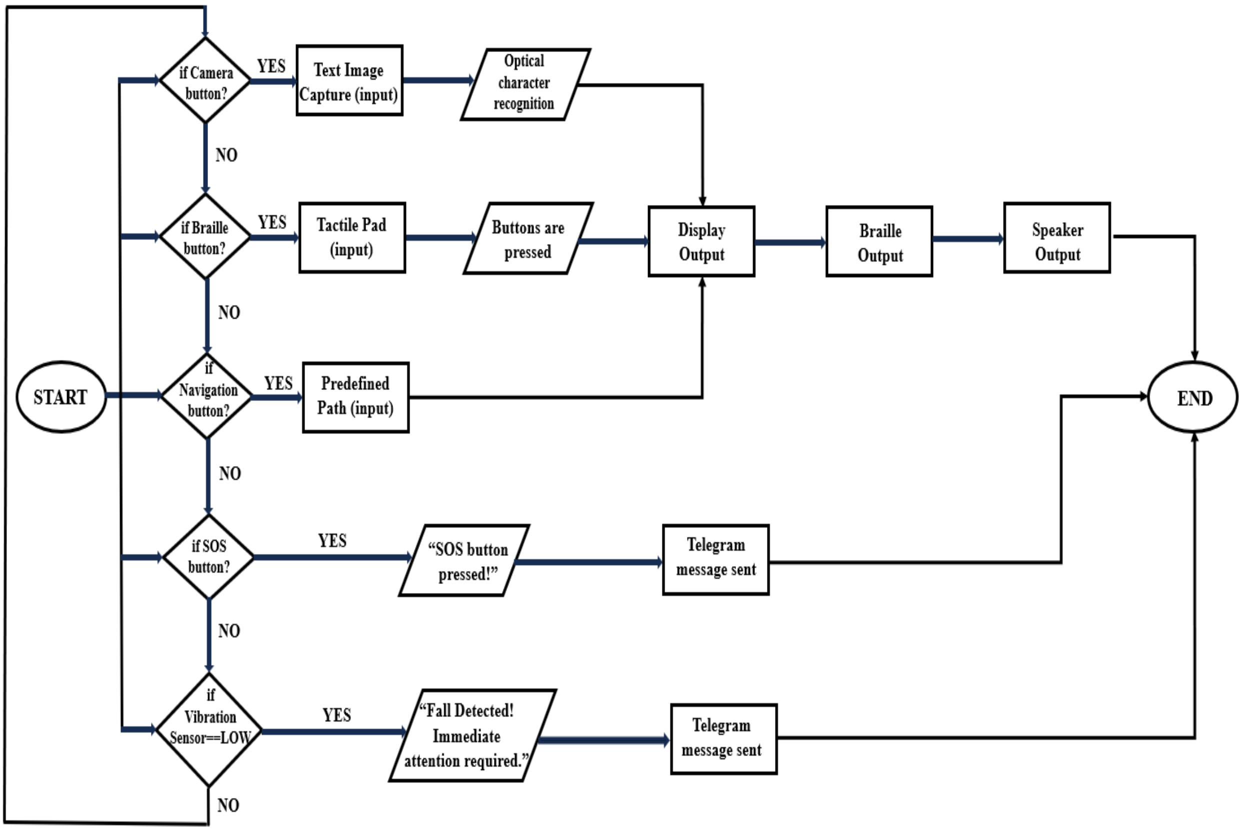

Figure 2: Flowchart

The implementation of the Smart Braille system involves careful integration of the hardware and software components. The following steps are involved:

- Install necessary Python libraries on the Raspberry Pi. This includes Tesseract, gTTS, OpenCV, and Luma.OLED.
- Upload the Smart Braille project code to the Raspberry Pi using SSH or direct USB connection.
- Configure the GPIO pins on the Raspberry Pi to control the solenoids and other hardware components.
- Connect the hardware components (camera, solenoids, buttons, OLED, speakers) to the Raspberry Pi based on the wiring diagram.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 11, November 2024

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- Run the Smart Braille script using the command "python3 smart_braille.py".

Upon successful implementation, the Smart Braille system is able to effectively,

1. Convert printed text captured and tactile pad input into:

- Braille patterns on solenoids: The system generates tactile Braille patterns using the solenoids, allowing users to "read" the converted text.
- Audible output using text-to-speech: The system converts the extracted text into audible speech using the gTTS library.
- Visual display on OLED: The system displays the extracted text and other system information on the OLED.

2. Send SOS message on Telegram.

3. Detect fall and send alert message on Telegram.

IV. RESULTS

Figure 3: Text Input

Figure 4: Braille Output

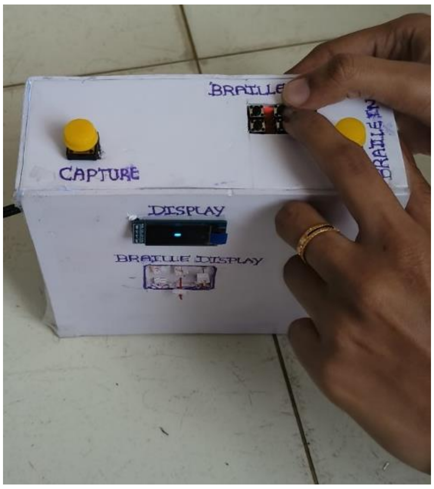

Figure 5: Braille Input from Tactile pad

Figure 6: Braille Output with Audio

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Figure 7: SOS button is pressed and message is sent

Figure 8**:** Fall is detected and message is sent

V. CONCLUSION

The Smart Braille project successfully demonstrates the potential of assistive technologies to enhance accessibility for visually impaired individuals. The system provides a low-cost, user-friendly, and multi-functional solution for converting printed text into Braille, audio, and digital text. The project's success lies in its ability to integrate different technologies effectively.

ACKNOWLEDGMENT

I would like to express my sincere gratitude to all those who have supported and guided me throughout the course of this project. First, I would like to thank my project guide and faculty members for their valuable insights, continuous support, and encouragement. Their expertise and guidance were instrumental in the successful completion of this project.

I am also grateful to the technical staff and colleagues who helped with the hardware setup, troubleshooting, and system integration. Their collaborative efforts and suggestions were crucial in overcoming several challenges faced during the development of the project. A special thanks to my family and friends for their unwavering support and motivation, which kept me focused and driven throughout this journey.

Lastly, I would like to acknowledge the resources and tools provided by the university and the online platforms, which played a significant role in enhancing my learning experience and ensuring the project’s success.

This project would not have been possible without the contributions of all these individuals, and I am truly grateful for their support.

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