

Design and Implementation of an Open API-Based Bus Information System for the Visually Impaired

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OVERVIEW

Through social media and online communities, we encountered frequent stories of visually impaired individuals struggling to board the correct bus on time. In crowded bus stops or when multiple buses arrive simultaneously, it is difficult for them to identify their intended vehicle, often resulting in missed rides or requiring help from nearby passengers.

Motivated by these real-world challenges, our team decided to participate in the 47th Electronics Exhibition and chose the project theme of developing a smart bus information display for the visually impaired. We began by analyzing why existing bus guidance systems fail to sufficiently assist visually impaired users. Current bus stop systems typically provide only a generic announcement such as “The bus is arriving soon,” but when several buses arrive at once, the user becomes confused. Moreover, there is no clear audio alert indicating that a specific bus has actually arrived and is ready to board, making it inconvenient and sometimes unsafe for visually impaired passengers.

To address these issues, we aimed to design an intuitive and accessible audio-based guidance system that clearly announces both upcoming buses and actual arrivals.

PROPOSED METHOD

This project utilizes the open public transportation API provided by the Korea Transport Database (TAGO) to fetch real-time bus arrival information for specific stops. The API provides details such as bus route numbers, remaining arrival times, and vehicle positions, which are essential for informing users about approaching buses. The hardware system is built using an Arduino Uno and an ESP8266 (WeMos D1 R1) module. The ESP8266 connects to Wi-Fi and retrieves live bus data from the TAGO API, then transmits this information to the Arduino via serial communication. The Arduino processes the received data and controls the audio announcement system to inform the user of both the bus number and the estimated arrival time.

For audio output, we employed a DFPlayer Mini MP3 module, which plays pre-recorded voice files stored on an SD card. Although the DFPlayer cannot dynamically synthesize speech, this limitation posed no practical issue because the types of buses arriving at a given stop are usually fixed and limited. We pre-recorded necessary announcements such as “Bus 5 will arrive soon,” “Bus 5 has arrived,” and “Bus 58-1 will arrive soon,” enabling clear and situation-specific playback.

Unlike typical bus stop announcements, our system clearly distinguishes between the “approaching soon” message and the “arrived and ready to board” message, helping visually impaired users confidently approach and board the correct vehicle without confusion.

Conclusion

Through this project, we moved beyond the typical scope of simple Arduino-based hardware prototypes by integrating an ESP8266 module to access real-time internet data. This experience provided valuable insight into combining IoT technologies with open public datasets (APIs) to create practical, user-focused solutions.

Equally important, this work allowed us to design from the perspective of the user. During testing, we blindfolded ourselves to simulate the experience of a visually impaired passenger and quickly realized how uncomfortable and uncertain it is to board a bus without visual cues. This hands-on perspective guided us in refining the system to deliver clear, reliable, and user-friendly audio feedback.

Participating in the 47th Electronics Exhibition gave us the opportunity to apply engineering skills to address real social challenges, improve our teamwork, and gain experience with hardware design, API integration, and accessibility-focused user interface development. Moving forward, this system could be expanded into a low-cost, scalable solution for accessible public transportation in more bus stops across the country.