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AN ANDROID-BASED LEARNING TOOL FOR TRAFFIC SIGN RECOGNITION AMONG STUDENTS WITH DISABILITIES

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Abstract

This study presents the design of *Traffic App*, an Android-based application aimed at enhancing the understanding of traffic signs among students with disabilities. The research used a design-based research (DBR) method with four stages: analysis, design, iteration, and reflection. The *Traffic App* incorporates augmented reality (AR) and is tailored to the needs of disabled students because it provides accessible features such as customizable text size, audio support, and 3D media that facilitate easier comprehension. Expert validations confirmed the app's feasibility because the design aligns with the cognitive and sensory needs of the target users. However, broader testing is still necessary to fully evaluate its effectiveness. This study is significant because it contributes to inclusive education by offering adaptive learning tools that support the independence and safety of students with disabilities in understanding traffic signs.

Keywords: Android, Application, Disabilities, Traffic App, Traffic sign.

1. Introduction

Mastery of traffic signs is a crucial aspect in developing independence and active participation in community life, including for students with disabilities. A good understanding of traffic signs contributes to their safety and empowers them to interact with the surrounding environment independently [1]. However, conventional methods of teaching traffic signs often fail to accommodate the diverse learning needs of students with disabilities, who may face unique challenges in visual, auditory, or cognitive information processing [2].

Many reports regarding this matter have been well-documented. Table 1 shows previous studies, highlighting the importance of using disability-friendly learning media equipped with features such as adjustable text size, color contrast, audio narration, and alternative navigation options [3, 4]. Additionally, the integration of adaptive learning, which adjusts to each student's progress, ensures that learners receive appropriate challenges and support [5].

Table 1. Previous studies.

No.	Tittle	Ref.
1	Effectiveness of the teaching offered through infographics in teaching traffic rules to students with intellectual disability.	[1].
2	Pedestrian navigation and public transit training interventions for youth with disabilities: A systematic review	[2].
3	Safe transport of children with disabilities and medical conditions: Caregiver experiences. *Scandinavian*	[4].
4	Improving the Reading and Writing Skills of Students with Mild Intellectual Disability: The Effectiveness of Infographics.	[6].
5	Work-in-Progress-Teaching Traffic Safety Skills to People with Moderate Intellectual Disability Using Augmented Reality.	[7].
6	Video-blogs and Linguistic Simplification for Students with Intellectual Disability.	[3].
7	Empowering People with Intellectual and Developmental Disabilities through Cognitively Accessible Visualizations. IEEE VIS 2023-Workshop *Visualization for Social Good*	[5].
8	Effects of Digital Navigation Aids on Adults with Intellectual Disabilities: Comparison of Paper Map, Google Maps, and Augmented Reality.	[8].
9	Navigation Support for Students with Intellectual Disability Using Mobile Devices.	[9].
10	The Importance of Accessible Information in Promoting the Inclusion of People with an Intellectual Disability.	[10].
11	Graphic Design of Pictograms Focusing on the Comprehension of People with Intellectual Disabilities-The Next Step in Standardization.	[11].

In response to these challenges, this study aims to design a *Traffic App*, an Android-based application integrating augmented reality (AR), to improve the understanding of traffic signs for students with disabilities. Many reports regarding AR have been well-developed, showing the importance of AR in many fields [12-15]. This study employed design-based research (DBR) to ensure the app is pedagogically sound and practically applicable. The novelty of this study includes:

(i) producing a *Traffic APP* design specifically adapted for students with disabilities, (ii) incorporating accessible features aligned with their needs, and (iii) using 3D AR media to enhance interest and comprehension regarding traffic materials [7]. Finally, this study helps in supporting people with special needs as reported elsewhere [16-18].

2. Literature Review

Android-based applications work in much the same way as other applications. When an application is opened, the Android system starts its own Linux process. The application then runs its components to perform specific tasks, such as displaying a UI, interacting with sensors, or sending data to a server. The Android system manages these processes, killing them when they are not needed or reclaiming memory when necessary. Figure 1 illustrates the communication flow between an Android app, an app server, and a database, including (1) Client makes HTTP request: The Android app sends an HTTP request (such as GET or POST) to the app server; (2) Queries for the database: The app server (which contains the script) receives the request and queries the database to find the information it needs; (3) Database returns information: The database then responds by sending the query data/information back to the app server; and, (4) Script processes, formats and sends JSON response: The app server processes the data, formats it into JSON (JavaScript Object Notation) format, and sends the response back to the Android app. In essence, this is a general working diagram of a mobile client-server system, where the app acts as the client, communicating with the server, and the server interacts with the database.

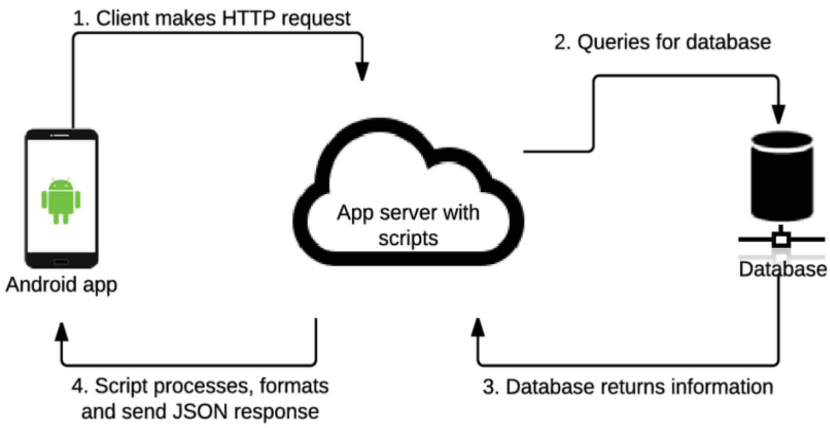

Fig. 1. Application with Android system.

3. Method

This study employed design-based learning (DBR), following four stages: analysis, design, iterative development, and reflection [19]. Detailed information for this method is explained elsewhere [18]. The Android-based Traffic App was created to improve the understanding of traffic signs for students with disabilities. The analysis identified students' needs for accessible traffic sign learning. During the design stage, the app incorporated features like adjustable text, color contrast, voice support, and 3D augmented reality (AR) media. Media experts, material experts, and disability specialists validated the app's content and design. In the iterative stage, the app underwent continuous revisions based on expert feedback, focusing on improving interface elements, language clarity, and instructional flow. The reflection stage remains incomplete due to limited field trials. Future research is required to evaluate the app’s full effectiveness in improving students' traffic sign comprehension.

4. Results and Discussion

Figure 2 shows the Traffic App flowchart, starting from the play button and leading to four main menus: Material, Evaluation, AR Book, and Games. This design addresses the specific needs of students with disabilities, particularly in recognizing traffic light colors and traffic signs [1-2].

Figure 3 illustrates the interface layout. When Material is selected, users access videos, 3D augmented reality media, and quiz questions. The colors and layout are optimized for accessibility, accommodating visual and cognitive processing differences [1].

Expert validation provided essential feedback:

(i) Media experts highlighted the need for refined button assets, an opening greeting, and closing acknowledgments [19, 20].

(ii) Language experts suggested improvements in word choice, clarity, and punctuation.

(iii) Material experts recommended adding discussion content and enhancing the evaluation space to foster literacy engagement [6].

These revisions were addressed in the iterative phase. However, the implementation stage (testing the app directly with students) was not completed, limiting conclusions about its effectiveness in improving traffic comprehension [8, 9].

Despite this, the Traffic App integrates modern AR technology and offers potential as an adaptive learning tool for traffic education among students with disabilities [5]. This study also adds new information regarding the use of android application, as reported elsewhere [21-25].

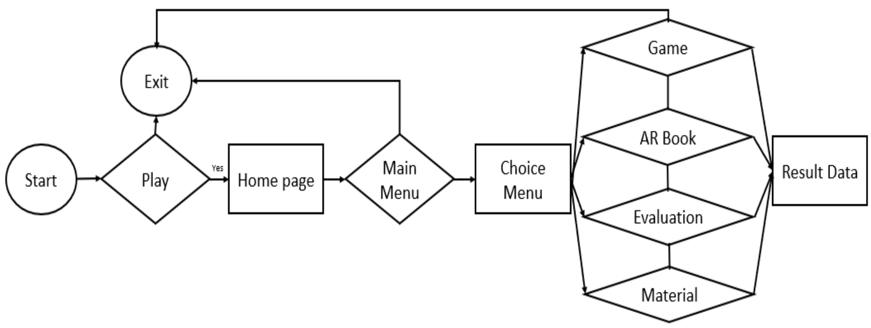

Fig. 2. Flow chart Traffic App.

Fig. 3. Learning activity on recognizing traffic signs.

5. Conclusion

This study developed the Traffic App, an Android-based application designed to improve traffic sign understanding for students with disabilities. The app integrates AR and adaptive features tailored to the needs of these students. Validation by experts confirmed its feasibility and accessibility. However, field testing with students has not yet been conducted. Future research should focus on evaluating its effectiveness in real educational settings. The novelty of this app lies in its AR integration and inclusive design, offering an interactive learning tool to support safe and independent mobility.

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