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PROCEEDINGS OF JOHOR INTERNATIONAL INNOVATION INVENTION COMPETITION AND SYMPOSIUM 2024 (JIIICaS 2024)



*“Flourish and Nurturing Sustainable
Innovation for a Prosperous Nation”*

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Preface

In the name of Allah, the Almighty who gives us the enlightenment, the truth, the knowledge and with regards to Prophet Muhammad (peace be upon him) for guiding us to the straight path. We thank to Allah for giving us guidance and strength to write this e-book.

This e-book compiles the extended abstracts that submitted to Johor International Innovation Invention Competition and Symposium 2024 (JIIICaS2024), where JIIICaS2024 is a virtual platform for all creative minds to share and present their invention and innovation. Each abstract gives a brief background on the innovation or project.

We hope that this e-book will help the readers to get to know the innovation done by the students and get some ideas to develop future innovation products.



Foreword Rector



Assalamualaikum warahmatullahi Wabarakatuh,
Salam Sejahtera, Salam Malaysia MADANI and
Salam UiTM Dihatiku.

In the name of Allah, the Most Gracious, the Most
Merciful.

It is a great honor to welcome you to the Johor
International Innovation, Invention, Competition, and
Symposium 2024 (JIIICaS 2024). This event

connects various disciplines, focusing on education and engaging educators,
students, researchers, and innovators from all walks of life.

Innovation is not just about ideas; it demands perseverance, creativity, and
determination to turn those ideas into reality. The remarkable projects
showcased today highlight the dedication and spirit of all participants.
Initiatives like this not only explore new technologies but also cultivate skills
and leadership among our youth. At Universiti Teknologi MARA (UiTM) Johor
Branch, we are fully committed to fostering a dynamic culture of innovation,
promoting the commercialization of new products, and encouraging
meaningful collaborations with industry and society.

As we celebrate this event, I would like to extend my heartfelt gratitude to all
sponsors, judges, the College of Computing, Informatics and Mathematics,
UiTM Pasir Gudang Campus as the event organizer, as well as to the
researchers and participants for their hard work in making this event a
success. Let us continue striving for innovation and excellence. May the
ideas presented today inspire us and lay the groundwork for future
achievements.

Thank you.

Associate Professor Dr. Saunah Zainon
Rector
Universiti Teknologi MARA (UiTM)
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(A-ST173) AUTISM EMOTION INTERACTIVE LEARNING

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ABSTRACT

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by difficulties in social communication, particularly in recognizing and interpreting facial expressions. Traditional methods for teaching emotional recognition, such as self-reporting and physiological measurements, often lack engagement and practicality for children with ASD. This project addresses these limitations by developing an interactive app designed to enhance the social and emotional skills of children with ASD. The primary objectives of this project are to study the requirements for recognizing and learning emotion expressions in children with autism, design and develop an interactive emotion app tailored to these needs, and to validate the system's ability to recognize emotions such as Angry, Happy, Sad, Surprise, and Neutral. The app comprises three key modules: the Learn Module, offering educational content on emotions; the Activity Module, providing interactive games and exercises to reinforce learning; and the Scan Module, using real-time facial emotion detection with advanced computer vision and machine learning techniques, including convolutional neural networks (CNNs) and cascade classifiers for face detection. The app's interactivity is designed to be engaging and user-friendly for children with ASD. The validation process involves questionnaires and surveys administered to children at Sekolah Taman Universiti 1, gathering valuable feedback on the app's interactivity and effectiveness. This feedback highlights how well the app facilitates learning and engagement, providing insights into its impact on users' emotional and social development. The findings from the validation indicate that the app successfully enhances emotional recognition skills and provides an engaging learning experience for children with ASD.

Keywords: Emotion Learning Application, Malaysian University Student, Mobile - Based Application.

INTRODUCTION

Autism Emotion Interactive Learning for autism children is a mobile application designed specifically to support individuals with mild autism in recognizing and understanding emotions. Utilizing computer vision and machine learning techniques, this application can identify and interpret facial emotions in real-time, providing immediate feedback to the user. By capturing and analyzing facial expressions and visual cues, the app helps users learn about emotional states through interactive and engaging activities.

This application is intended for direct use by individuals with mild autism, with guidance from their parents or caregivers. The interactive nature of the app allows users to

engage in activities and quizzes that teach them to recognize and understand different emotions. Additionally, the app features a real-time emotion detection system that uses the device's camera to capture the user's facial expressions, analyze them, and provide feedback on the detected emotion.

Autism Emotion Interactive Learning focuses on the unique needs of its users by providing a supportive learning environment. Parents and caregivers can also use the app to monitor progress and guide their children through the learning process. By offering an accessible and user-friendly interface, the app makes it easier for users to interact with and learn from the technology.

The emotion detection system within the app works by analyzing various facial features such as the position of the eyebrows, the shape of the mouth, and the movement of the eyes. These features are compared to a database of facial expressions to determine the user's emotional state. The system can detect a range of emotions including happiness, sadness, anger, surprise, and neutrality.

Overall, Autism Emotion Interactive Learning aims to provide valuable tools for individuals with mild autism to improve their emotional awareness and understanding, fostering better social interactions and personal development.

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by difficulties in social communication and interaction, as well as restricted and repetitive behaviors or interests. Individuals with ASD often struggle with identifying and interpreting facial expressions, which can hinder their ability to communicate effectively and understand social cues. (Lord, C., Elsabbagh, M., Baird, G., & Veenstra-Vanderweele, J. (2018)). People with autism spectrum disorder (ASD) usually have their own therapy sessions. One of the activities from the session they received is learning about emotions.

Traditional emotion detection methods, such as self-reporting and physiological measurements, often fall short in accuracy and practicality. (Beran, T. N., & McLaughlin, T. (2019)). These methods can be subjective, require extensive training, or rely on the individual's ability to articulate their emotions, which can be challenging for those with ASD. Additionally, traditional methods may not provide real-time feedback, limiting their effectiveness in dynamic social interactions.

Moreover, traditional methods are often too monotonous and may fail to engage individuals with ASD, who may not find these approaches interesting or motivating. This lack of engagement can hinder the learning process and limit the improvement of emotional recognition skills.

The development of an app that leverages advanced technologies such as machine learning and computer vision can address these gaps. Such an app can provide a more interactive and engaging platform, capturing the interest of individuals with ASD and motivating them to learn and improve their emotional recognition. The app's real-time feedback and user-friendly design can enhance the learning experience, making it more effective and enjoyable for individuals with ASD.

Autism Emotion Interactive Learning aims to support individuals with mild autism by providing a comprehensive tool that analyzes facial expressions and other visual cues in real-time. This app seeks to address the challenges associated with teaching

emotional recognition and understanding to individuals with autism by offering interactive and immediate feedback. While the primary focus is on real-time emotion detection and feedback, the app also includes a variety of engaging activities designed to enhance the learning experience.

These activities are specifically tailored to be enjoyable and educational, helping users to learn about emotions in a fun and interactive way. The app's modules cover a range of topics and skills, providing a holistic approach to emotional education. By offering a diverse array of activities, Autism Emotion Interactive Learning ensures that users remain engaged and motivated throughout their learning journey.

This application is intended for use in various settings, such as at home, in schools, therapy sessions, and social skills training programs. By providing immediate feedback and guidance, Autism Emotion Interactive Learning can help individuals with mild autism develop stronger social and emotional skills, ultimately improving their overall quality of life. The app provides a platform where users can learn to identify and understand different emotions through real-time interaction and diverse educational modules.

Other than that, the ethical implications of using real-time facial emotion detection technology must be carefully considered. Issues such as privacy, data security, and the potential for misuse are significant concerns. It is crucial to address these ethical considerations to ensure that the benefits of the technology are maximized while minimizing any potential risks and drawbacks. The app is designed with these ethical considerations in mind, aiming to provide a safe and supportive learning environment for its users.

The primary objectives of the project are to study the requirements for recognizing and learning emotional expressions in children with autism, to design and develop an interactive emotion app specifically tailored for these children, and to validate the app's effectiveness in identifying and teaching five key emotions: anger, happiness, sadness, surprise, and neutrality. The scope of the project includes several critical components. The proposed system will focus on detecting these five types of facial emotions using cascade classifiers to identify frontal views of faces. Users will interact with the system through input devices such as a camera, which will capture and analyze their facial expressions. The application is designed with the goal of helping children with autism learn about and understand emotions more effectively. By combining these objectives and scope elements, the project aims to create a comprehensive and engaging tool for emotional education.

METHODS

The selection of an appropriate development method is crucial in ensuring the success of a project. It plays a significant role in determining the project's feasibility and aligning the project organization's objectives with the chosen method. In the case of this project, the Waterfall model has been identified as the ideal choice. The Waterfall model follows a sequential and linear approach, making it suitable when the project's objectives remain stable throughout the entire development process. With a clear and well-defined goal in mind, the Waterfall model's structured phases can be executed smoothly, eliminating the need for frequent and drastic changes in the system requirements. This allows the project team to proceed methodically, progressing

through each phase in a logical order, from requirements gathering and system design to implementation and testing. By adopting the Waterfall model, the project benefits from a systematic and predictable development process that facilitates effective project management and ensures the delivery of a robust and reliable facial emotion detection system.

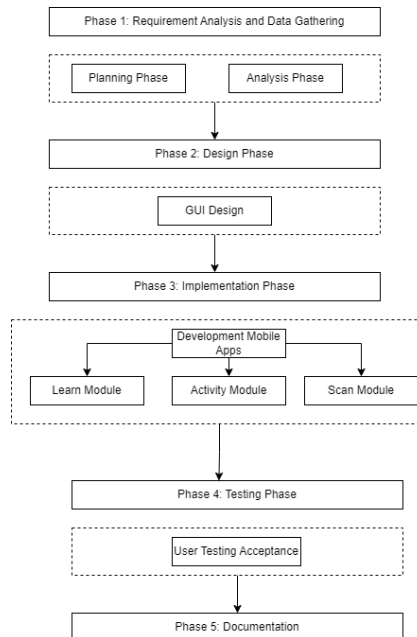


Figure 1: System Framework Diagram

In the first phase of the Waterfall methodology, requirement gathering and analysis were conducted through comprehensive research rather than direct stakeholder meetings. This research focused on evaluating existing manual and web-based emotion detection systems to identify their limitations and functionalities. By analyzing these solutions, the project team derived a set of requirements for a new mobile application. This approach provided insights into necessary features and improvements, resulting in a Requirement Specification Document that outlines the project's needs for accessibility, efficiency, and user-friendliness.

The design phase aimed to develop a detailed architectural blueprint for the application, ensuring both user-friendliness and technical feasibility. This phase involved defining the overall system architecture, including major components and their interactions. Special attention was given to designing intuitive UI and UX layouts and planning data flow to support the application's functionality. Tools such as TensorFlow Lite were selected for emotion detection, and interactive features like quizzes, flashcards, and an emotion board were included to enhance user engagement. The phase resulted in a System Design Document, UI mockups, and data flow diagrams to guide development.

During the implementation phase, the design documents were translated into a functional application using Android Studio, XML, and Java. The phase was divided into three modules: Learn, Activity, and Scan. The Learn Module provided educational content through interactive flashcards. The Activity Module reinforced learning with quizzes and an emotion board, with future plans to enhance quizzes dynamically. The Scan Module focused on real-time emotion detection using TensorFlow Lite, enabling

the app to analyze facial expressions captured by the camera and provide instant feedback.

The testing phase was crucial for ensuring the application's functionality and performance. It involved unit testing individual components, integration testing to ensure seamless interaction between components, and system testing against specified requirements. The TensorFlow Lite model's performance was evaluated for real-time accuracy in emotion detection. Interactive features were rigorously tested, including user acceptance testing (UAT) with children with ASD, parents, and educators. Feedback from a local autism school was used to make final adjustments, resulting in a thoroughly tested and validated application.

RESULTS AND DISCUSSION

The Autism Emotion Interactive Learning App underwent extensive testing with children diagnosed with Autism Spectrum Disorder (ASD), educators, and parents, revealing significant improvements in emotional recognition among the children. The app's interactive features, particularly the emotion board game and quizzes, effectively engaged the users, making the learning process both enjoyable and immersive. The user interface was well-received for its simplicity and accessibility, allowing users to navigate the app with ease.

The integration of TensorFlow Lite and OpenCV for real-time facial expression recognition proved successful, with the model demonstrating high accuracy across different devices. Educators noted the app's educational value, highlighting its potential for seamless integration into existing curricula to support emotional learning in classroom settings. Overall, the app's ability to enhance emotional recognition in children with ASD showcases the potential of leveraging technology in special education. The positive feedback from all user groups validates the app's effectiveness, though future improvements, such as expanding the range of emotions and refining detection capabilities, were identified for further development.



Figure 2: User (with autism) learning and playing with the app

Before using the app, each participant completed a pre-test questionnaire designed to capture their initial impressions, expectations, and familiarity with similar technology. This questionnaire helped establish a baseline for evaluating the app's impact and usability.

Below pie chart in Figure 3, show all 13 respondents from guidance indicated that they had never used any applications to teach emotions to their child, student, or

themselves before this testing. This highlights the uniqueness of the Autism Emotion Interactive Learning App in providing a new tool for emotional learning.



Figure 3: Respondent answer for using any emotion apps before

After the testing session, participants completed a post-test questionnaire. This survey focused on gathering feedback about their experience using the app, including its usability, effectiveness, and overall satisfaction. Participants were asked to rate various aspects of the app and provide open-ended feedback on what they liked or disliked, and any suggestions for improvement.

The total responses shown in below Figure 4 are 14 participants. Interactive games were the most engaging feature. Nearly two-thirds of the participants found them appealing. These games likely provide an enjoyable and interactive way to learn about emotions. Flashcards that was refer to emotion cards in the apps received the highest engagement. Almost all respondents (92.9%) interacted with the emotion cards. These visual aids are effective for reinforcing emotional concepts and memory retention.

Quizzes were the least popular feature, with only 21.4% engagement. Participants might prefer other methods over quizzes for emotional learning. Facial expression recognition was well-received, with 78.6% engagement. This feature likely helps users understand emotions through visual cues.

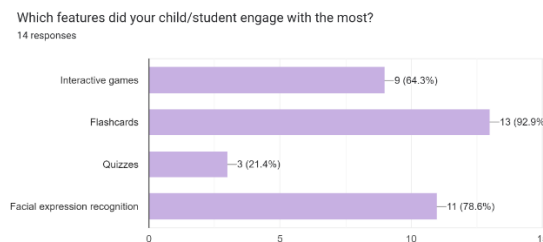


Figure 4: Respondent's answer on features their child/student engage the most

REFERENCES

- [1] Admin, S.-S. (2020a, June 2). Facial expressions quiz. Autism Guide. <https://autismguide.co.uk/fitting-into-the-world/facial-expressions-quiz/>
- [2] Alzubaidi, L., Zhang, J., Humaidi, A. J., Al-Dujaili, A., Duan, Y., Al-Shamma, O., Santamaría, J., Fadhel, M. A., Al-Amidie, M., & Farhan, L. (2021, March 31). Review of Deep Learning: Concepts, CNN Architectures, challenges, applications, future directions - Journal of Big Data. SpringerOpen. <https://journalofbigdata.springeropen.com/articles/10.1186/s40537-021-00444-8>

[3] Face recognition emotions detection using Haar Cascade Classifier and ... (n.d). https://assets.researchsquare.com/files/rs-2048290/v1_covered.pdf?c=1669606932

[4] Follow meAjitesh Kumar I have been recently working in the area of Data analytics including Data Science and Machine Learning / Deep Learning. I am also passionate about different technologies including programming languages such as Java/JEE. (2023, May 12). Different types of CNN Architectures explained: Examples. Data Analytics. <https://vitalflux.com/different-types-of-cnn-architectures-explained-examples/>

[5] Gavrilova, Y. (2021, August 3). What are convolutional neural networks?. Serokell Software Development Company. <https://serokell.io/blog/introduction-to-convolutional-neural-networks>

[6] Riyantoko¹, P. A., Sugiarto¹, & Hindrayani¹, K. M. (2021, March 1). IOPscience. Journal of Physics: Conference Series. <https://iopscience.iop.org/article/10.1088/1742-6596/1844/1/012004>

[7] Yegulalp, S. (2022, June 3). What is tensorflow? The Machine Learning Library explained. InfoWorld. <https://www.infoworld.com/article/3278008/what-is-tensorflow-the-machine-learning-library-explained.html>