



TED UNIVERSITY

CMPE 491-O SENIOR PROJECT

Project Specification Report: **MallMinds**

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Introduction

This report outlines the features, requirements, and scope of the MallMinds project, developed as part of the CMPE 491-O Senior Project. The goal of this project is to create a smart kiosk that enhances the shopping experience in malls by using an AI-powered system. The kiosk will help visitors find store locations, navigate the mall, and connect with customer service representatives when needed. It will also offer voice and text-based communication, ensuring a user-friendly experience.

By incorporating advanced technologies such as facial recognition and Natural Language Processing, the kiosk will provide a personalized and seamless experience for users. The aim is to break down language barriers, improve accessibility, and offer real-time assistance, making shopping malls more efficient, accessible, and enjoyable for everyone.

Description

The MallMinds system is designed to be an interactive and AI-driven kiosk that will be placed in shopping malls. It will serve as a guide for visitors by processing their questions through natural language understanding and generating accurate answers using cutting-edge AI methods. The kiosk will support multiple languages, allowing users to communicate easily, no matter their background.

In addition to offering voice and text communication, the kiosk will provide navigation assistance by displaying clear routes on a map, helping visitors find stores quickly. It will also use facial recognition to offer a more personalized experience while respecting privacy and security. One of the most notable features of this system is its ability to connect users with live customer service, providing them with real human support instead of automated responses.

The MallMinds system is designed to be reliable and efficient, operating throughout the mall's business hours. It will help improve customer satisfaction, streamline navigation, and provide real-time assistance, ultimately making the shopping experience more enjoyable for everyone involved.

Constraints

Hardware Constraints

- Processing Power:** The kiosk must have sufficient processing capabilities to handle real-time AI interactions, facial recognition, and advertisement tracking.

- Display Limitations:** Advertisements must be displayed clearly and attractively on the kiosk screen while ensuring that they do not interfere with the core functionality of the system.

- Camera Accuracy:** The system must accurately detect and count viewers of advertisements, distinguishing between genuine views and incidental passersby.

- Network Dependency:** A stable internet connection is required for real-time advertisement tracking, billing updates, and data synchronization.

Software Constraints

- Natural Language Processing (NLP) Limitations:** The AI-driven system must support multiple languages, but certain languages may have lower accuracy due to limited training data.

- Voice Recognition Accuracy:** The system should accurately process different accents, dialects, and background noise to ensure a seamless experience.

- Real-Time Responsiveness:** The system must process user queries and advertisement view counts without significant delay.

- Ad Tracking Accuracy:** The system must ensure reliable detection of viewers to prevent inaccurate billing, minimizing false positives (e.g., people glancing unintentionally).

Security and Privacy Constraints

- Facial Recognition Data Protection:** While tracking advertisement views, the system must comply with data privacy laws (e.g., GDPR, KVKK) and ensure user anonymity.

- Anonymity and Data Retention:** Viewers should not be personally identifiable, and aggregated advertisement interaction data should be stored securely.

- Billing Transparency:** Shops advertising on the kiosk must receive clear and fair billing based on accurate viewership data.

Deployment Constraints

- Physical Space:** The kiosk design must fit within designated mall spaces without obstructing visitor pathways.

- Power Supply and Maintenance:** The system must operate efficiently within standard mall power constraints and allow for easy maintenance.

- Advertising Space Limitations:** The number of advertisements displayed must be optimized to avoid overwhelming users while maintaining effective engagement.

Professional and Ethical Issues

The **MallMinds** project involves several ethical and professional considerations to ensure responsible development and deployment.

User Privacy and Data Protection

- The advertisement tracking feature must ensure that no personally identifiable information (PII) is stored or used for profiling without user consent.

- All facial recognition or viewer detection must be **anonymous** and **strictly for ad view counting**, ensuring compliance with global data privacy laws.

- Users should have a clear option to opt out of being counted for advertisements if desired.

Fair and Transparent Billing

- Advertisers must be billed fairly, ensuring that only genuine views (e.g., users who actually looked at the ad for a minimum duration) are counted.

- The system should log all ad interactions transparently, providing advertisers with **detailed reports** to verify their charges.

- There should be clear guidelines on how views are counted, preventing **fraudulent or accidental** charges.

Accessibility and Inclusivity

- The kiosk must support multiple languages and accessibility features, ensuring that all users can engage with the system effectively.

- Ethical AI principles should be followed to **eliminate biases** in advertisement tracking and ensure fair representation.

Transparency and Accountability

- A clear **Terms of Service** should be provided to mall visitors, informing them about how advertisement tracking works.

- Advertisers should have access to **audit logs** that detail how many views their ads received.

- The system should log interactions responsibly, ensuring that any errors or discrepancies in billing can be reviewed and corrected.

Reliability and Safety

- The kiosk must function effectively during all operational hours of the mall, preventing downtime that could disrupt advertisement tracking and user assistance.

- Regular updates and maintenance should be conducted to ensure that AI models remain accurate and secure against **potential cyber threats or fraudulent manipulation**.

Requirements

Functional Requirements

1. User Interface

- **3D AI Avatar Display:** The kiosk shall display a 3D AI avatar capable of interacting with users via voice and text.

- **Multi-language Support:** The kiosk shall support at least 10 languages for user interaction.
- **Touchscreen Interaction:** The kiosk shall provide a responsive touchscreen for typing queries and navigation.

2. Language and Communication

- **Language Selection:** Users shall be prompted to select their preferred language at the beginning of their interaction.
- **Voice Recognition:** The system shall accurately process and respond to voice queries in real time in the selected language.
- **Text Input:** Users shall have the option to type queries using an on-screen keyboard.
- **Text-to-Speech:** The AI's textual output shall be convertible to spoken language.

3. Natural Language Processing

- **Language Model Integration:** Integrate an LLM to process natural language inputs accurately.
- **Conversational Context Awareness:** The avatar shall maintain context to provide relevant, coherent responses.

4. Content and Services

- **Mall Information Retrieval:** Provide updated information on store locations, mall services, and promotions.
- **Navigation Assistance:** Offer interactive navigation guidance within the mall.
- **Personalized Recommendations:** Provide suggestions based on user preferences and interactions.
- **Face Recognition:** Utilize facial recognition technology to enhance personalization by identifying returning users and tailoring interactions accordingly.
- **Advertisement in Sleep Mode:** When idle, the kiosk shall display advertisements and promotions from mall stores to maximize engagement and revenue.
- **Facial Recognition-Based Advertisement Payments:** The kiosk shall track the number of people who view and engage with advertisements using facial recognition. Payment to advertisers shall be based on the number of individuals who have stared at the advertisement, ensuring a performance-based payment model.

5. Security and Privacy

- **User Data Protection:** Implement measures to ensure that all collected user data is securely stored and accessed only when necessary.
- **Secure Information Handling:** Ensure both voice and text interaction data are protected against unauthorized access and breaches.

Non-Functional Requirements

1. Performance

- **Response Time:** The system should process voice and text inputs with a latency of no more than 10 seconds.
- **Concurrent Users:** Support at least 50 simultaneous users without performance degradation.

2. Reliability

- **System Availability:** Maintain at least 99.5% uptime to ensure continuous accessibility and minimal downtime.
- **Fault Management:** Generate clear and precise error messages with user-friendly guidance to assist in troubleshooting when issues arise.

3. Scalability

- **Scalable Architecture:** Design the system to accommodate additional languages and services without significant overhauls.

4. Usability

- **User-Friendly Design:** Ensure an intuitive user interface that requires minimal user training.
- **Consistent Experience:** Maintain a consistent user experience across different languages and features.

5. Maintainability

- **Modular Design:** Implement a modular design that enables effortless updates and simplifies maintenance.
- **Regular Updates:** Regularly update language models and interface features to enhance performance and user experience.

6. Security

- **Data Protection and Encryption:** Ensure that all sensitive user data, including facial recognition records, is encrypted and handled with the highest level of security.
- **User Authentication and Access Control:** Implement multi-layer authentication methods to prevent unauthorized system access and data misuse.

7. Compliance

- **Regulatory Compliance:** Ensure that the system aligns with global and local data protection standards, such as KVKK, to maintain user trust and legal compliance.

References

- Bengio, Y., Courville, A., & Vincent, P. (2013). Representation learning: A review and new perspectives. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 35(8), 1798-1828. <https://doi.org/10.1109/TPAMI.2013.50>
- Deng, J., Guo, J., Xue, N., & Zafeiriou, S. (2019). ArcFace: Additive angular margin loss for deep face recognition. *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, 4690-4699. <https://doi.org/10.1109/CVPR.2019.00482>
- Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep learning*. MIT Press.
- Hirschberg, J., & Manning, C. D. (2015). Advances in natural language processing. *Science*, 349(6245), 261-266. <https://doi.org/10.1126/science.aaa8685>

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