

A Fully Functional Shopping Mall Application – ShopVista

¹D.I. De Silva, ² W. A. C. Pabasara, ³A.H.J.S.S. Dias, ⁴K.J.M. Hansani, ⁵A.G.T.
Dewinda, ⁶S.A.N.S.H. Niyangoda

*1Dept. of Computer Science and Software Engineering, Fac. of Comput.
Sri Lanka Institute of Information Technology
Malabe, Sri Lanka.*

*2Dept. of Computer Science and Software Engineering, Fac. of Comput.
Sri Lanka Institute of Information Technology
Malabe, Sri Lanka.*

*3Dept. of Computer Science and Software Engineering, Fac. of Comput.
Sri Lanka Institute of Information Technology
Malabe, Sri Lanka*

*4Dept. of Computer Science and Software Engineering, Fac. of Comput.
Sri Lanka Institute of Information Technology
Malabe, Sri Lanka*

*5Dept. of Computer Science and Software Engineering, Fac. of Comput.
Sri Lanka Institute of Information Technology
Malabe, Sri Lanka*

*6Dept. of Computer Science and Software Engineering, Fac. of Comput.
Sri Lanka Institute of Information Technology
Malabe, Sri Lanka*

Abstract: -In today's fast-paced world, shopping has become an integral part of daily life for most individuals. However, the demands of busy lifestyles have left limited time for this essential activity, prompting a quest for quicker and more convenient shopping solutions. Shoppers encounter a range of challenges, including uncertainty about product availability, navigating extensive shopping malls, and occasionally forgetting intended purchases. To address these issues, this paper introduces a comprehensive shopping mall application that offers a solution to modern shopping dilemmas. The proposed application offers a wealth of features, including detailed information about every shop within a mall, real-time updates on product availability, the ability to create and manage customer wish lists, and an interactive mall map. This multifaceted system comprises a mobile application designed for the Android platform and a robust server-side module serving as the central database connecting customers and shop owners. Additionally, there is a web service interface that allows administrators to efficiently manage functions within this system. This research paper outlines the conceptualization, development, and implementation of this cutting-edge shopping mall application. By addressing the challenges faced by today's shoppers and harnessing the power of technology, the proposed solution seeks to enhance the shopping experience, offering both shoppers and mall operators a modern and efficient means of engagement.

Keywords: ShopVista, shopping mall, google map, shopping application, navigation, end users, web service

1. Introduction

Innovative mobile applications have become essential in reshaping the shopping experience, responding to evolving technological advancements and shifting consumer preferences. Within the realm of shopping malls, several challenges have emerged, including fragmented shopping experiences due to difficulties in recalling shopping needs, recurring inconveniences resulting from unclear mall layouts, and heightened difficulties in emergencies stemming from unfamiliar premises. These challenges underscore the urgent need for an innovative and all-encompassing shopping mall application. ShopVista, a mobile app designed to unify and simplify shopping experiences, acquaint shoppers with the mall's environment and ensure safety and convenience, even during crit. situations. The res. findings presented here offer a comprehensive understanding of the areas where enhancements and innovative solutions can improve the shopping experience for consumers in Sri Lanka. The enthusiastic response to ShopVista suggests that technology can play a pivotal role in addressing these challenges, ultimately enhancing overall shopper satisfaction. Consequently, the decision to proceed with the development of this proposed system aligns seamlessly with the survey's findings and the potential for meaningful improvements.

The survey results offer valuable insights into the shopping behavior and needs of the 84 participants from Sri Lanka. Notably, a significant portion of respondents lacks proper knowledge of responding to emergencies, with almost 43% uncertain about handling situations like fires. This underscores a potential safety concern within shopping environments that warrants attention and action. Furthermore, the survey identifies challenges in mall navigation, with approximately 33.3% of participants feeling disoriented, especially when trying to find specific shops. This indicates room for improvement in terms of mall layout and signage to enhance the overall shopping experience. Another significant finding is that 59.5% of shoppers frequently forget their intended purchases, and some are unsure about their shopping needs. This presents an opportunity to enhance shopping experiences, potentially through better organization and guidance for shoppers. The survey's most compelling revelation is the strong willingness among smartphone owners, a striking 94%, to embrace a fully functional mobile application aimed at addressing these shopping-related challenges. This underscores the potential for technology-driven solutions to not only improve shopping experiences but also assist shoppers during emergencies.

The develop. of ShopVista holds diverse significance. For consumers, it promises heightened convenience, personalization, and access to real-time information, ultimately enhancing their overall shopping experiences. Simultaneously, for mall operators, it represents a powerful tool capable of boosting foot traffic, increasing engagement, and enhancing operational efficiency. The proposed research project demanded a diverse set of expertise and technical skills. It involved the creation of a mobile application for Android and a server-side module that served as the central database server to facilitate communication between customers and shop owners[1]. These two modules communicated with each other through web services. This involves identifying essential features, exploring practical ways to integrate them, and clarifying the potential effects on various stakeholder groups, including shoppers, shopping mall managers, staff, administrators, and shop owners. Throughout this res., the investigation aims to thoroughly explore and comprehend the various aspects of ShopVista, the innovative shopping mall application, and its implications for everyone involved. The ShopVista application offers a range of valuable features to enhance the shopping experience for consumers while also benefiting mall operators and shop owners. The key objectives of this project include:

- **Crime alert notification:** ShopVista mobile application is a vital safety mechanism that allows shoppers and customers to swiftly alert mall security staff in case of theft or other incidents. With a simple tap within the app, users can trigger this alert, ensuring a proactive response to any potential security concerns within the mall. This functionality not only enhances shopper safety but also fosters a secure shopping environment, instilling confidence among visitors that help is readily available in emergencies.



- **Fire safety notification:** This app enables mall security to instantly notify shoppers, customers and all people inside the mall in case of emergency such as fire. The app dynamically displays the nearest emergency exits based on the user's location. It ensures quick and accurate seamless emergency exit guidance.
- **Price comparator:** With the ShopVista app, users can effortlessly explore the best prices for their favorite products. This feature empowers them to make informed decisions by comparing prices with other offerings in the market, ensuring that they pay a fair price for their purchases and enhancing their overall shopping satisfaction.
- **Comprehensive server-side functionality for Shop Owners:** Shop owners are equipped with control over their shops and product specifics through the ShopVista mobile app. This ensures that customers receive the latest retail updates effortlessly, enhancing the overall shopping experience for patrons.
- **QR scanner and QR generator:** ShopVista's integrated QR scanner and generator ensure a streamlined experience for customers and vendors alike. This innovative feature allows customers to easily access store or product information by scanning QR codes, promoting quick and convenient access to details they seek. Simultaneously, vendors benefit from its user-friendly interface for inputting and updating store and product information, fostering a harmonious digital marketplace where information flows seamlessly. ShopVista enhances the shopping experience for all parties involved.

In conclusion, ShopVista's array of features serves to not only enhance the convenience and safety of shoppers but also provides valuable tools and resources for mall operators and shop owners. These functionalities collectively contribute to reshaping the shopping experience and potentially revolutionizing the way people interact with shopping malls, ultimately benefiting all stakeholders involved.












2. Literature Review

In the text that appears beneath, the researchers conducted an extensive background study, identifying several mobile applications that bear similarities to the proposed system, both in the local (Sri Lankan) and international contexts. As part of the research process, these analogous mobile applications were identified, including 'iCanMall'[2], 'One Galle Face Mall'[3] and 'NOLIMIT'[4] have been identified in the domestic space and 'LIUHUA MALL Apparel Wholesale'[5] and 'Mall.sk'[6] on the international front. To facilitate a comprehensive comparison of functionalities among these applications, Table I, titled "FUNCTION COMPARISON TABLE," has been included for reference and clarity. This table will serve as a valuable resource for readers seeking insights into how the proposed system distinguishes itself within the mobile application landscape.

Table 1: FUNCTION COMPARISON TABLE

Mobile Apps	Functions			
	Shop Locator	Emergency Management	Price Comparator	Criminal Alert Notify Func.
ShopVista Mobiel App 				
One Galle Face Mobile App 				



iCanMall Mobile App 				
Liuhua Mall Mobile App 				
Mall.sk Mobile App 				

The evolution of mobile shopping applications has been characterized by an unwavering commitment to enhancing user experiences. Recent trends have witnessed the incorporation of innovative features such as indoor navigation systems, leveraging real-time mapping technologies to guide shoppers through intricate retail environments seamlessly. Furthermore, the integration of QR code scanners and generators has become increasingly prevalent, empowering users to swiftly access comprehensive product details and additional information. Additionally, the inclusion of price comparators has gained prominence, offering consumers the ability to make informed purchasing decisions by effortlessly comparing prices across various retailers. Mastering these dynamic trends is essential in assessing ShopVista's competitiveness and relevance in the rapidly evolving market landscape. Research in this area has also examined user-adoption rates and satisfaction levels with respect to mobile shopping applications. Factors influencing users' decisions to use and continue using such applications, as well as the role of user experience design, are explored in depth.

Mobile shopping apps face problems like keeping information safe, protecting your privacy, and fixing technical issues. Solving these problems is important for the apps to work well. These apps also affect how businesses connect with customers and make money. Different ways of doing business, like teaming up with stores, are becoming more common to make these apps work and make money.

To conclude the literature review section provides an overview of existing knowledge related to mobile shopping applications, establishing a foundation for exploring ShopVista. The subsequent sections of this paper will explore ShopVista's unique features, implementations, and contributions in this dynamic landscape.

3. Methodology

ShopVista is a comprehensive system encompassing three key components designed to cater to the diverse needs of its users: a mobile application, a web application, and an inventory control system. These components interact seamlessly to create a harmonious shopping experience for shoppers, provide essential tools for managers, and offer critical functionalities for vendors and administrators.

In the grand scheme of the ShopVista system, the mobile application assumes the pivotal role of being the primary gateway for shoppers. They depend on this application to peruse products, complete purchases, and elevate their overall shopping experience. It presents a user-friendly interface, bestowing convenience right at their fingertips. Furthermore, in the event of an emergency such as a fire, shoppers who may not be familiar with the premises can utilize the application to pinpoint the nearest emergency exit. This is made possible by leveraging their current location, providing them with a crucial safety feature that enhances their overall experience and security within the establishment. Managers, on the other hand, have their own set of responsibilities, primarily governed by the web application. This application empowers managers to exercise control over the physical structure of the premises. Through the web application, they can oversee and make necessary updates to the store layout, ensuring that it is optimized for the shoppers' needs. Vendors, another

crucial stakeholder, also play a vital role within the ShopVista ecosystem. They interact with shoppers through the mobile app, providing products and services. This engagement is facilitated through the web services integrated into the system, which ensures data reliability and maintainability. This results in a seamless and trustworthy exchange of information between vendors and shoppers. Lastly, the administrators have a dual responsibility: overseeing the web application and the inventory control system. They are entrusted with maintaining the overall integrity and efficiency of the entire system. The inventory control system allows administrators to manage product availability and stock levels, ensuring that shoppers can always find what they need.

Figure 1, a visual representation of the interaction between these four key stakeholders, serves as a valuable reference. It illustrates how the mobile application, web application, and inventory control system act as connective elements between shoppers, managers, vendors, and administrators. This visual aid is instrumental in understanding the flow of information and actions within the ShopVista ecosystem. In essence, ShopVista is a multi-faceted system that caters to the diverse needs of its users, leveraging web services to maintain the reliability and maintainability of the data shared among shoppers, managers, vendors, and administrators. The system ensures a seamless and efficient shopping experience while enabling managers to shape the physical premises to meet shoppers' evolving requirements.

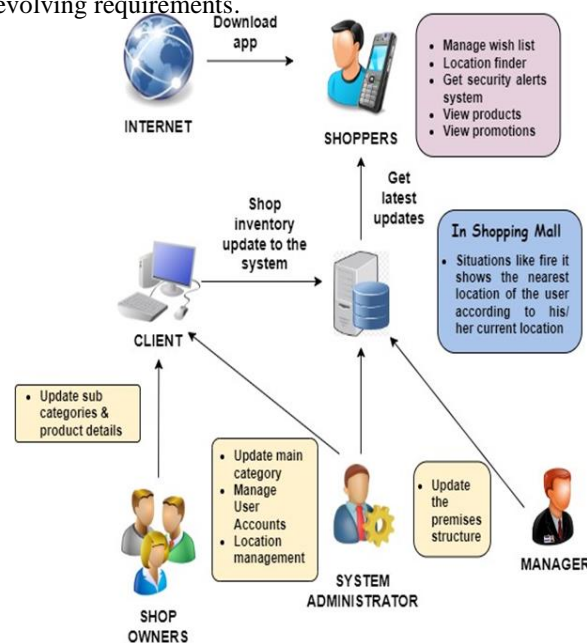


Figure 1: ShopVista System Diagram

A.Mobile Application

The mobile application implementation was started in parallel with the website. Initially, the server-side implementation was developed and successfully finalized. Subsequently, the focus shifted towards the implementation of the previously outlined key features. It was started under three main sections. The initial emphasis was placed on finalizing the implementation of the crime alert notification system. In order to streamline this process, they undertook the development of a mobile alarm system that would provide customers or users of the mobile application with a quick and effective means of alerting the security personnel at the shopping complex about any safety concerns. This innovative mobile alarm system was meticulously crafted, offering users the convenience of triggering a safety alert with a simple tap on their mobile devices. It was designed to display a user-friendly prompt box on the mobile phone screen, allowing users to input vital location information. Upon submission of this information, the system was meticulously configured to relay it promptly and automatically to the dedicated security personnel stationed within the shopping mall. This implementation not only enhances the safety and security of the premises but also empowers shoppers with a valuable tool to ensure their peace of mind and wellbeing while using the mobile application.

As second function, the development of the QR code reader and generator was initiated [7][8]. The integration of QR code scanning functionality in a shopping mall application, coupled with the utilization of Firebase as a backend service, represents a significant technological advancement that enhances the overall shopping experience for mall visitors. This research paper explores the intricate process of implementing this technology stack, emphasizing the key steps and considerations that underpin its successful deployment.

The methodology for implementing the integrated QR scanner and generator in ShopVista encompasses two key aspects, catering to both shoppers and vendors. This innovative feature serves as a versatile tool, allowing users to seamlessly scan QR codes for information retrieval while also empowering vendors to effortlessly update their store and product details. To begin, the implementation process can be accomplished using the popular development framework, Flutter, within the Android Studio environment. Flutter's cross-platform capabilities make it an ideal choice, ensuring a consistent experience for both Android and iOS users. This simplifies the development process and reduces the need for platform-specific code.

Firebase-Firestore plays a pivotal role in the implementation, acting as the backend database to store and manage the QR code data. Firebase-Firestore offers real-time database functionality, making it well-suited for ShopVista's dynamic requirements[9],[10]. The first step in implementation involves setting up the Flutter project in Android Studio and configuring the Firebase Firestore database. Next, developers can design and integrate the user-friendly interface for both shoppers and vendors. For shoppers, the QR scanner interface should be intuitive and responsive, enabling them to easily scan QR codes and access store or product information. Vendors, on the other hand, should be provided with an accessible interface for inputting and updating their store and product details. Once the user interfaces are in place, the QR code generation and scanning functionalities can be integrated seamlessly into the application. Flutter offers readily available packages for QR code generation and scanning, simplifying the development process further.

The fire safety notification system serves a critical function in ensuring the safety of individuals within a mall during emergency situations, particularly fires. This system is designed to provide immediate and accurate information to shoppers, customers, and all occupants inside the mall, enabling them to respond swiftly to a fire emergency. Its primary features include real-time notification capabilities, dynamic display of the nearest emergency exits, and seamless guidance to these exits. To implement this system effectively, a structured methodology can be followed, leveraging the capabilities of Flutter in Android Studio, and integrating Firebase-Firestore. The process involves several key steps:

- Firstly, the creation of a 2D indoor map using the Unity tool is essential[11], [12],[13]. Unity's user-friendly environment allows for the development of visually appealing and precise indoor maps. These maps should encompass vital details such as store locations and clearly marked emergency exit routes to aid occupants during emergencies.
- The next step involves integrating Unity with Android Studio, facilitating real-time interaction between the Unity indoor map and the Flutter app. This integration is crucial to ensure that the map and app work seamlessly together to provide accurate guidance. or the Flutter app development phase, it's important to design a user-friendly interface. This interface should empower mall security personnel to initiate emergency notifications effortlessly. Additionally, the app should offer options for selecting the type of emergency, with a specific focus on fire incidents.
- Firebase Firestore serves as the backbone of the system, functioning as the backend database. It is utilized to store crucial information about the mall's layout and emergency exit data. By organizing this data in Firestore collections, it becomes easily accessible for real-time use within the app. To dynamically find the nearest exit based on the user's location, the Flutter app can make use of the device's GPS capabilities. Implementing location services in the app allows for continuous tracking of the user's position. This information can then be combined with the data stored in Firestore to calculate and display the closest exit routes. In the app's front-end, the system should dynamically display these nearest emergency exits to users. Using straightforward graphics and intuitive text, the app guides shoppers, customers, and all individuals inside the

mall towards the safest exit routes. Importantly, this guidance should update in real-time as users move within the mall, ensuring quick and accurate response during emergencies.

B. Web Application

The website that accompanies the shopping mall app has been carefully crafted to perfectly complement the mobile application. It serves as a user-friendly platform, primarily accessible to administrators, aiming to meet their specific needs related to vendor management, product listings, advertising management, and essential settings.

This website has been built using technologies like Flutter and Firebase Firestore, ensuring a secure and robust platform for administrators. With exclusive administrative access, it acts as a central control center, streamlining various aspects of mall operations for those in charge. Its core functions include managing vendor details, controlling their status (activation or deactivation), categorizing products effectively, launching strategic advertising campaigns, and fine-tuning settings that impact the app's performance. One notable feature of this website is its reliance on Firebase Firestore, which provides administrators with real-time data on inventory, vendor details, and advertising performance. This data-driven approach empowers administrators to make informed decisions and optimize mall operations, ensuring a smooth and efficient shopping experience for users.

In summary, this accompanying website for the shopping mall app offers administrators a centralized platform to oversee vendors, products, advertising, and critical settings. Its primary goal is to help maintain an up-to-date and engaging shopping experience while emphasizing security and efficiency. By utilizing Flutter and Firebase Firestore, it ensures a scalable and robust solution for mall management.

C. Inventory Management System

The Inventory Control System (ICS) is a sophisticated solution meticulously designed and implemented, taking inspiration from established industrial systems. It seamlessly integrates with the main website and leverages Dart language, the Flutter framework, and Firebase Firestore as its database.

ICS, developed in Dart and Flutter, offers a user-friendly interface and adheres to industry standards, making it an ideal choice for efficient inventory management. It handles extensive data operations while ensuring the integrity of CRUD functionalities. Firebase Firestore powers ICS's real-time data handling capabilities, enabling instant updates and ensuring users always work with the most current information. This enhances overall operational efficiency. Additionally, ICS integrates seamlessly with the main website through web services, ensuring a unified and consistent interface for inventory management.

In conclusion, the Inventory Control System, built with Dart, Flutter, and Firebase Firestore, is a cutting-edge solution for businesses seeking optimal inventory management. Its architecture is inspired by industrial systems, delivering exceptional performance, and its integration with the main website enhances the user experience across all inventory control aspects.

4. Results and Discussion

The implementation of the fire safety notification system within a mall environment, as described in the preceding methodology, yielded significant results in enhancing emergency response capabilities. The core functionality of the system, which includes real-time notifications, the display of nearby emergency exits, and the provision of guidance to these exits, was successfully achieved. These outcomes are paramount for ensuring the safety of mall occupants during fire emergencies.

One of the key accomplishments of this system was the creation of a 2D indoor map using the Unity tool. The user-friendly nature of Unity facilitated the development of visually comprehensible indoor maps, featuring store locations and prominently marked emergency exit routes. This proved instrumental in aiding mallgoers to quickly identify the nearest exits, reducing potential panic and confusion during emergency situations. The integration of Unity with Android Studio facilitated seamless interaction between the Unity indoor map and the user-friendly Flutter app, a vital aspect of the system's success. This integration ensured that the map and app

collaborated harmoniously to provide precise guidance to the users. Moreover, the incorporation of a QR code scanner and generator within the app added a layer of versatility to the system. By enabling users to scan QR codes placed strategically throughout the mall, they could instantly access relevant safety information or report emergencies, further enhancing their ability to respond effectively during crises.

Firebase Firestore, functioning as the system's backbone database, played a pivotal role in storing crucial information related to the mall's layout and emergency exit data. The organization of this data into Firestore collections enabled real-time access within the app, contributing to the dynamic identification of the nearest exits based on the user's GPS location. This real-time guidance, displayed in a simple and intuitive format on the app's interface, ensured that shoppers, customers, and all individuals within the mall could swiftly navigate to the nearest exit, even as they moved within the mall during emergencies.

Comparatively, the integration of QR code scanning and generation brought several advantages to the system. The QR scanner allowed users to access specific emergency instructions or information about their current location within the mall simply by scanning a code. On the other hand, the QR code generator provided mall authorities with a powerful tool to disseminate critical information, such as real-time emergency updates or evacuation instructions, in a highly accessible and efficient manner. This feature proved particularly valuable in emergency scenarios where immediate communication is paramount.

In conclusion, the successful implementation of the fire safety notification system, integrating Unity, Android Studio, Flutter, Firebase Firestore, and QR code scanning/generation, demonstrated its effectiveness in enhancing the safety of mall occupants during fire emergencies. The system's ability to provide real-time guidance to the nearest exits in a user-friendly manner, coupled with the added versatility of QR code technology, is a substantial advancement in emergency response capabilities. These results underscore the importance of employing modern technologies and structured methodologies to enhance fire safety measures in public spaces while leveraging QR codes to further streamline communication and accessibility during emergencies.

5. Conclusion and Future Work

The main research objective of this study is to examine the impact of the innovative mobile application ShopVista on the shopping experience in malls. This investigation aims to understand how ShopVista influences consumer behavior, enhances convenience, and addresses safety concerns in shopping environments. By focusing on these aspects, the study seeks to contribute valuable insights that can inform both retailers and consumers about the potential benefits and challenges associated with the use of such technology in the context of mall shopping.

The research findings, predominantly derived from the survey conducted, have unveiled crucial insights regarding ShopVista's impact on the shopping experience within malls. Notably, ShopVista emerged as a positive force, significantly enhancing the convenience of mall navigation and shopping for users. Shoppers benefited from its integrated functions, which included a shop locator, price comparator, QR scanner, and QR generator. These features empowered users to effortlessly find stores, compare prices, and access product information, streamlining their shopping experience. One standout advantage of ShopVista, distinguishing it from similar apps is its robust emergency management feature. ShopVista excels in providing a crime alert notification system and fire safety notification functionality, addressing critical safety concerns within mall environments. This key differentiator ensures that shoppers and customers can promptly alert security staff in case of theft or emergencies, contributing to a secure shopping atmosphere and instilling confidence among visitors that help is readily accessible during critical situations.

Moreover, the study's findings suggest that ShopVista effectively mitigates the issue of shoppers frequently forgetting their intended purchases, with the app facilitating better organization and guidance for shoppers. This feature promotes more efficient shopping and minimizes the frustration of leaving a mall without all the desired items.

Comparing these findings to the existing literature, it is evident that ShopVista aligns with the evolving trends in mobile shopping applications. These trends emphasize the integration of real-time indoor navigation systems, QR code scanning capabilities, and price comparison functions to enhance the shopping experience. ShopVista's comprehensive functionality caters to these trends while adding the crucial elements of safety and security, setting it apart as a promising solution for mall shoppers.

However, the study acknowledges certain limitations, including the specific geographic focus on Sri Lanka and the reliance on self-reported data. Future research in this area could explore the application's effectiveness in different cultural contexts and employ diverse research methodologies to further validate the findings. Accuracy level of the proposed system can be increased by using upcoming technologies. Thus, in the future the system can be developed in a way to utilize those technologies.

In conclusion, the research findings underscore ShopVista's potential to revolutionize the mall shopping experience by offering a comprehensive range of features that enhance convenience, safety, and shopping efficiency. Its unique combination of functions, notably the emergency management features, sets it apart from similar applications and positions it as a valuable tool for both consumers and shopping mall operators. This research contributes to the evolving landscape of mobile shopping applications and highlights the importance of continued investigation and innovation in this dynamic field.

References

- [1] M. Karunarathna, H. Weerasingha, M. Rummy, D. De Silva and N. Kodagoda, "A Fully Functional Shopping Mall Application--SHOPPING EYE," *IEEE*, pp. 292-296, 2014.
- [2] L. ican group co., "iCanMall," Google Play, 10 Dec. 2020 . [Online]. Available: <https://play.google.com/store/apps/details?id=com.easypay.shop&hl=en&gl=US>. [Accessed 15 August 2023].
- [3] S.-L. I. H. M. P. Ltd, "One Galle Face," Google Play, 24 Oct. 2019 . [Online]. Available: <https://play.google.com/store/apps/details?id=com.onegalleface.ogf&hl=en&gl=US>. [Accessed 18 August 2023].
- [4] ZMESSENGER, "NOLIMIT," APKCombo, 03 Dec. 2016 . [Online]. Available: <https://apkcombo.com/nolimit/lk.zmessenger.nolimit/>. [Accessed 19 August 2023].
- [5] S.-S. U. I. Tech, "LIUHUA MALL Apparel Wholesale," Google Play, 20 Jul. 2021 . [Online]. Available: <https://play.google.com/store/apps/details?id=com.leihou.liuhua&hl=en&gl=US>. [Accessed 19 August 2023].
- [6] I. M. a.s, "Mall.sk," Google Play, 25 Jun. 2014 . [Online]. Available: https://play.google.com/store/apps/details?id=com.nrholding.mall.sk&hl=en_US. [Accessed 19 August 2023].
- [7] K. Johns, "Building a QR Code Generator using Firebase," 21 Oct. 2020 . [Online]. Available: <https://medium.com/@kiranjohns/overview-78483d91a38b>. [Accessed 18 Sept. 2023].
- [8] A. Gupta, "Scanning & Generating QR code in Flutter," 26 Jul. 2020 . [Online]. Available: <https://medium.flutterdevs.com/scanning-generating-qr-code-in-flutter-3d5251a61244>. [Accessed 24 Sept. 2023].
- [9] A. Ashok, "Android app to scan QR and update data in firebase and display it," 24 Apr. 2019. [Online]. Available: <https://medium.com/club-devbytes/android-app-to-scan-qr-and-update-data-in-firebase-and-display-it-39f4753a40c2>. [Accessed 03 Sep. 2023].

- [10] A. Losari, "Flutter Text & Barcode Scanner App with Firebase ML Kit," 11 Jun. 2018. [Online]. Available: <https://medium.com/flutter-community/flutter-text-barcode-scanner-app-with-firebase-ml-kit-103db6b6dad7>. [Accessed 03 Sep. 2023].
- [11] B. Kahyaoglu, "Indoor mapping in Unity," 20 Oct. 2017 . [Online]. Available: <https://blog.mapbox.com/indoor-mapping-in-unity-74999aaa851a>. [Accessed 03 Sep. 2023].
- [12] A. Pavani, "ndoor navigation in AR with Unity," 26 Jan. 2018 . [Online]. Available: <https://blog.mapbox.com/indoor-navigation-in-ar-with-unity-6078afe9d958>. [Accessed 04 Sep. 2023].
- [13] S. Khan, M. A. Shayokh, H. M. Mahdi and M. Bhuiyan, "A Framework for Android Based Shopping Mall," in *Proc. of the Int. Conf. on eBusiness, eCommerce, eManagement, eLearning and eGovernance (IC5E 2014)*, London, UK, 2014.