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Design and Development of an Urban School Mobile Application using Android Studio: a Case Study of Kachela Trust School

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Abstract

Many urban schools continue to depend on manual and fragmented systems for communication, academic management, and administrative operations, resulting in delayed information sharing, data inconsistencies, and increased administrative workload. This study presents the design and development of a mobile application for Kachela Trust School, an urban learning institution in Zambia, intended to improve communication, academic information accessibility, and administrative efficiency. A mixed-methods research design was adopted, combining questionnaires, interviews, and document review with the Prototype Model of the systems development life cycle. Android Studio was used as the primary development environment, with Java and Kotlin used for application logic, XML used for interface design, and Firebase and MySQL used for backend data storage. The developed application integrates modules for announcements, attendance tracking, timetable access, student profiles, and academic results viewing. A baseline survey of thirty respondents, with a response rate of 67%, was conducted to establish user requirements, and user acceptance testing was carried out with selected staff, parents, and students. It was found that the application improved real-time communication, reduced administrative workload, and provided centralized access to academic information when compared with the existing manual system. It is concluded that a dedicated mobile application of this nature can meaningfully support the digital transformation of urban schools operating in resource-constrained settings. Future enhancements, including e-learning integration, fee monitoring, push notifications, and iOS compatibility, are recommended.

Keywords: Mobile Application, Android Studio, School Management System, Educational Technology, Digital Transformation

1. Introduction

Mobile applications have become an integral part of how institutions deliver services, communicate, and manage information. The education sector, particularly in urban environments, increasingly relies on digital solutions to improve efficiency and enhance the experience of students, parents, and administrators. Despite this trend, many schools in Zambia, including Kachela Trust School, continue to depend on manual and paper-based processes for communication, academic management, and administrative operations. These traditional methods often result in delays, data loss, miscommunication, and limited real-time access to important school information.

Kachela Trust School currently uses manual and semi-digital systems for issuing announcements, tracking attendance, managing academic performance, and updating parents on school events. These systems lack automation, are prone to human error, and offer no centralized platform for information access. With the widespread availability of Android smartphones among students and parents in urban communities, a mobile application presents a practical solution for enhancing efficiency and communication within the school. This study was therefore undertaken to design and develop a mobile application for Kachela Trust School using Android Studio, with the aim of providing a centralized, reliable, and accessible platform for managing school-related information.

1.1 Problem Statement

Kachela Trust School relies on manual and semi-digital processes for communication, academic reporting, attendance management, and dissemination of school-related information. These methods often lead to delays, information gaps, data inconsistencies, and higher administrative workload. Parents sometimes miss important updates, students do not always receive information on time, and teachers spend excessive time performing routine tasks that could be automated. Despite the widespread availability of Android smartphones among stakeholders, the school lacks a centralized mobile platform to support efficient communication and information management. This gap creates operational challenges and reduces the effectiveness of interactions between the school and its stakeholders.

1.2 Objectives of the Study

The general objective of this study was to design and develop a functional mobile application that enhances communication, academic information accessibility, and administrative efficiency at Kachela Trust School through the use of Android Studio. The specific objectives were as follows.

1. To analyse the existing communication and administrative processes at Kachela Trust School.
2. To design a mobile application framework that addresses identified challenges in information sharing and record management.
3. To develop an Android-based school mobile application with features such as announcements, attendance tracking, timetable access, and academic results.

1.3 Research Questions

1. What challenges exist in the current communication and administrative processes at Kachela Trust School?
2. How can a mobile application be designed to address the identified challenges?
3. What key features should be included in the mobile application to support school operations and information access?

1.4 Significance and Scope of the Study

The study is significant in that it addresses the growing demand for digital solutions that enhance communication and administrative efficiency within urban school environments. It provides a practical tool that improves the management of academic and administrative processes, benefits parents through real-time updates, and reduces the time spent by teachers and administrators on repetitive manual tasks. The study also contributes to the integration of technology in Zambia's education sector by demonstrating how mobile applications can be used to address communication challenges in schools.

The study was limited to the design and development of a mobile application for Kachela Trust School, covering core functionalities such as viewing announcements, accessing academic results, checking class timetables, monitoring attendance, and facilitating communication between the school and its stakeholders. The scope did not extend to developing an iOS version, integrating advanced e-learning

modules, or implementing a full-scale enterprise management system. Data was collected from Kachela Trust School's administrators, teachers, students, and parents only, and no comparative analysis was conducted with other institutions.

2. Related Research Work

This section presents a review of literature relevant to mobile application development, educational technology, and digital school management systems, and it establishes the theoretical and empirical foundation for the present study.

2.1 Mobile Applications in Education

Mobile applications are increasingly adopted to support administrative functions, enhance communication, and improve access to academic information in schools. Mobile learning technologies have been reported to offer flexible, anytime and anywhere access to educational content and to improve communication and school administration (West and Vosloo, 2013). Android-based school and college management applications have similarly been found to offer reliability and time savings, allowing students and parents to view results, attendance, and notifications at any time, thereby simplifying and speeding up processes that were previously handled manually (Kadam, et al., 2017).

Android, as an operating system, dominates the mobile device market, particularly in developing countries, and is considered the preferred platform for educational applications on account of its accessibility and affordability. Android-based attendance systems have been proposed as a means of eliminating the problems associated with manual, paper-based attendance registers and of promoting a paperless environment within institutions (Noor, et al., 2015). Firebase, as a backend-as-a-service platform offering authentication, real-time data storage, and cloud messaging, has similarly been found to provide a reliable and convenient foundation for Android application development, supporting fast data synchronisation between the mobile interface and the backend database (Khawas and Shah, 2018).

In the Zambian context, the integration of information and communication technology into schools remains uneven; a review of information and communication technology subject implementation in schools in Lusaka Province found that, despite supportive national policies, effective implementation is hindered without adequate resources, infrastructure, and administrative support (Nyanja and Musonda, 2020). This finding underscores the practical relevance of developing a locally tailored, resource-conscious mobile application, such as the one proposed for Kachela Trust School, rather than relying on imported systems that assume infrastructure not always available in the local context.

2.2 Review of Related Systems

Three categories of existing systems were reviewed to establish a foundation for the proposed application. The School Management System (SMS), an Android-based application, provides attendance tracking, announcements, grade management, and timetable scheduling using a cloud database such as Firebase. Its strengths include real-time data access, a user-friendly interface, and push notifications; however, it offers limited customisation and lacks features specific to local school needs, such as fee balances and offline access.

EduPortal, a web and mobile school communication system, supports modules for e-learning, messaging, examination management, and staff-student communication, and it centralises academic information effectively. Its limitations include dependence on stable internet connectivity, subscription costs, and a relatively complex interface that may not suit schools with limited information and communication technology training.

GEMS Mobile, an international school information management application, provides modules for attendance, homework, calendars, messaging, and digital reports, with strong security, scalability, and parent-teacher communication features. However, high development costs, complex deployment, and limited localisation restrict its suitability for small and medium-sized schools in developing countries, including schools such as Kachela Trust School that may not have consistent access to high-speed internet.

2.3 Gaps in Existing Literature

The reviewed literature reveals the following gaps, which the present study seeks to address.

1. Most existing applications are not tailored to the context of Zambian urban schools, leading to usability and relevance challenges.
2. Many reviewed systems address communication or academic records in isolation, rather than integrating attendance, timetables, announcements, and performance within a single application.
3. Systems that rely heavily on internet connectivity may not be fully accessible to users in areas with inconsistent network coverage.

3. Research Methodology

3.1 Research Design

A mixed-methods research design, combining qualitative and quantitative approaches, was adopted for this study. This design was selected because it allowed detailed insights to be gathered from school administrators, teachers, parents, and students, while also allowing patterns and user needs to be quantified. The Prototype Model of the systems development life cycle, illustrated in Figure 1, was used to guide the design and development of the mobile application, as it enabled iterative testing, refinement, and validation of system features by end users prior to final deployment.

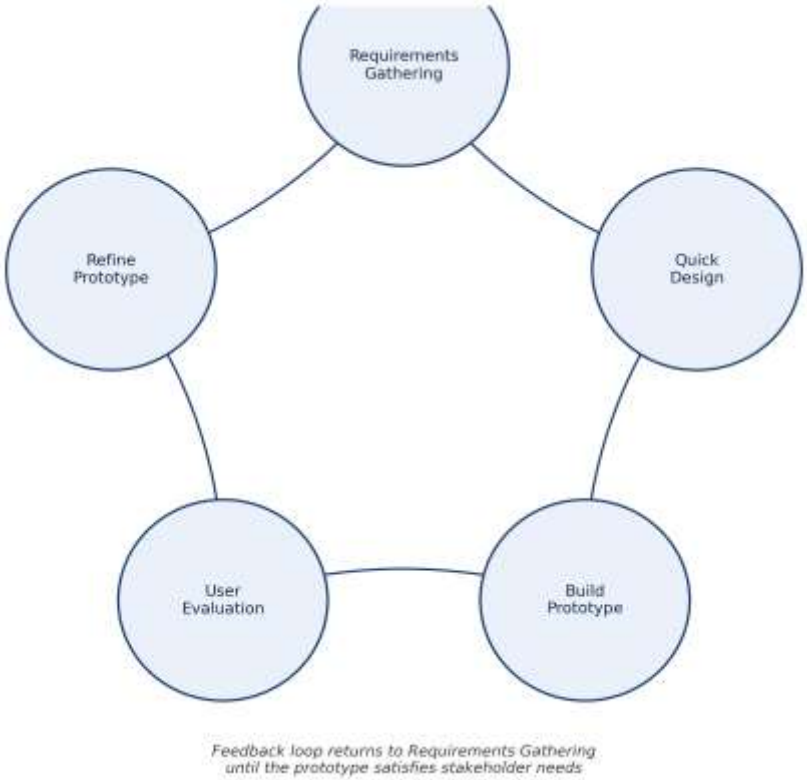

Figure 1: Prototype Model Adopted for System Development

3.2 Data Collection

Data was collected using a structured questionnaire and face-to-face interviews administered to administrators, teachers, parents, and students of Kachela Trust School. The questionnaire included both closed-ended and open-ended questions; closed-ended items facilitated straightforward computation of responses, while open-ended items provided richer qualitative insight. Thirty questionnaires were administered, of which twenty were completed and returned, representing a response rate of 67%, which was considered sufficient for analysis. Both primary data, focusing on the current communication and administrative processes, and secondary data, drawn from institutional records and prior studies, were used.

3.3 System Development Approach

The development process followed four major phases: requirements specification, interface design, coding, and testing. During the requirements specification phase, functional and non-functional requirements were gathered through interviews, observations, and document analysis; these included viewing announcements, accessing timetables, checking attendance, viewing examination results, managing student profiles, and providing an administrator module for content management.

During interface design, wireframes and preliminary screen sketches were prepared, and Android Studio's layout editor was used to design interactive interfaces in XML, with emphasis on simplicity, familiar Android components, clear typography, and compatibility with different device sizes. Selected teachers and students reviewed the designs, and feedback was incorporated prior to implementation. During the coding phase, the frontend was implemented using XML layouts with Java and Kotlin for activity logic, the backend was implemented using Firebase Realtime Database and MySQL, and Firebase Authentication was used to manage login and user verification. Application programming interface calls and database synchronisation ensured real-time updates for announcements, attendance, and results.

Testing was conducted throughout the development cycle through unit testing of individual components, integration testing to confirm smooth communication between the interface and database, and user acceptance testing involving teachers and selected students. Feedback obtained from testing was used to refine the system, adjust interface elements, and optimise performance. Following successful testing, the application was packaged as an Android Package Kit file and installed on selected devices for pilot use within the school.

3.4 Development Tools and Technologies

The following tools and technologies were used in the development of the application: Android Studio as the integrated development environment; Java and Kotlin as the programming languages; Extensible Markup Language for interface design; and Firebase and MySQL for backend data storage, authentication, and real-time synchronisation.

4. Results and Discussion

4.1 Baseline Survey Results

Of the thirty questionnaires administered, twenty were completed and returned, representing a response rate of 67%. The age distribution of respondents, summarised in Table 1, shows that the majority of respondents were above 41 years of age, indicating that most participants were experienced stakeholders with sufficient familiarity with the school's existing communication and administrative processes to provide informed input on system requirements.

Table 1: Age Distribution of Survey Respondents

Age Group (Years)	Percentage of Respondents (%)
Below 30	3.0
32 - 35	15.5
36 - 40	16.3
41 - 45	22.5
Above 50	26.9

The baseline study further established that the school relied heavily on physical notices, paper-based attendance registers, manual result distribution, and face-to-face communication between parents, teachers, and administrators, which resulted in delays, miscommunication, and data inconsistencies. It was also found that the majority of parents and learners owned Android smartphones, confirming the feasibility of a mobile-based solution and providing justification for the development of an Android application integrating academic management, communication, and administrative processes.

4.2 System Implementation Results

The application was implemented using Android Studio, supported by Firebase and MySQL for backend data storage and retrieval, following the layered architecture shown in Figure 2. A modular approach was followed, in which subsystems such as user authentication, announcements, attendance management, timetable display, and results viewing were implemented and tested individually before integration into the main application. Firebase Authentication was successfully integrated to manage secure login and role-based access control, ensuring that sensitive information such as attendance records and academic results was accessible only to authorised users. The real-time database supported instant retrieval and updating of announcements, which improved communication efficiency relative to the manual system previously used.

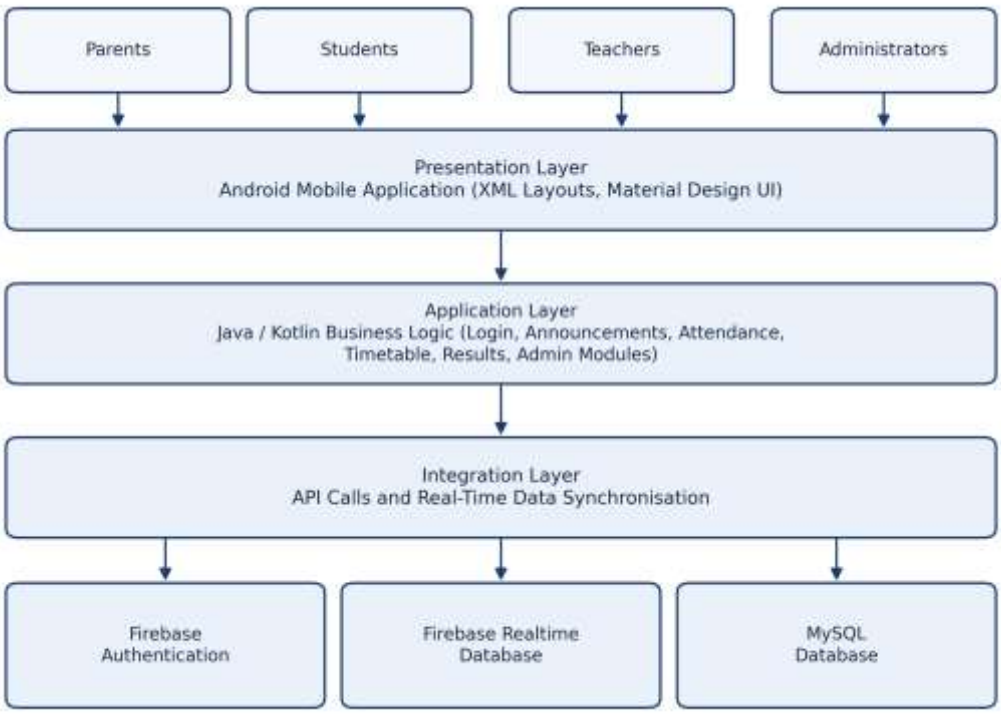

Figure 2: System Architecture of the Urban School Mobile Application

The attendance module allowed teachers to record student presence digitally, with parents able to view attendance status instantly, thereby improving transparency and reducing the need for physical follow-up. The results module enabled administrators to upload academic performance data for retrieval by students and parents, reducing delays and eliminating the risk of misplaced printed report slips. System testing, comprising unit tests, integration tests, and user acceptance testing, confirmed that functional requirements were met, and feedback from selected staff, parents, and students indicated high levels of satisfaction, particularly regarding timely communication, ease of access to school data, and reduced dependency on manual processes.

4.3 Discussion of Findings

The findings indicate that the developed application addressed the principal challenges identified during the baseline study, namely delayed communication, difficulty in accessing academic information, and inefficiencies associated with manual record-keeping. Parents, teachers, and administrators reported that the application's real-time updates, centralised information management, and intuitive interface improved stakeholder interaction and reduced administrative workload. The application was found to perform reliably across different Android devices, supporting its suitability for wider use in an urban school context. These findings are consistent with prior studies indicating that Android-based school and attendance management applications reduce reliance on manual, paper-based processes and improve the speed and reliability of communication in educational settings (Kadam, et al., 2017; Noor, et al., 2015).

Certain challenges were encountered during the study. The research was confined to Android devices, so users with iOS devices could not participate in testing or benefit from the application. Time constraints limited the extent to which advanced features, such as fee management, push notifications, and e-learning components, could be developed and fully integrated. The study also relied on feedback from a limited number of respondents at a single institution, which may not represent the needs of all potential users, while resource limitations, including access to testing devices and stable internet connectivity, affected the comprehensiveness of system testing.

5. Conclusion

This study set out to design and develop a mobile application for Kachela Trust School with the aim of improving communication, enhancing access to academic information, and streamlining administrative processes. It was found that the school's existing manual systems were inadequate in meeting the growing demand for timely information sharing, efficient data management, and improved stakeholder engagement. Through a combination of user-centred design, requirement gathering, and iterative development, a functional Android-based mobile application was produced that addresses these operational challenges.

The developed system centralises essential services, including announcements, attendance tracking, timetables, and academic results, reducing communication gaps and enhancing convenience for parents, students, and teachers. It is concluded that mobile applications can significantly transform school operations, particularly in resource-constrained settings, and that adoption of such digital technologies can help schools such as Kachela Trust School improve efficiency, increase transparency, and foster a more connected learning community.

5.1 Recommendations for Future Work

Future development should focus on incorporating push notifications for real-time alerts on announcements, timetable changes, attendance updates, and examination results, as well as extending

compatibility to iOS devices to widen the user base. Stronger authentication mechanisms, such as two-factor authentication and encrypted communication protocols, should be implemented to improve data security. Additional recommendations include integrating school bus tracking functionality, incorporating analytics dashboards to support administrative decision-making, developing a complementary web-based administrative portal, and introducing e-learning and fee-monitoring modules, supported by continuous user training and feedback mechanisms.

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