

حلقة

Halaqa

IT 497: Graduation Project Report  
Product Release-2

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# Halaqa

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## Abstract (English):

Having a successful collaboration between students' parents and schools makes the educational process more effective. Today, there are many technological solutions that facilitate everyday tasks for humans. However, even with all these solutions, parents and schools are still facing difficulties in contacting each other. This is why we have built an application named "Halaqa" ( حلقة ) that facilitates communication between those two parties. The application provides many features such as,-notifying the school for student pickup, offering chat service between parents and teachers, uploading school's required documents, tracking students' absence and grades, uploading absence excuses, and sharing announcements and events of the school. Halaqa currently supports only Arabic language, and it has two types of user interfaces: a website (platform-independent) and a mobile application that supports both iOS and Android. The school principal and administration staff use the website interface, while parents, teachers, and commissioners use the mobile application interface. Agile methodology was used for the development of the application, which manages a project by breaking it into multiple phases with constant improvement at each phase. Halaqa uses HTML, CSS, and JavaScript for the client-side of the web application, Flutter for the mobile application, Node.js for the server-side of the web application, and Firebase for the application's database. Finally, through users' acceptance testing, we concluded that users find the application easy to use, understandable, and beneficial for parents and schools' communication.

## Abstract (Arabic):

التعاون الناجح بين أولياء الأمور للطلاب والمدارس يجعل العملية التعليمية أكثر فعالية. في العصر الحالي، يوجد العديد من الحلول التقنية التي تسهل على البشر أداء مهامهم اليومية بارغام من وجود كل هذه الحلول، لا يزال أولياء الأمور والمدارس يواجهون صعوبات في التواصل مع بعض. لهذا السبب قمنا ببناء تطبيق يُدعى "حلقة" الذي يُسهل عملية التواصل بين هذين الطرفين التطبيق يوفر العديد من الميزات مثل إخطار المدرسة لاصطحاب الطالب، وإمكانية الدردشة الإلكترونية بين أولياء الأمور والمعلمين، وتحميل المستندات المطلوبة في المدرسة، وتتبع غياب ودرجات الطلاب، وتحميل أذون الغياب، ومشاركة إعلانات وأحداث المدرسة. تطبيق حلقة حالياً يدعم اللغة العربية فقط، ولديه نوعين من واجهات المستخدم: موقع الكتروني (لا يعتمد على الجهاز) وتطبيق للهاتف المحمول الذي يدعم كلي نظامي (iOS) و (Android). يستخدم مدير المدرسة والإداريين واجهة الموقع الإلكتروني، بينما يستخدم أولياء الأمور والمعلمون والمفوضون واجهة تطبيق الهاتف المحمول. تم استخدام منهجية Agile لتطوير التطبيق، وهي منهجية تدعم إدارة المشاريع عن طريق تجزئته إلى عدة مراحل مع التحسين المستمر في كل مرحلة. تطبيق حلقة يستخدم (HTML) و (CSS) و (JavaScript) و (Node.js) لواجهة المستخدم من تطبيق الويب، و (Flutter) لواجهة تطبيق الهاتف المحمول، و (Firebase) لواجهة الخادم من تطبيق الويب، و (MongoDB) لقاعدة بيانات التطبيق. وفي الختام، من خلال اختبار قبول المستخدمين، تم استنتاج أن المستخدمين يجدون التطبيق سهل الاستخدام ومفهوم ومفيد للتواصل بين أولياء الأمور والمدارس.

**Keywords:** School-Parent Communication; Student's School Pickup; Student's Absence Follow-up, Student's Grades Follow-up, Parent's Direct Communication with Teacher; Mobile Application; Web Application.



# Chapter 1

## Introduction



## 1 Introduction

Schools and educational communities are an essential part of the human journey in building a strong foundation of knowledge and social skills. A communication mechanism between parents and schools must be established in order to make the educational process more effective for the youth and to guarantee that the learning process evolves fluently.

Unfortunately, with all the advanced technology that has been offered to the public, there is no proper way for parents and schools to communicate with each other easily, as they still tend to use traditional communication methods which are prone to many problems. Such a problem is using a mediator between the parents and the school, which is a long and an overwhelming process. The mediator relays information from the school administration or teachers to the parents and responds to parents' questions.

In many situations, schools do not give the parents the teachers' phone numbers to protect their privacy, and to make communication limited on the working hours only. Direct communication between teachers and parents is necessary for good cooperation between the school and home, yet it is still lacking.

In addition, school's faculty sometimes face obstacles on reaching out to the student parent. Sometimes students either forge their parent's phone number to avoid punishments or the parent would change their contact information without prior informing the school. This will eventually affect the educational process.

In the other hand, schools suffer from traffic at the end of the school day due to the inefficient way of picking up the students. Parents and drivers line up in front of the school gates in a non-systematic way to announce their arrival, which is a time-consuming process and might cause incidents.

Based on our experiences with our families and schools, and upon our marketing analysis, there is still no dedicated platform that offers the parents and the school with functionalities that make the communication between the two parties easier and more functional. That is why we developed an Arabic web-based mobile application called (Halqa), with the goal of providing solutions for the communication problems mentioned in this document. It allows direct communication between school staff (administrators, teachers, and event organizers such as for school field trips) and parents. It allows parents to view grade and absence reports in order



for parents to follow up with their children. Finally, it allows the parents to inform the school when they are ready to pick up their children. Thus, it focusses on communication between school and home to make it more efficient and less stressful for everyone. Having the application in Arabic, makes it more accessible for Saudi and Arabic families.

This chapter contains the necessary information gathered to build our web-based mobile application (Halaqa), such as the problem and the solution to solve it, including the objectives and scope of the project. Then, it presents our product vision. After that, it briefly describes the approach used to build our project. Then it highlights the main contributions of the project. Finally, it presents the organization of the remaining of the project report.

## 1.1 The Problem

This time and age is considered the revolutionary era of technology. Despite that, parents and school faculties are still facing difficulties in reaching and contacting each other as there still isn't a technological solution that will facilitate these parties. Plus, communication methods that are being used between the school and the parent are inclined with many issues and are prone to mistakes.

One of the problems arise from schools facing a shortage on faculty members that are responsible of relaying information between the school and the parents, and even if there is a dedicated mediator between them, they will still face difficulties with the job. Parents are usually curious and concerned about their child's education status, so they tend to contact the school immensely. This will make it overwhelming for the mediator to handle all the parents' concerns, questions, and requests, as parents become frustrated when the mediator does not respond in a timely matter.

Unfortunately, the communication between the school and the parent is still done through traditional methods such as, making a phone call to the parent/school mobile number, sending personal emails, and contacting each other through a chat application. Also, teachers usually would have to announce something to the classes they teach out of the school day, contacting each student's parents individually consumes time and effort. These methods are non-effective and stressful for both the parents and the mediator.

On the other hand, parents and teachers sometimes like to discuss an issue with each other privately without a mediator. Most schools do not give the parents the teachers' phone numbers to protect their privacy and to limit communication to the teacher office hours. As a result,



relaying information between the teachers and parents takes time, and it will include more parties to the conversation than needed. As a result, this makes direct communication between teachers and parents flawed.

Part of the educational process includes handing out papers to students to hand them over to their parents in order to facilitate the students and parents' experience with the school. Examples include, field trips participation permissions, monthly reports, clinical health form, and parents/child contact information form. This is an inefficient way for several different aspects. For instance, hardcopy papers tend to get lost, damaged, or forgotten before or after handing them over. On the other side, hardcopy papers are harmful, due to the environmental effects of paper production, which include deforestation, the use of enormous amounts of energy and water as well as air pollution and waste problems.

Schools also suffer at the end of the day of car jam problems, car accidents and traffic. Usually, parents and drivers line up in front of the school in a non-systematic way to announce their arrival by calling the student's name using a microphone, which makes it a time and effort consuming process. Plus, students are not allowed to bring their personal digital devices with them to school, which makes the situation challenging as students usually don't have a clue if their parent is waiting for them outside the schools' gates.

## 1.2 The Solution

Digital communication has many advantages over traditional forms of communication. For example, facilitating timely online information exchange and immediate feedback between parents and teachers. It also makes it easier and reliable to intervene in learning and behavioral problems at an early stage, and thereby improves the study outcomes.

The proposed solution provides a single Arabic platform that will serve the parents and school staff a means of easier communication between them. This allows the two parties a direct way to reach each other. Our application focuses on two main areas, which are the communication area and the attendance and pickup area.

On the communication area, our goal is to enhance the communication between the parents and the school by providing the school the capability of uploading any documents that must be approved or filled by the parents, uploading students grades for parents to view them and publishing any activities or events that are planned to be organized. In addition, the school



teachers and the parents can communicate directly with each other through a private chat. Also, teachers will be able to broadcast a message to all students' parents in a specific class.

On the attendance and pickup area, our goal is to allow the school to inform the parents if their child is absent, and therefore parents can upload medical or personal reports to clarify the absences. The parents can also inform the school when they have arrived to pick up the student. In addition, parents can inform the school if someone else is picking up their child or authorize someone to be able to pick up their child and use the pickup feature. A web screen will be used by the school at the pick-up area to display the names of students that are ready for pickup.

As a result, the proposed solution solves the problems of communication between school and parents. It benefits both the school staff (administrators and teachers) and parents. Facilitating easier and simpler communication between them ultimately benefits the students and improves the efficiency of their educational process.

The application was developed using the client-server system architecture. The client-side of the application contains the system interfaces, and it is divided into two parts: the mobile application for parents, teaching staff, and authorized commissioners, and the website for school administration staff. The server side of the application contains the database that stores all exchanged information and is responsible for its storage and retrieval. The client retrieves the information from the server to display it to the user and connect between different users.

### 1.2.1 Project Objectives

Halaqa's main target is to act as a connection bridge between the school and the student parents, as the educational field seeks for a technological solution to link between the two parties since it is essential for parents to indulge in the learning experience of their children at an early stage, and thus improving the study outcomes.

The following is the list of the main product features according to user:

#### School Principal:

- Setup the school account and add administrators.

#### School Administrators:

- Add classes and add students to classes.
- Specify subjects for classes.



- Add teachers and assign them to subjects for classes.
- Upload any documents that must be approved, filled, or viewed by the parents.
- View the parent uploaded filled documents.
- Publish any activities or events that are planned to be organized.
- Publish any urgent or important announcements.
- Inform the parents if their child is absent and view uploaded absence excuses by the parent.
- Access the pickup screen to view the student names to be picked and view any one-time commissioner of the day.

### School Teachers:

- Communicate directly with the parents through private chats.
- Broadcast a unified message to all students' parents in a specific class.
- Customize a subject grade distribution and upload the students grades for a specific subject.

### Students' Parents:

- Communicate directly with the teachers through private chats.
- Inform the school when they have arrived to pick up the student.
- Authorize someone else to pick up the student for a one time in a specific day of the week.
- View student absences and upload medical or personal reports to clarify the absences.
- View uploaded documents for a student from the school and respond to them if applicable with a filled document.
- View the student grades in a specific subject.
- View the school's published announcements and events.
- Create and manage the authorized commissioner accounts that are authorized to pick up their children.



## 1.2.2 Project Scope

This project is a web application and a web-based mobile application that supports the Arabic language only and it is limited to elementary, middle, and high schools' faculty and student parents. The application is provided in Saudi Arabia, and it was developed using HTML, CSS, JavaScript, Node.js, and Flutter which supports cross platform development for different operating systems. The application was developed using the client-server system architecture. The client-side of the application contains the system's interface, and it is divided into two parts: the mobile application for parents, teachers and commissioners, and the website for the school administration staff. The mobile application was developed for both iOS and Android platforms. The project needs a database to store the user's information which is handled by Firebase on the server side of the application. The project was developed and managed by Jira, Git, GitHub, Android studio, Visual Studio, XCode, Google Chrome and Firebase.

Halaqa provides only the main features listed in Section 1.2.1. It does not provide other features such as online classes, exams and quizzes, the ability of viewing the academic schedule and calendar, and the ability of parents' registering their children to the school through the app.

## 1.3 Product Vision

Our product vision statement will describe the long-term desired outcome for our application product.

Our product is for schools and student parents, who need a means of easier communication methods between them.

Halaqa is a website and a web based mobile application. That will provide several features that focuses on enhancing the communication and the pickup method between the school faculty and the students' parents.

Unlike other school application that mean to provide services to parents and teachers such as, BlueRide، مدرستي النتائج، مدرستي.

Our product aims to provide a single platform that combines most of the different features that other applications provide to aid the communication between the two parties and easing and organizing the pickup methods in the school.



## 1.4 Project Approach

Agile methodology was used for the development of the application. The Agile methodology focuses on iterative and incremental delivery. It supports flexible response to change and focuses on the involvement of the customer throughout the development process. The project was distributed among sprints as each sprint delivers part of the product and it is merged with the last sprint deliverables, thus making the process incremental such that at the end of the last sprint a working software is delivered.

A questionnaire campaign was conducted to fathom the users' needs and requirements in order to gain a deeper understanding of the market that the project serves. A domain analysis was made to allow us to recognize and relate to the problems faced by users, empowering us to make informed decisions to address these challenges effectively. Based on the findings from the domain analysis, we proceeded to design and develop the application, employing software tools that provided the optimal user experience. Throughout the development phase, we focused on creating intuitive user interfaces, smooth navigation, and efficient functionality to meet the identified needs and requirements. Thorough testing was carried out to verify the application's performance and ensure it met the expected standards. The testing phase included the involvement of target users, who tested the application to validate its ability to deliver the intended services as anticipated.

## 1.5 Project Contributions

The main contribution of Halaqa is to act as a bridge between school faculty and students' parents, addressing the crucial need for parental participation in children's learning at an early stage. By providing a web-based application with various features, Halaqa aims to enhance communication and pickup methods, ultimately improving study outcomes for students.

Halaqa serves as a single platform that combines multiple features to facilitate effective communication between school faculty and parents, while also streamlining and organizing pickup processes within the school. The application aims to overcome the issues and mistakes often associated with traditional communication methods, offering an adequate technological solution for both school administrators and parents.

The impact of Halaqa on the local and global community is significant. At a local level, the application improves the engagement and involvement of parents in their children's education



in KSA. By providing a user-friendly platform, it encourages parents to actively participate in their children's learning journey, leading to better study outcomes and overall academic success.

On a global scale, the importance of parental involvement in education is widely recognized. By offering a solution that simplifies and enhances communication between school and parents, it contributes to the global effort of improving education systems. It promotes collaboration and cooperation, fostering a supportive learning environment that benefits students worldwide.

What sets Halaqa apart from existing solutions in the market is its comprehensive approach. While there may be other applications focusing on communication between school and parents, Halaqa combines multiple features into a single platform. This integration of various functionalities allows for a more seamless and efficient user experience, eliminating the need for parents and school faculty to juggle between multiple applications or platforms.

## 1.6 Report Organization

The remaining of the project report is organized as follows:

- Chapter 2 presents the background material for the project. It describes the importance of school-home communication and its obstacles. Then it briefly describes cross-platform development since it is used in the development of the project.
- Chapter 3 presents the literature review for the project. It shows a competitive product analysis that compares our applications with existing similar applications.
- Chapter 4 of this document presents the system design and development for the project. It begins by introducing the methodology that was used for the project implementation, which is the Agile methodology. The chapter then proceeds to outline the system requirements that were identified for Halaqa's users, including the process of gathering requirement elicitation and analysis to understand the user's needs and aid in discovering the desired services. Additionally, the chapter describes the user interactions that were designed for each user. It also provides a roadmap for developing and releasing Halaqa and outlines the key milestones. It lists the product backlog that contains a prioritized list of work for development, as it is derived from the roadmap.

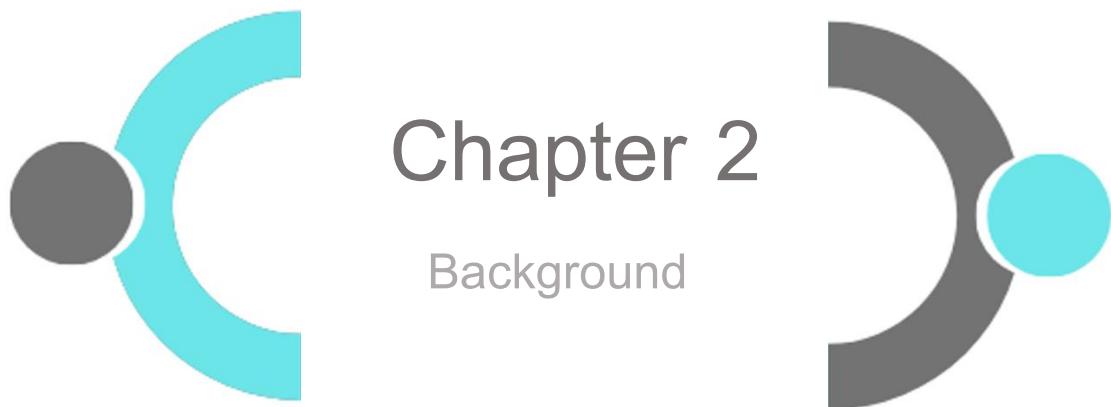


and its requirements. Furthermore, the chapter details the system design, which includes the client-server architecture that was chosen, the class diagram that displays the relationships between the objects and describes their functions, as well as the key components. The data design section shows the ER diagram and a hierarchical database model. The interface design is also described in this chapter, which includes the website structure using a sitemap and a navigation diagram, as well as the mobile application structure. Additionally, the user experience guidelines that were used to design the application are listed. Finally, the implementation section explains how the system was implemented briefly, including how it connects to existing APIs, data sources, and third-party applications.

- Chapter 5 of this document presents the system evaluation. The user acceptance testing method was used to evaluate the system, confirm its usability, and collect feedback and suggestions from users to improve the system. The chapter also includes an illustration of the demographics of the participants, as well as the results of the questionnaire. In the quality attributes section, we documented the non-functional requirements and their testing results. Finally, the chapter includes a discussion section that summarizes the conclusions drawn from the user acceptance testing, along with their suggestions for improvement.
- Chapter 6 of this document presents the conclusions and future work, summarizing the chapters listed. In the global and local impact section, it outlines the global impact in the education field and the need for effective communication between schools and students' families. It also shows how KAS has attached great importance to education and why the system features were implemented in this way. The chapter also includes a section on the problems and challenges encountered during software development, documenting the challenges that arose while implementing certain features and how they were overcome. The limitations of the system section shows the limitations of certain features that can be overcome in future work. Furthermore, the main contribution of the project section describes how the project aims to help the education industry in KSA. The future work section lists the suggested extra features to be implemented in the future.



- Chapter 7 presents the acknowledgment where we expressed our gratitude and appreciation to who have contributed to this project.
- Chapter 8 presents references that list the sources cited in this document and includes the full citation information for each source.
- Chapter 9 presents the appendix section, that contains additional information that is relevant to this document. We included the user testing form, charts, graphs, and images, along with the user's contact information that provide further details about the user testing.



# Chapter 2

## Background



## 2 Background

Education is an essential social institution. The value of schooling in society is derived from the fact that it provides possibilities for learning knowledge and skills. As a result, we seek to make the educational process easier as it benefits both students and teachers. Our project focuses on a domain that we are familiar with, which is the education and school industry. This chapter first presents the domain of the application, which is school-home communication. Then it briefly describes cross-platform development since it is used in the development of the project.

### 2.1 School-Home Communication

#### 2.1.1 The Impact of School-Home Communication on Students

The educational career of every child begins from the moment of birth. It is a fact that children learn every day in their everyday lives, but when they enter a classroom, they begin the process of learning in a more formal setting. This trip's success depends heavily on communication between teachers and parents; it influences the child's emotional, cognitive, and social development [13].

Families and schools need to communicate effectively to ensure students' success. Parents and teachers who exchange important information about a student will be better equipped to provide academic assistance to that student, according to a study in [18]. Outside of the classroom, parents are the first educators and teachers of their children. Parents, however, often fail to cooperate actively on their own. Communication between the student, parents, and school benefits everyone. Parental understanding of the school's goals and how they intend to achieve them is essential for aiding their children in their studies [17]. A student's success is largely dependent on family involvement, which is no surprise to teachers. Parents and teachers provide essential support for students' academic success [17]. According to [18], a student's academic, social, and emotional well-being may be greatly influenced by the successful collaboration of both parents and teachers. The more parents and teachers communicate with each other and build a positive relationship, the more amazing things begin to occur. Students gain more trust and confidence in their teachers. Due to being able to observe their parents' affection and concern for their education, they become more motivated, focused, and committed to their academic goals [15].



It is also important to keep parents informed and maintain a close relationship between home and school so that any behavioral issues can be resolved early on. It is possible that students with behavioral problems do not act out in all situations. According to [18], it's possible that kids show these issues at school while their parents are entirely unaware of the issues they're facing. Parents should be informed about these problems by communicating with them. By informing everyone, they may be able to cooperate to resolve the issue before it becomes out of their hands.

Throughout every stage of the schooling process, communication plays a significant role in so many ways. Across a range of areas, from fostering social growth to creating a safe learning environment, to ensuring academic success. Communicating between teachers and parents can go a long way towards providing students with the best start in life [14].

In an ideal world, parents and teachers would communicate constantly. By doing so, parents can better understand how their child is developing. It allows them to understand how their child's development will progress throughout the year, what topics they will study, and what capabilities their child will acquire [16]. According to [18], a teacher can observe a child's academic progress as well as their emotional development. Teachers can keep tabs on a kid's development because they interact often with them. The teachers can provide parents with important information that will enable them to raise self-assured, confident learners for their children.

Studies in [18] suggest that parents and teachers' communication can influence student learning. Study in [18] shows that students' learning environment affects their ability to learn significantly. Sleeping less, eating less, and not being socially involved are the factors that make it harder for the brain to form neuronal connections. To fully capitalize on the brain's development, the student's physical and intellectual wellness must also be supported. It has also been found that stressed pupils are less likely to learn well because cortisol, which is released in response to stress, interferes with memory formation. Having peace at home and at school may help a child's brain learn.

These recent neuroscience studies in [18] highlight how important it is for students to build effective connections with their families and teachers in order to achieve better academic results. A way to support this comprehensive strategy is to ensure regular communication between school and family.



### 2.1.2 Parents-Teachers Communication Obstacles

School administrators are keen to keep their teachers in constant contact with parents, and they do not mind having direct communication between the two parties, but they find it difficult to find the appropriate means. Most schools organize a regular meeting called “Parents Meeting Day” so that parents can meet their children's teachers, but this method has its downsides. Due to several reasons, some parents find it difficult to come in-person to school, such as unavailability of transportation, being busy on the specified day, or the time intersection with work hours for working parents. Some parents just don't care about the progress of their child educational journey, or they do not see the benefit of the meeting, and thus do not attend it. In addition, the meetings are only held once or twice a year, which makes the teacher's feedback very late.

On the other hand, teachers are also keen to communicate with parents to keep the student learning process efficient, but they did not find a convenient way to maintain it. One of the ways some teachers tried to use is to give their personal phone numbers to the students' parents to exchange messages, if necessary. However, there were some problems that made teachers refrain from giving out their numbers nowadays, such as calling outside office hours. Some parents make voice calls instead of text messages and other things that might make teachers aware of the violation of their privacy.

Also, in some situation where teachers would ask the student to request their parents to come to school to discuss a matter, students will avoid that because they usually are afraid that the teachers will say something against them, or they tend to hide some things from their parent. The students actually do not realize the importance of communication between their parents and teachers, and that teachers always strive for their own good.

Moreover, despite the technological development and electronic communication methods that exist today, there are many obstacles to maintain an easy and convenient communication between teachers and parents. Providing a reliable platform and channel to support communication between teachers and parents will facilitate the process of education and the exchange of important information between the two parties.



### 2.1.3 Students' Pick-up Scenarios

Most schools and parents find that the way students leave school is disorganized and causes many problems for both parties. The following shows some existing scenarios for student pickup. They were observed by us in schools, and they were also obtained as feedback from some parents and school staff who are listed in Appendix C. They have clarified and thoroughly explained multiple scenarios to the team.

Parents are used to picking up their children by standing in front of the school gate and then calling their children's names through a microphone that the school provides outside next to the gate. This method leads to problems that cause wasted time and effort, such as a car jam in front of the school that may cause car accidents. Also, some students would miss the call of their parents, then the parent or the driver would be forced to line up and call the student's name again.

To save time, some students would stand outside of the school near to the gate to wait for the one who is going to pick them up. This behavior is dangerous for children. It may harm their health because they could wait for a long time and the sun would affect them badly. In addition, they are exposed to the danger of the street and cars.

In some situations, a parent requests that someone else pick up their child during or at the end of the school time. In this case, the school administrator would ask for papers or personal identification to authenticate this person, and they inform the parents for approval. This process takes time and effort.

## 2.2 Cross-Platform Development

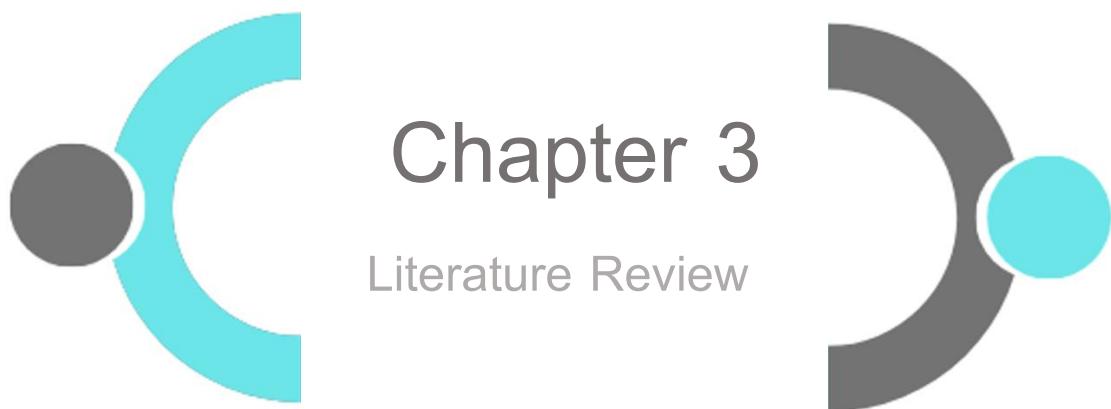
In the era of modern development, and with the growth of mobile phones industries, building a mobile application that runs on different platforms such as, Android, IOS and Windows has become essential for application developers. The term “cross-platform mobile app development”, as defined in [1], is an approach that allows developers to build a mobile solution that is simultaneously compatible with several operating systems and platforms (Android, iOS, Windows). Developing using a cross-platform development tool saves time and effort since developers won't need to program on both Android studio for the Android version and XCode for the iOS version.



### 2.2.1 Cross-Platform Tools

There are so many different tools and frameworks for cross-platform development where each one of them supports one or more programming languages. Examples include Ionic, React Native, Xamarin and Flutter as listed in [2]. Each one of the tools has its own features and specifications. In our project, are going to use Flutter. Flutter is an open-source framework developed by Google that allows developers to learn and use a single language called Dart to build native mobile apps in a timely manner [3]. Flutter is an SDK that compiles the Dart code into a native code for several platforms. Flutter is widget based, such that it provides pre-built and pre-styled user interface elements that are known as widgets to construct the user interface. Widgets can be created and used by applying object-oriented programming to elements [3].

As Flutter is an open-source framework, it has provided a large and active community of software developers that share their knowledge in Flutter development. Developers would usually publish code examples, create diverse libraries, and provide techniques on developing cross-platform applications using the framework. Plus, since flutter is widget based, developers can create their own custom widgets that provide amazing visuals to the application and are consistent to their shape throughout different devices. These are the reasons for selecting to use Flutter in our project.



# Chapter 3

## Literature Review



### 3 Literature Review

In this chapter, we position our product with relation to the market that we are targeting. First, we analyze our competitors in terms of features and drawbacks. Then we construct a comparison between the competitive applications based on the most important features related to school-home communication systems.

#### 3.1 Competitive Product Analysis

School and parents' communication is a very popular concept in mobile applications nowadays. Despite that, there are a variety of applications that are still being developed and launched to facilitate this communication. This can be mapped to the reason that the applications that are provided still did not meet with the desired requirements and wishes of the school's staff and parents. This section lists some of the most famous school management applications along with their features and drawbacks. The applications are divided into two categories based on their focus area: communication area, and attendance and pickup area. Following that, it compares all the presented applications with Halaqa based on the main features regarding school management and parents' communication.

##### 3.1.1 Communication Area

###### 3.1.1.1 Madrasati



Figure 1: Madrasati logo Source:[5]

Due to the expansion of the Corona pandemic, the Saudi Arabian Ministry of Education created an educational system called “Madrasati” to aid kids in kindergarten and all through to high school students in their academic journey. “Madrasati” platform [5] is a digital platform, that uses interactive videos to deliver educational content. In addition, it uses different and creative methods to teach educational courses to students by providing explanations through brief video clips based on visual effects and animation. It also enables students to take study tests remotely without effort. Plus, it includes the educational materials offered to students at all levels and



educational stages in various schools. The application provides an easy and accessible way to access the materials and adopts the best method of explanation for them. “Madrasati” platform is based on an educational strategy. It differs from providing explanations for the lessons, continuing through the monthly and class tests, to clearly announcing the test results. Also, it publishes the students’ tasks and activities.

Several tools are available on the “Madrasati” platform [5] that assist parents in keeping track of their children's studies during the distance-learning process, viewing their reports, and enabling them to participate and interact with the school community while they are attending the distance-learning program. In addition, it contains many tools that are specifically intended for teachers, including tools that can be used for communicating with students to answer their questions and inquiries about the educational materials in the classroom using a private chat.

One of the best features of the “Madrasati” platform is that it uses prizes as a way of motivation to encourage students to work hard and progress. In addition, students engage with the educational content on the platform by holding study competitions, which builds competition among them and adds suspense to the learning process as shown in Figure 2.

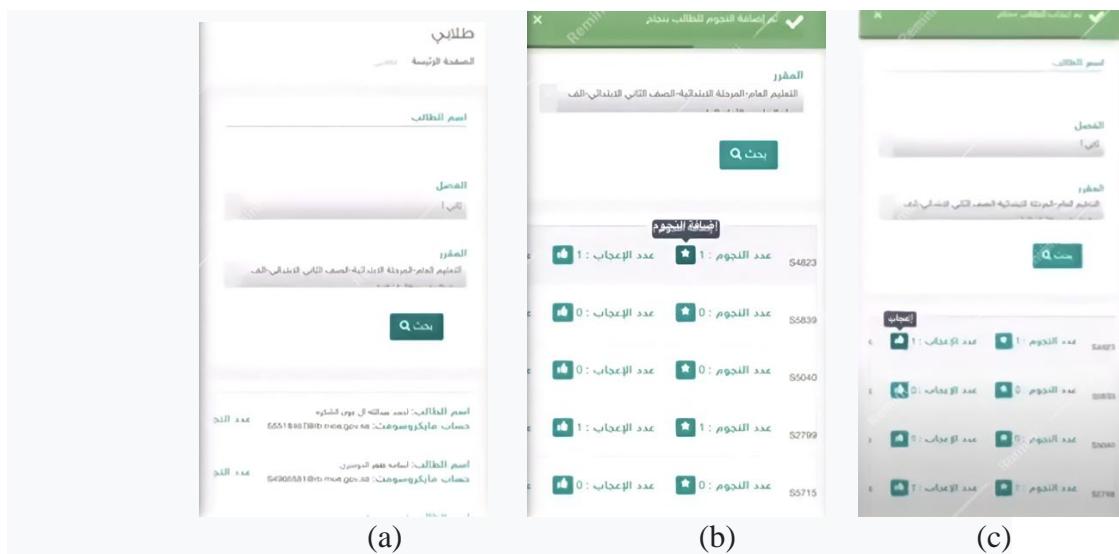


Figure 2: Madrasati interface for Contests and Prizes

Figure 2 shows the steps for how the teacher can use prizes by adding stars. First, the teacher must choose a class and a subject, and then a list of student's names will appear automatically along with a star icon, a like icon, and a dislike icon next to each one of them. All the teacher has to do is to click on one of the icons. Then, it will reflect back into the student's profile.



There are several flaws and drawbacks to “Madrasati” platform in addition to its many benefits. The platform/ site suffers from recurrent technical issues that affect the users experience with the application. Most users in the App store review section have described their frustration with it as it influences their usage of the application. Certain users also lack understanding of how to use the platform, as the application contains a great number of functionalities. The application enables its users to synchronize the platforms courses with Microsoft teams. Microsoft Teams is the most used video meeting application by schools. Unfortunately, students face some difficulties at the concept of synchronization of the platform’s courses with those in Teams. This prevents the students from having proper access to the platform’s thorough lessons. In addition, the platform often locks after the end of the school day, and the teachers are unable to provide accurate feedback to students, as they are inexperienced on how the application functions.

### 3.1.1.2 مدرستي النتائج



Figure 3 مدرستي النتائج logo Source:[6]

“مدرستي النتائج” [6] is an application provided for smart phone devices. The application displays the student’s file, including personal and academic information, as well as the results of the student’s grades throughout the school year and the student’s final grade in the stages of education. This information and content are provided in two ways, depending on whether it is for the student alone or the guardian and his students. The application is used to review students’ results for the current academic year. Furthermore, it provides access to the school academic calendar and insights into future academic events.

As in any application, many users have expressed in the App store review section the difficulty of using the application. This is due to either the application’s tiny surface area, heavy load, or



trouble updating the data since it does not respond to requests on the first try. Many users found it challenging to run the application.

### 3.1.1.3 Bounce

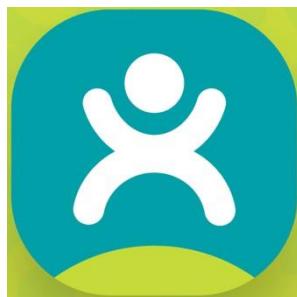


Figure 4: Bounce logo Source: [7]

Bounce [7] is a free mobile management and communication software for preschools. It is a platform that connects childcare centers, teachers, and families to create effective collaborative communities. It is a multi-language application that enable users to switch between Arabic and English. It manages children's enrollment and school fees payment through the application. Also, it manages the classrooms and groups to facilitate operations for the admins.

Teachers are able to take attendance, write and share daily reports. Also, they can create events and upload media. On the other side, parents are notified about events and catch every moment by viewing teachers' report.

Both parents and teachers can connect with each other through a usage of a private chat. In addition, the application provides virtual at-home learning to keep the students up with the teaching process.

All in all, the application is intended only for preschoolers which may considered as a drawback for the app, as other educational levels students tend to need attention on their academic journey.



### 3.1.1.4 Kushoof



Figure 5: Kushoof logo. Source: [9]

Kushoof [9] is an application that allows teachers to follow up, assess, and mark the attendance of students without the need of using and handling tons of sheet papers. The application allows the teachers to create a class that consists of several subjects. For each subject the teacher can add a student to it.

At first, the teacher selects a class and a subject to view its students. The class page represents each student with their name, score, and follow up icons list as shown in (a) in Figure 6. The follow up icons list consists of several symbolic icons that represent the student activities.

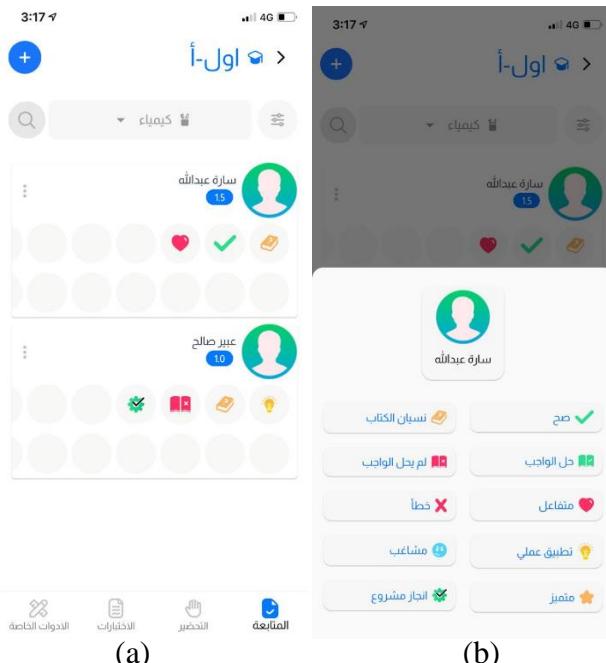


Figure 6: Students representation interface. All the class students are represented in follow up page (a), and when the teacher clicks on one of the gray circles in (a) it displays the follow up icons in (b)



As seen in (b) in Figure 6 for example, there are icons for the cases when the student forgot his/her books, submitted or didn't submit the assignment, participated in the class, achieved the practical application, achieved the project, or the student was turbulent. Each icon either adds to the student score or decreases it. This allows the teacher to follow up with the student behavior easily as it represents it in a friendly and symbolic manner.

On the attendance tab, a summary of the number of students that have attended, missed or where late to the class is presented, as seen in Figure 7.

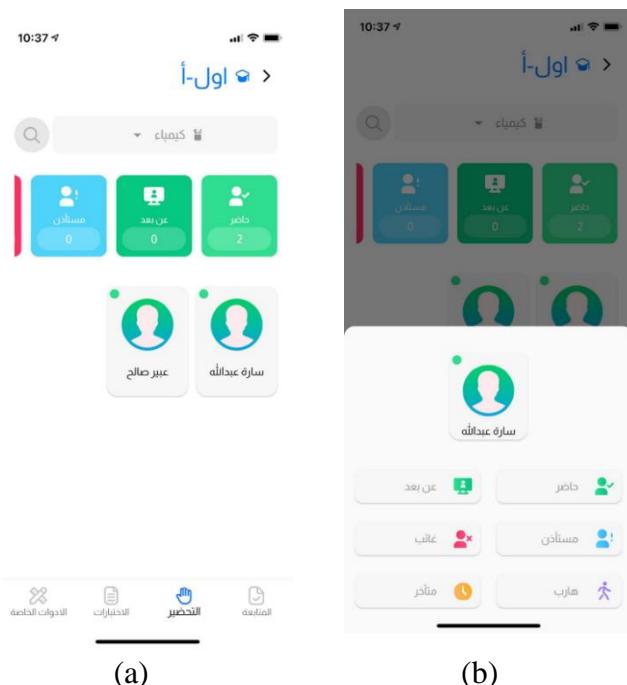


Figure 7: Attendance page interface. In (a) it showcases the attendance page layout. When a student is clicked it displays the markup options at (b)

However, the application has several drawbacks. One of them is when a teacher transfers a student to another class, all the student's collected data gets deleted. This makes it troublesome for the teacher to re-upload them again, as it is inconvenient to re-enter all the data again when the goal of using the application is to keep track of the students' data. On the other hand, the tests tab only allows the teacher to keep track of the first three quarters total grades for each student, and thus not allowing the flexibility of handling them when the teacher desires to keep track of more than three quarters. Parents are not involved in this application, and thus the teacher can only share the student file and information with the parent through the traditional communication methods by exporting the file and sending it.



At the end, the application does not give the user the freedom of using all features to their maximum capability, as they need to upgrade their account by paying a subscription fee in order to use them freely.

### 3.1.1.5 المدرسة الذكية



Figure 8: المدرسة الذكية logo. Source: [10]

”المدرسة الذكية“ [10] is a paid service application provided by Enjaz Advanced for Technology Information Institution. The application’s main source of data is obtained by withdrawing the school data from the Noor system, thus gaining all the students information.

The application serves three parties which are the school teachers, parents and students. Their main purpose is to keep track of the assigned tasks, assignments, student grades, and student status.

The application allows the parents to keep track of their child’s homework and allows them to upload the solution to the platform. Parents can also keep track of their child participation status in the class and view their research and projects progress that are assigned to them.

Teachers are given the capability of taking the attendance of each class, viewing statistical results of the student’s attendance and absence, and keeping track of the warnings and notifications for each student. They can also view their work schedule and classes times in a tabular manner. In addition, the teacher can send notes for each student in private to discuss with them any comments regarding a specific homework or project.

As for the students, the application allows them to keep track of their assignments, tasks, and their attendance status. Students can also view their grades records and keep track of their warnings and their courses academic status in order to grasp their academic progress. The application also allows them to view their educational schedule represented by a table for easier eye-navigation.



Despite of these functionalities, the application suffers from severe technical lagging problems, as the data sometimes either won't take shape in a timely manner or won't appear at all, thus making the usage of the application insufferable as data plays a crucial role in the application in making it usable. Additionally, the application doesn't provide any mean of direct communication between the school and the students or parents, which some users have shown their desire in the application review section of providing private chat rooms between them and the teacher to communicate with them directly to facilitate their learning outcomes. Users have also shown their frustration on the application font size and color, as they sometimes suffer from understanding and reading the content due to the lack of text design.

#### 3.1.1.5 SchoolVoice



Figure 9: SchoolVoice logo. Source:[12]

SchoolVoice [12] is a school-parent communication application designed for schools to optimize, overview, and organize communication within their community as well as amplify engagement with parents. The application supports multiple languages such as Arabic, English, French and more. The application provides several packages for schools to choose from, which are Free, Standard and Advanced. The price depends on the number of students and the chosen package.

The application has built-in messages that schools can use such as invitations to the school, asking for permission, and payment requests. Parents can track their children's progress and it is not limited to their grades only, but they can check out their participation in school activities and more. Teachers can store private documents and share class material, homework and other documents with parents and students. Also, teachers are allowed to conduct classroom challenges and live classes or discussions with the students. Instant messaging is available for all school faculty and parents.



However, to access all the interesting and useful features, the non-chargeable package is not enough, and a yearly fee is required. In addition, number of school faculty that can use the application is limited in the non-chargeable package.

### 3.1.2 Attendance and Pickup Area

#### 3.1.2.1 BlueRide



Figure 10: BlueRide logo. Source: [11]

BlueRide [11] is an application that presents a new experience in managing students' pick up, drop off and transportation. The application focuses on two main sections: the first is pick up and the second is bus and transport. Moreover, the application provides other features such as attendees management, messaging system, assigning meetings, and sending emergency alerts.

For pick up, when a parent is close to the school premises, the school will be alerted automatically, and students will be out after clicking a button which will announce the arrival of the parent on the calling screens which is a screen that shows who is ready to be picked up. Also, parents can authorize someone else to pick up their children instead of them through the application. However, after reading parents reviews in the App Store and in their Instagram account comments section, some of the parents who have used the application have been complaining of not getting the benefit that is intended of this application. Since the application uses GPS, parents can't click the button unless they are exactly outside the school gates which causes an irrational traffic because each parent has few seconds of time to stand directly outside the school gate then they have to get back to the end of the line when the time is up, thus making them repeat the process again which causes frustration, obstructs the process and consumes time.

On the other hand, BlueRide offers live observation for school administrator to track each bus and see the daily route and which student is being picked up now by the bus. In addition, parents



can find out when the bus arrives at the house as they will be notified when it approaches. Also, a timeline is offered for parents which contains information of the time of pick up from home, arrival at school, pick up from school and arrival at home, which will make it easier for parents to keep an eye on their children.

Payments are required from schools to access the application, and some of the parents are interested in using the application and willing to pay for it but the application has not given them the ability to benefit from the provided features without the school consent and subscription.

### 3.1.2.2 Nida



Figure 11: Nida logo. Source: [8]

Nida [8] is a free mobile application that documents the attendance, delay, absence, and the departure from the school premises. It provides parents and authorized drivers with the service of calling the school for their child's pick up through the application without the need to leave the car. It's a multi-language application that enable users to switch between Arabic and English.

The app provides the ability of recording the attendance and leaving of the students by a smart card that they hold as soon as the students cross through the smart gates. Parents are notified of absence automatically without the need to call them or send SMS message. In addition, the school can write and send any notification to the parents directly on the application. Also, when the parents or the driver arrives at the school's geographical location during the time of the school end day, he/she can call through the mobile application directly without leaving the car.

One of the distinctive features that distinguishes the application is the integrated system for managing and tracking school buses by sending instant notifications and updating detailed reports. The school can take advantage of the call technology for buses to manage the buses, drivers, and trips. They can register students for the bus drop off/pick up service and track all bus trips through a control panel. Parents can also enjoy tracking the trips of their daughters



and sons who are commuting through the school buses. They receive automatic instant notifications about the arrival of the bus and the student's boarding and disembarkation as shown in Figure 12.

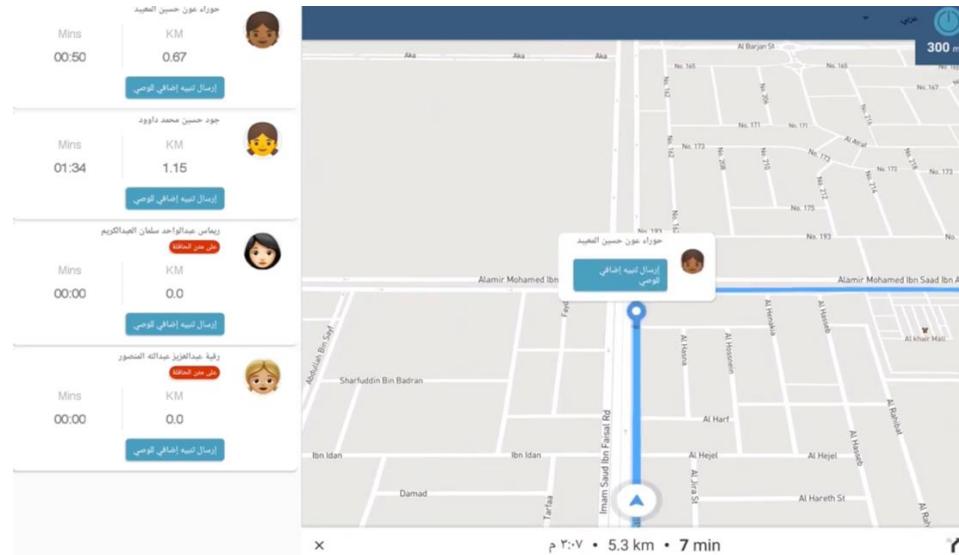


Figure 12: Bus tracking technology in Nida [8]

However, users of the application may face some difficulties in some cases. For example, recording the attendance and leaving using built-in RFID chip can be challenging because it is exposed to be damaged, forgotten, or lost by students. In addition, the smart gate that records attendance electronically and automatically may miss the entry of some students due to the large numbers that may enter at the same time.



### 3.1.3 Comparisons And Conclusions

With the aim of developing an application for the educational field, we are comparing similar applications to our application based on the most important features related to school and communication systems, to achieve competitive product analysis. Table 1 lists all the features used in the comparison and describes them. The features described are a collection of all the main features that are provided in our competitors' applications, to obtain the best possible outcomes from our market analysis. The comparison results are presented in Table 2.

**Table 1: Features description**

No.	Feature	Description
1	Create an account	Allow the user to register to the application/system to have a school account.
2	Support both IOS / Android platforms	The ability to run applications on both IOS and Android platforms.
3	Free Application	Allow the users to download the application for free.
4	Free features	Allow the users to use all features for free.
5	Support the Arabic language	The application language can be viewed in Arabic.
6	Private chat between parent and teacher	Allow the parents to privately communicate with the teacher.
7	Group chat between teacher and the parents of a class	Allow teachers to communicate with the students' parents through a group chat.
8	Teacher broadcast message to parents	Allow teachers to send unified messages to all parents in a class.
9	Inform the school when parent arrives for pick up	Allow the parents to inform the school staff when they are near/in front of the school to pick up their child.
10	Uploading attendance	Allowing the school staff to mark up the attendance of the students through the application and parents to view them.



11	Uploading grades	Allow the teachers to upload the student grades and enable parents to view them.
12	Upload absence excuse	Allow the parent to submit their child absence excuse to the platform.
13	Provided for all educational levels	The application aims to service all kinds of student's educational level.
14	Authorization for student pick up	The application allows the parent to authorize someone other than themselves to pick up their child.
15	Publishing events	The application allows the school to publish any upcoming event.
16	Students sign up	The application allows the student to have an account in the platform.
17	Parents sign up	The application allows the parent to create its own account in the platform.
18	Publish forms/document	Allow users to publish and upload forms/documents.



Table 2: Comparison between applications

Feature	Halaqa Our application	Similar Applications							Attendance and Pickup Area			
		Communication Area										
		Madrasati	مدرسني النتائج	Bounce	SchoolVoice	Kushoof	المدرسة الذكية					
Create an account	✓	✗	✗	✗	✗	✓	✗	✓	✓	✗		
Support both IOS / Android platforms	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Free Application	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Free features	✓	✓	✓	✗	✓	✗	✗	✗	✗	✗		
Support the Arabic language	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Private chat between parent and teacher	✓	✓	✗	✓	✓	✗	✗	✗	✗	✗		
Group chat between teacher and the parents of a class	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗		
Teacher broadcast message to parents	✓	✗	✗	✓	✓	✗	✗	✗	✗	✗		
Inform the school when parent arrive for pick up	✓	✗	✗	✗	✗	✗	✗	✓	✓	✓		
Uploading attendance	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓		



Feature	Halaqa Our application	Similar Applications							
		Communication Area						Attendance and Pickup Area	
		Madrasati	مدرسني النتائج	Bounce	SchoolVoice	Kushoof	المدرسة الذكية	BlueRide	Nida
Uploading grades	✓	✓	✓	✗	✓	✓	✓	✗	✗
Upload absence excuse	✓	✗	✗	✗	✗	✗	✗	✗	✗
Provided for all educational levels	✓	✓	✓	✗	✓	✓	✓	✓	✓
Authorization for student pick up	✓	✗	✗	✗	✗	✗	✗	✓	✓
Publishing events	✓	✗	✗	✓	✓	✗	✗	✗	✗
Students sign up	✗	✗	✗	✗	✗	✗	✗	✗	✗
Parents sign up	✗	✗	✗	✗	✓	✗	✗	✓	✗
Publish forms/document	✓	✓	✗	✓	✗	✗	✗	✗	✗

In Table 2, the applications have been categorized into two categories as done in the previous section: pickup applications and communication-based applications. We compared the features that our application provides with eight of the most popular education related applications on the market. All our competitor's applications support both IOS and Android operating systems, for the reason of reaching and facilitating a wider audience of users. All the applications are free to download but more than half of them require either purchasing access to the system by buying an account or upgrading the account to use more features. As can be seen in the table, none of the eight applications provide all the features that our application is meant to provide at the same platform. Bringing as many as possible features into one platform is more desirable for users and more convenient.



Recording the absence of students and notifying their parents about it, in addition to uploading the students' grades and making them accessible to view by the parents is considered a necessity for day-to-day update on the student progress and their academic position. For this reason, the features 'Uploading attendance' and 'Uploading grades' are available in most of the applications. Based on these features, our application is the only one that includes 'Upload absence excuse'. School principals are very keen to follow up on the student's absence and know its cause, as it obstructs the student's academic and educational journey. Asking parents to provide an excuse for a student's absence is an important part of the schoolwork schedule. In Halaqa, parents can raise an excuse for their child's absence on the application, which facilitates the process of reaching school administrators faster and easier.

In addition, not many applications provide the feature 'Inform the school when parent arrive for pick up' and 'Authorization for student pick up'. Schools suffer from traffic at the end of the school day due to the inefficient way of informing the school that the parent/driver has arrived to pick up the child. The one who is responsible for picking up the student must line up in front of the school gates in order to inform the school that the student is ready to be picked up by calling the student's name in a microphone. Having this feature will enable parents to announce their arrival through the application, which will help manage the departure process of students and will save time and effort for both parents and the school.

We aim for this application to be used by parents, teachers, and school administration staff throughout the Kingdom of Saudi Arabia, so our application and almost all the applications in the comparison 'Support the Arabic language' to enable and facilitate the use of the application for all members of the Saudi society.

The feature 'group chat between teacher and the parents of a class is not available in our application and in some of our competitor's application. It is considered a future work of our application. The project focuses on the main and important features that provide the needs of school administrator and students' parents communication.

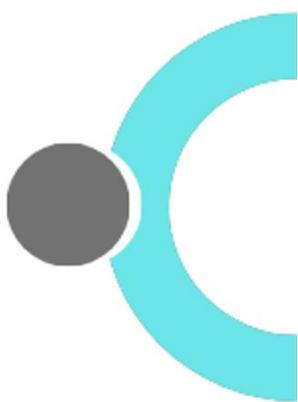
On the other hand, our application provides a 'Private chat between parent and teacher' and the ability for 'teacher broadcast message to parents' for the means of easier communication between the two parties, which some of our competitors have failed to provide. Also, more than half of our competitors did not provide the feature of 'Publishing events', which allows the school staff to publish and inform the parents for any upcoming pre-planned school



activities. The majority also did not provide the feature ‘Publish forms/document’, which our application provides to enhance papers and form management for the two parties.

For parents, it is difficult to manage all their children if they are in different schools and different levels of study. Therefore, approximately every application is ‘provided for all educational levels’ to enable the guardian to follow his\her children in the various stages of education on the platform.

We seek in our application to achieve convenience and ease for all parties involved in the education institution by combining important and basic operations and features in one platform for easier and effective communication.



# Chapter 4

## System Design & Development





## 4 System Design And Development

This chapter focuses on describing our system to give more understanding of what our functionalities are, who are our users, and how the system was designed and developed. The chapter first starts with the methodology section that presents the general approach and methodology we used to develop the software. The second section is the system requirements section which consists of four parts: system users, requirements elicitation and analysis, user interactions, and the project's roadmap along with the product backlog. The system users' part describes our product's general characteristics to give a more understanding of what type of users it serves. The requirement elicitation part presents the methods used for conducting the application requirements. It also presents the requirement discovery method which is a questionnaire that has been published to the targeted users and the results are presented. The user interaction part shows the use cases diagrams for the system. The last part in this section shows our application product roadmap and backlog. The third section of this chapter is the system design section that shows the architectural diagram, class diagram, and component level design. The fourth section presents the data design for our database. The fifth section is the interface design section that includes the sitemap and navigation diagrams. It also includes our design choices to show the justification for some of the main parts of our interface design. The sixth and final section presents the implementation details.

### 4.1 Methodology

The Agile approach to software development is a set of methodologies that prioritize flexibility and collaboration. The Agile methodology emphasizes iterative and incremental delivery, adaptive planning, and evolutionary development. It encourages a flexible response to change and places a strong emphasis on the involvement of the customer throughout the development process [27].

The Scrum framework is a specific implementation of Agile methodology that is widely used for software development. It is based on a set of roles, events, and artifacts that work together to provide a structured approach to managing and completing a project. For the roles, we have three roles in this project: the Scrum Master (Dr. Maha Alyahya), the Product Owner (Dr. Hessah Alsaaran), and the Development Team (Reema Alshabibi, Njoud Alfahad, Ghadeer Almuhan, Reema Alsinaidi). The scrum master is responsible for facilitating the scrum process and ensuring that the team follows the principles of scrum.



The product owner is responsible for representing the stakeholders and ensuring that the product backlog is good. The development team is responsible for delivering the product increment at the end of each sprint.

For the events, we have Sprint Planning where the team meets to plan the work that will be done in the upcoming sprint, Daily Scrum where the team briefly meets each day to discuss progress and plan for the next 24 hours, Sprint Review where the team demonstrates the work completed during the sprint and receives feedback from product owner, and Sprint Retrospective where the team reflects on the previous sprint and identifies ways to improve.

For the artifacts we have the Product Backlog which is a prioritized list of features and requirements for the product, Sprint Backlog which is a list of items from the Product Backlog that the team commits to completing during the sprint, and Increment which is the result of each sprint, which is a usable and potentially releasable product increment.

As a team, we practiced Agile principles by embracing change and being flexible in our approach to the project. We held daily stand-up meetings, where we discussed progress and planned for the next 24 hours. We also held sprint planning and review meetings, where we discussed the work that needed to be done and received feedback from the product owner. We used the Scrum framework as a guide for our process and adjusted as needed to ensure that we were meeting the needs of the project. We also regularly reflected on our process during sprint retrospectives and used the feedback to improve our workflow.

Jira <sup>1</sup>and GitHub <sup>2</sup>are two popular tools that are often used in Agile software development projects to help teams manage and track their work. Jira is a project management and issue tracking tool that can be used to manage and track tasks, bugs, and other items that are related to a project. It provides a centralized location for storing and organizing information about the project, and it allows teams to easily collaborate and communicate with each other. In our project, we used Jira to create and manage user stories, track progress on tasks, and plan sprints. It also provided a platform for team members to assign tasks to each other and track their progress. GitHub is a web-based platform for version control and collaboration that allows teams to work together on code. It provides a centralized location for storing and sharing code, as well as tools for tracking changes and managing code

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<sup>1</sup> Jira <https://2022-1st-gp06.atlassian.net/jira/software/projects/GP/boards/1>

<sup>2</sup> GitHub <https://github.com/reemashabibi/2022-GP1-06>



reviews. In our project, we used GitHub to store our code, manage branches, and share code between each other. Both Jira and GitHub helped us to work more efficiently as a team, by providing a centralized location for storing and sharing information, and by giving us the tools we needed to collaborate and manage our work. They helped us to stay on track, and to ensure that our code was of high quality.

## 4.2 System Requirements

### 4.2.1 System Users

Halaqa serves five types of users, with four of them targeted as being everyday users. The types of application users are as follows:

- The school principal, who has the main goal of registering the school in the platform and adding the schools' admins.
- The school admins, who are part of the school's faculty and are responsible for all the school management activities. They need a web application to simplify and decrease the workload for them, that they can use on the school's computers in their offices.
- The school teacher, who is aware of all the students registered in the class and needs a means of easier submission of their students' grades and communication with the parent. They need a mobile application to make it portable for them, and to simplify chats with parents.
- The student parents, who need a means of an easier method to communicate with the school staff and keep track of their child academic activities. They need a mobile application to make it portable for them to use it on-the-go, get timely notifications, simplify chats with teachers, and inform the school about student pick-up when arriving at the school.
- The authorized commissioner to pick up the student, who needs a means of a technological way to inform the school when he/she arrives, using a mobile application.

The age limit for the application is 13 and above as it aims to service school faculties and parents. The users should know how to use mobiles and mobile applications. The school administrators should know how to use websites. The developed application has two interfaces:



a web application for the school administrators and an Android/IOS mobile application for the parents, teachers, and authorized commissioners. Both interfaces support the Arabic language only. Therefore, the user should have a mobile device (for teachers, parents, and authorized commissioner) that supports these operating systems or a computer (for school principal and admins), both with Internet connection. In addition, the user should be able to read and understand the Arabic language and should also know the basic terminology used in the educational field.

#### 4.2.2 Requirements Elicitation And Analysis

In the interest of gathering information of the desired requirements for communication between parents and schools, we used our experience from our past years as elementary, middle, and high school students to formulate some of the requirements. We also conducted a market analysis on similar systems and their features in pursuance of knowing the current weaknesses and strengths of the provided products in the market. With those combined results we have formulated some of our system functionalities.

For requirement discovery, an online questionnaire was published to elicit the targeted users (school administrative staff, teachers, and parents) requirements to understand the users' needs and aid on discovering the desired services. Respondents were encouraged to type in any suggestions of functionalities that should be provided and covered in the product. The questionnaire consisted of 31 questions in total. The questionnaire received 230 responses, of which 129 of them were parents, 45 were teachers, and 56 were part of the school administrative staff. The questions in the questionnaire were as follows:

- Characteristic questions:
  1. What is your gender?
  2. What is your age group?
  3. What is the type of your mobile phone?
  4. On a scale from 1 to 5 how much is your capability of using mobile applications?
  5. What is your role in the academic community?
- Parent questions:
  6. What are the methods used to communicate with the school?



7. On a scale from 1 to 5, how satisfied are you with the number of regular parent-teacher meetings and their effect?
8. On a scale from 1 to 5, how successful is the school in indulging you on the progress of your child?
9. How often do you check on the messages that are sent from your child's school?
10. Would you rather have a direct method of communication between you and the teachers?
11. Do you prefer to view the pre-planned school activities flyers/posts?
12. If your answer was yes or maybe, do you prefer to receive notification messages about them?
13. Have you ever delegated someone else to pick up your children from school on your behalf?
14. Would you prefer to submit your daughter or son's absence excuses electronically?
- Teacher questions:
  15. What are the methods used to communicate with the student parents?
  16. Do you allow the students' parents to have your mobile phone number?
  17. Would you rather have a direct method of communication between you and the students' parents?
  18. Do you prefer to send mass messages to parents from time to time?
  19. What is the method currently used to enter the grades of the year's work into the system?
- School administrative staff:
  20. What are the methods used to communicate with the student parents?
  21. Choose the categories to be followed to record the attendance and absence?
  22. At which time does the attendance and absence of students get recorded during the school day?
  23. What is the method used to announce the school activities?



24. How do you verify the identity of a student recipient on behalf of their guardian?
- General questions of the application features:
25. In your point view, how important is communication between the school and parents?
26. In your point of view, how important is it to have a direct means of communication between teachers and parents?
27. Do you believe that there is a need for an application that regulates the departure and exit process for students?
28. Do you prefer receiving and submitting reports electronically instead of receiving them as hard copy papers? (Such as, student grades, excuses for absence, school activities, etc.)
29. In your opinion, what is the importance of continuously viewing the attendance and absence of the student electronically?
30. Have you ever used one of the available applications to communicate with schools? And what is your experience with it?
31. Do you have other suggestions for features that should be provided on the application?



## 4.2.2.1 Questionnaire Results

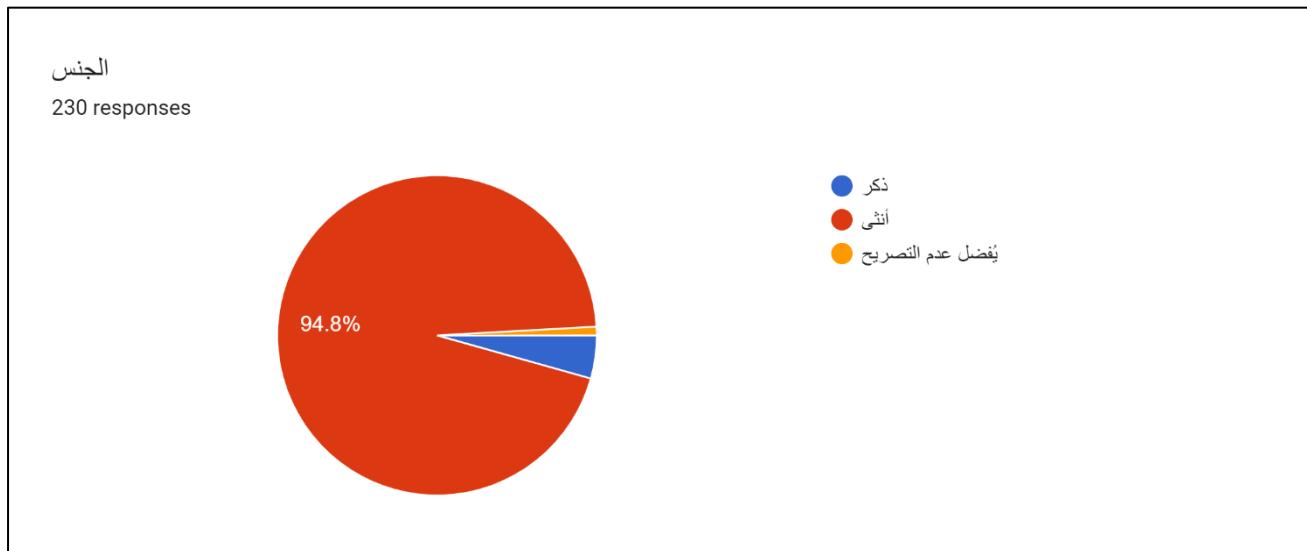


Figure 13: Responses for question 1: What is your gender?

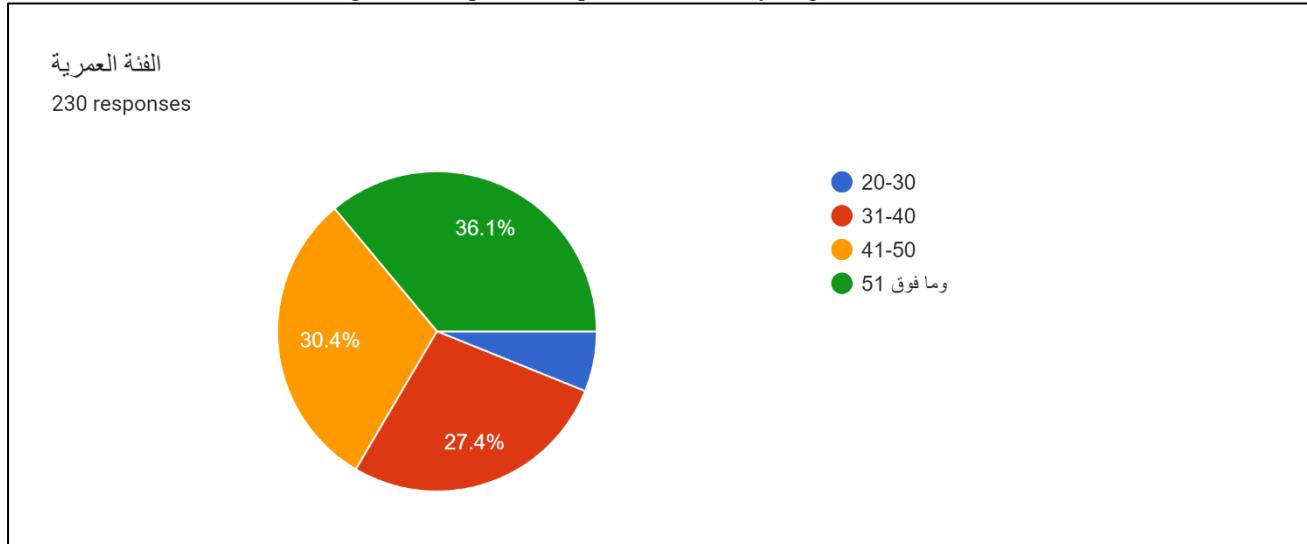


Figure 14: Responses for question 2: What is your age group?

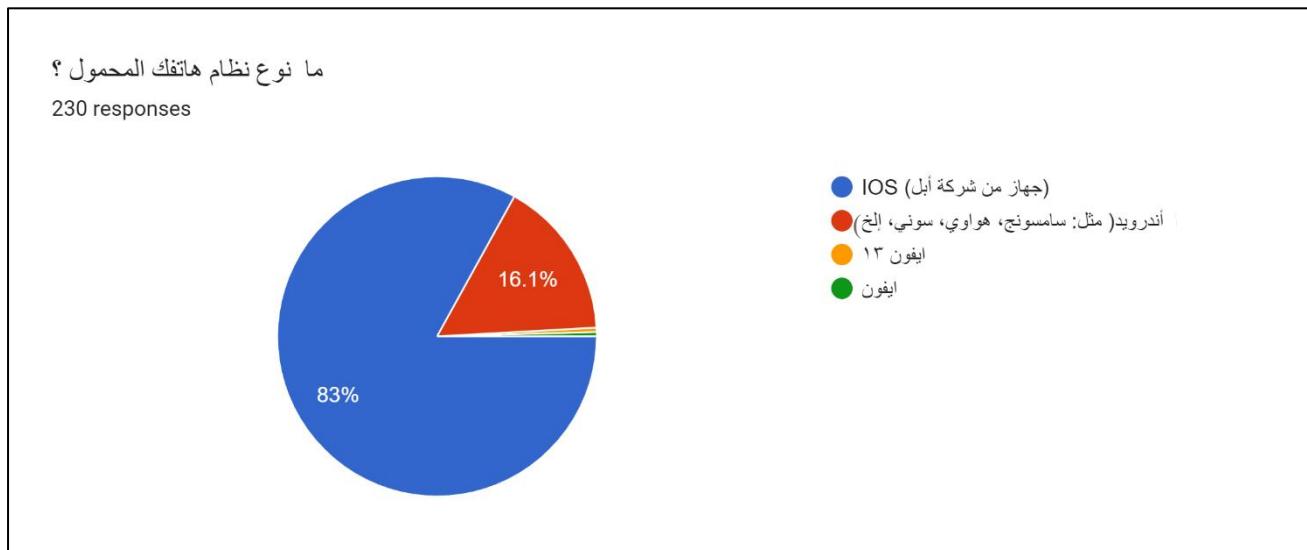


Figure 15: Responses for question 3: What is the type of your mobile phone?

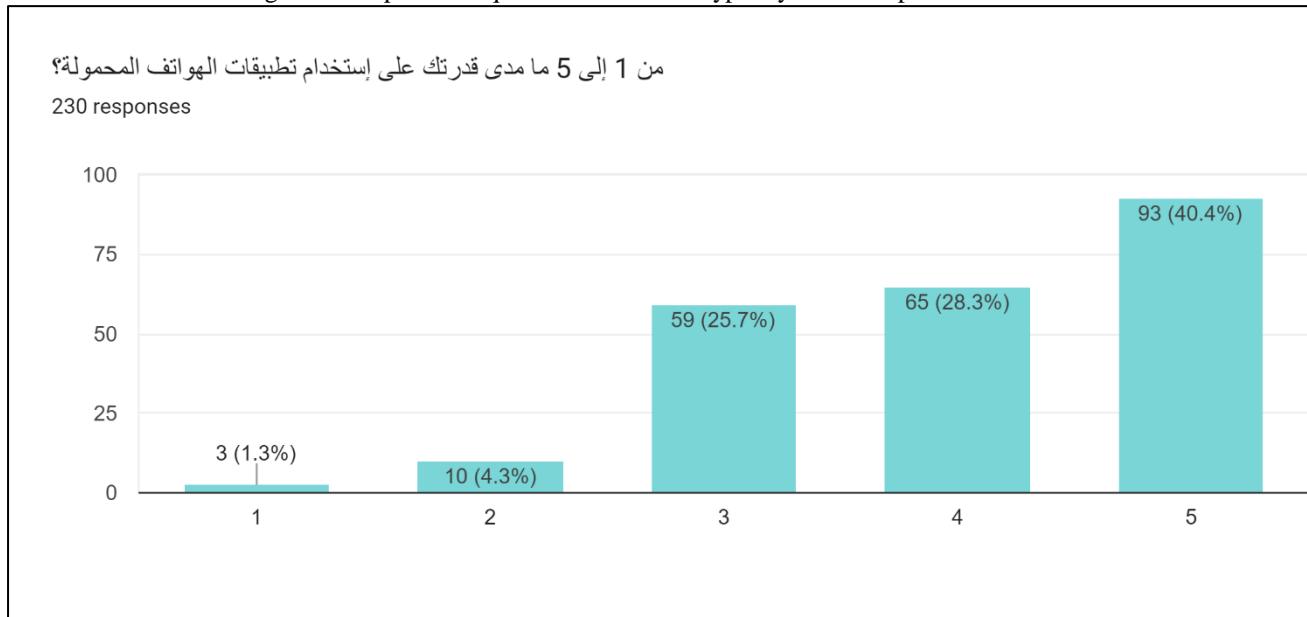


Figure 16: Responses for question 4: On a scale from 1 to 5 how much is your capability of using mobile applications?



# حلقة

ما دورك في المجتمع الدراسي؟

230 responses

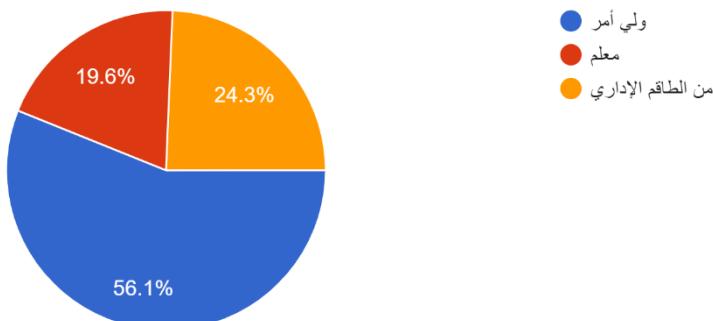


Figure 17:Responses for question 5: What is your role in the academic community?

ما هي الطرق المستخدمة للتواصل مع المدرسة؟

129 responses

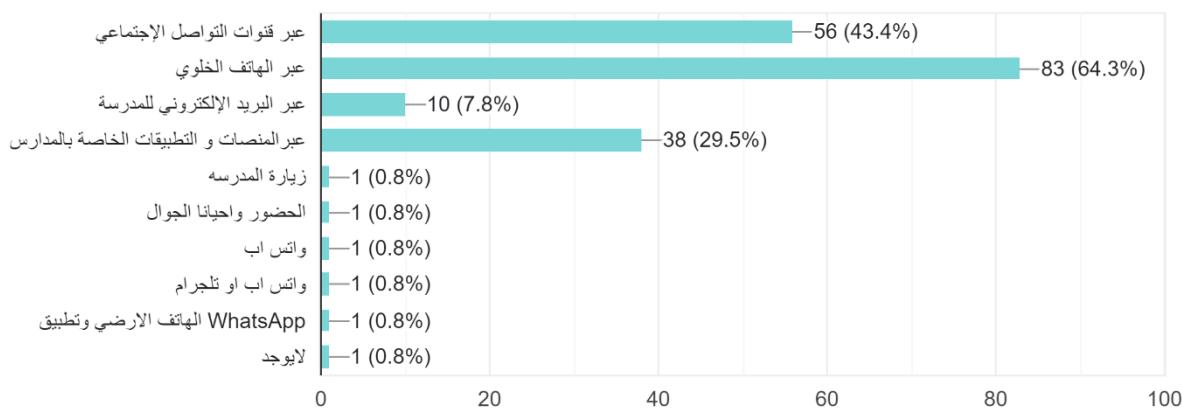


Figure 18: Responses for question 6: What are the methods used to communicate with the school?



## حلقة

على مقياس من 1 إلى 5 ، ما مدى رضاك عن عدد اجتماعات المدرسة الدورية بين أولياء الأمور والمعلمين وفائدتها؟  
129 responses

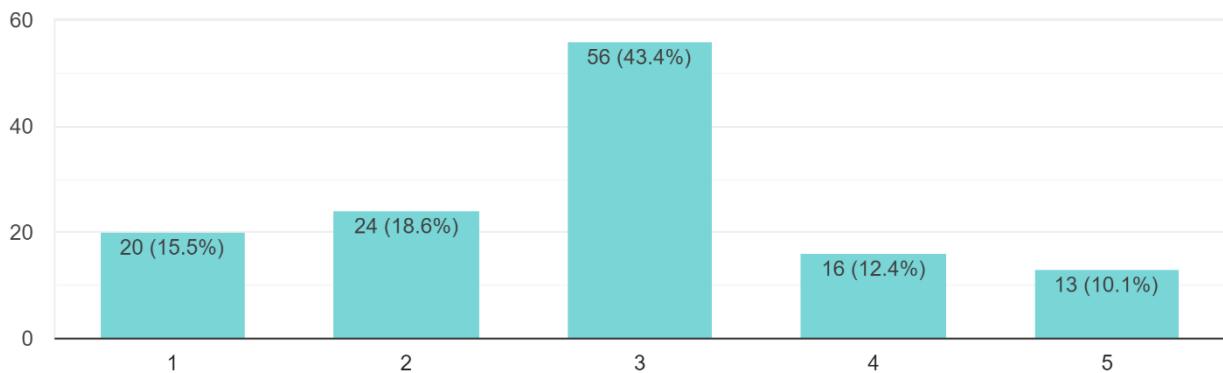


Figure 19: Responses for question 7: On a scale from 1 to 5, how satisfied are you with the number of regular parent teacher meetings and their effect?

على مقياس من 1 إلى 5 ، ما مدى نجاح المدرسة في إطلاعك على التقدم الذي يحرزه أبنائك؟  
129 responses

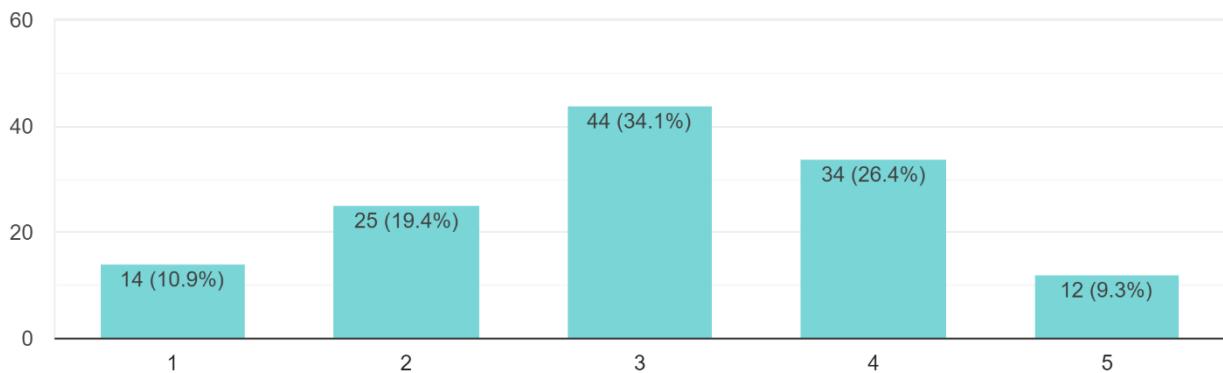


Figure 20: Responses for question 8: On a scale from 1 to 5, how successful is the school in indulging you on the progress of your child?



كم مرة تطلع على الرسائل الواردة من المدرسة؟

129 responses

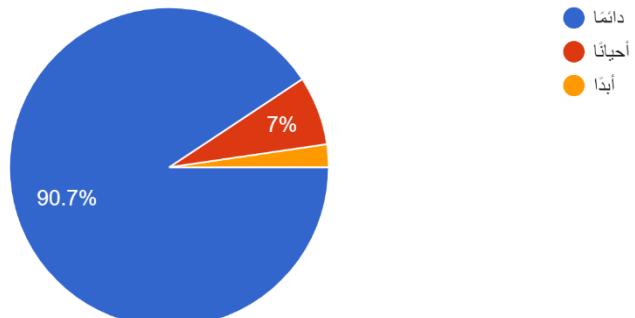


Figure 21:Responses for question 9: How often do you check on the messages that are sent from your child's school?

هل تفضل أن تكون هناك طريقة مباشرة للتواصل بينك وبين المعلم؟

129 responses

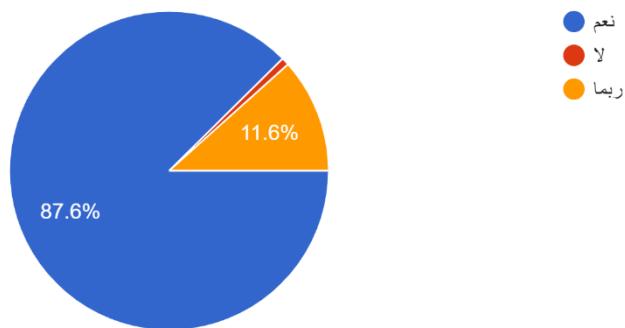


Figure 22:Responses for question 10: Would you rather to have a direct method of communication between you and the teachers?

هل تفضل الإطلاع على منشورات الأنشطة المدرسية المخطط لها مسبقاً؟

129 responses

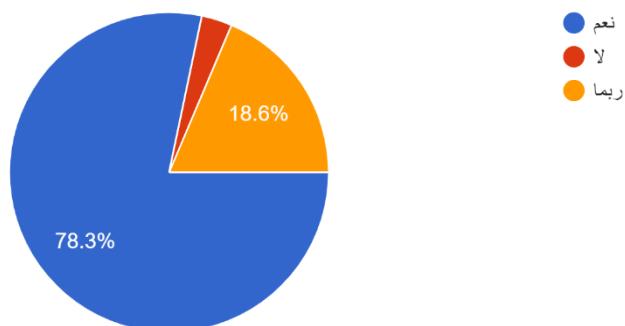


Figure 23:Responses for question 11: Do you prefer to view the pre-planned school activities flyers/posts?



إذا كانت أجابتكم نعم أو ربما، هل تفضل أن تتلقى أيضاً إشعارات فورية بخصوصها؟

128 responses

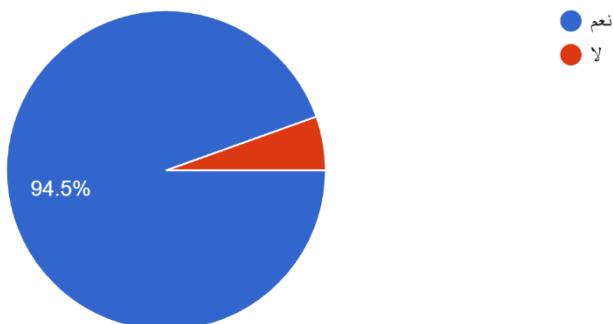


Figure 24: Responses for question 12: If your answer was yes or maybe, do you prefer to receive notification messages about them?

هل سبق أن فوّضت أحداً آخر لإستلام أبنائك من المدرسة بالنيابة عنك؟

129 responses

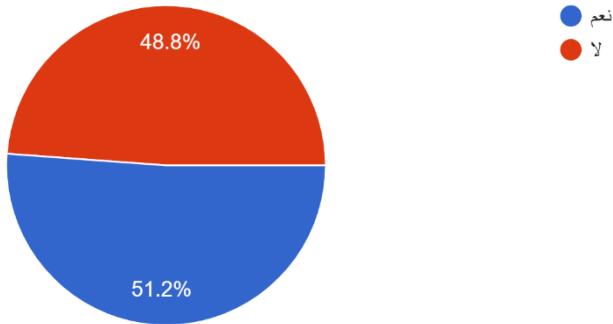


Figure 25: Responses for question 13: Have you ever delegated someone else to pick up your children from school on your behalf?

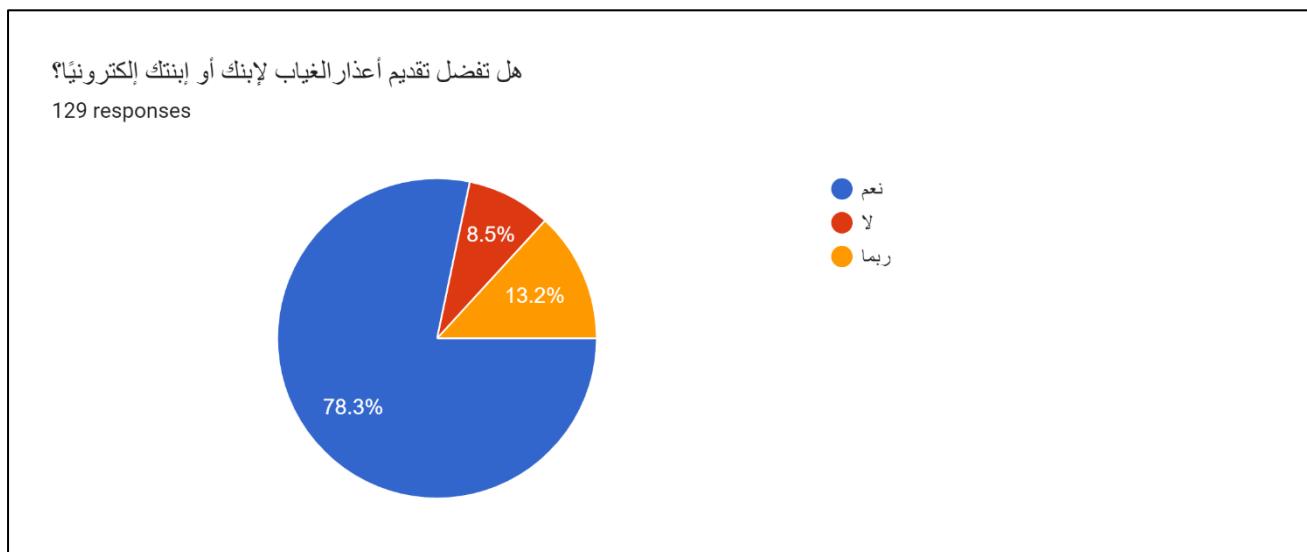


Figure 26:Responses for question 14: Would you prefer to submit your daughter or son absence excuses electronically?

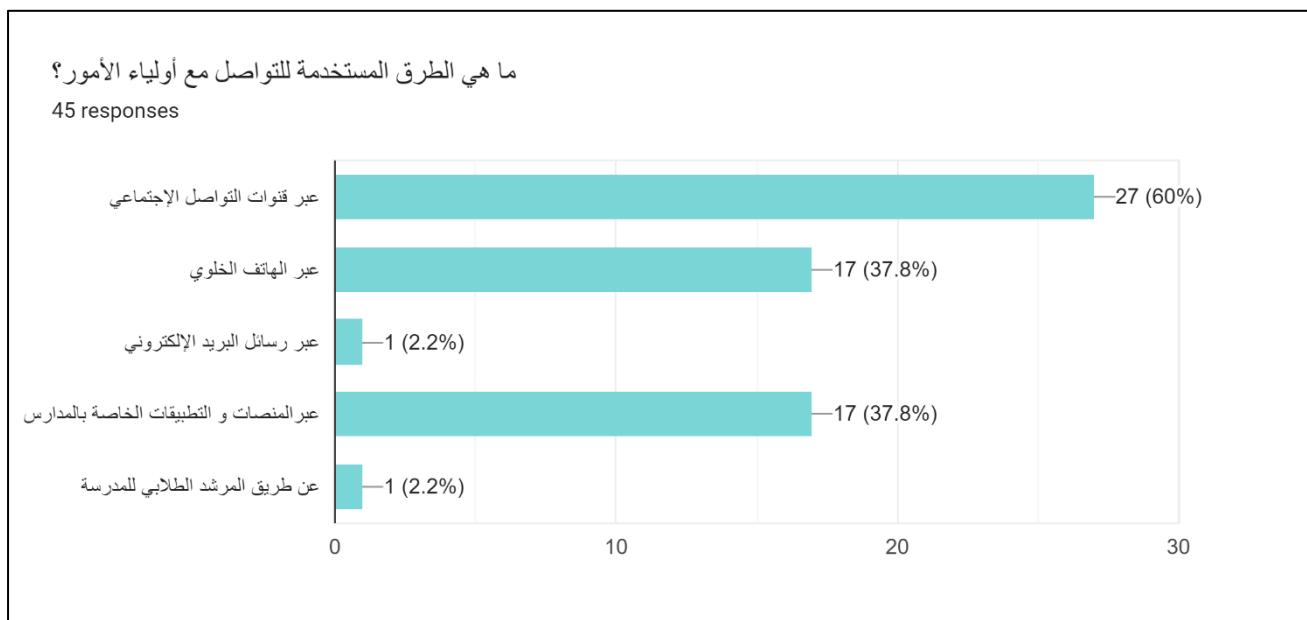


Figure 27: Responses for question 15: What are the methods used to communicate with the student parents?



هل تسمح لأولياء الأمور بالحصول على رقم هاتفك المحمول الخاص؟

45 responses

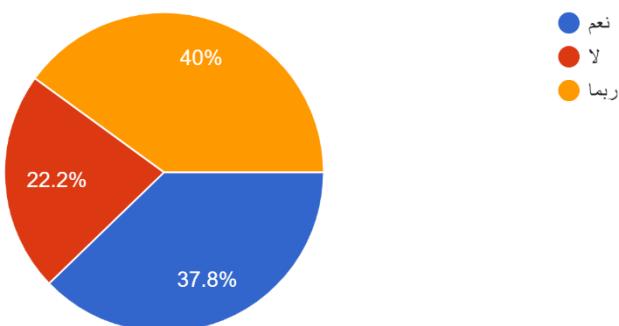


Figure 28: Responses for question 16: Do you allow the students' parents to have your mobile phone number?

هل تفضل أن تكون هناك طريقة مباشرة للتواصل بينك وبينولي الأمر؟

45 responses

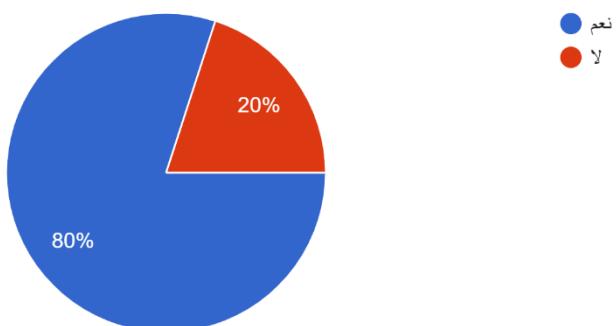


Figure 29: Responses for question 17: Would you rather to have a direct method of communication between you and the students' parents?

هل تفضل توجيه رسائل إلكترونية جماعية لأولياء الأمور من وقتٍ آخر؟

45 responses

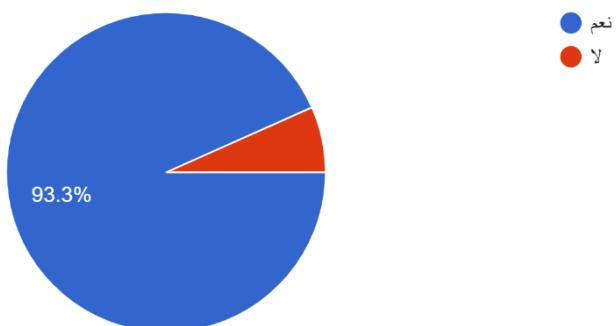


Figure 30: Responses for question 18: Do you prefer to send mass messages to parents from time to time?

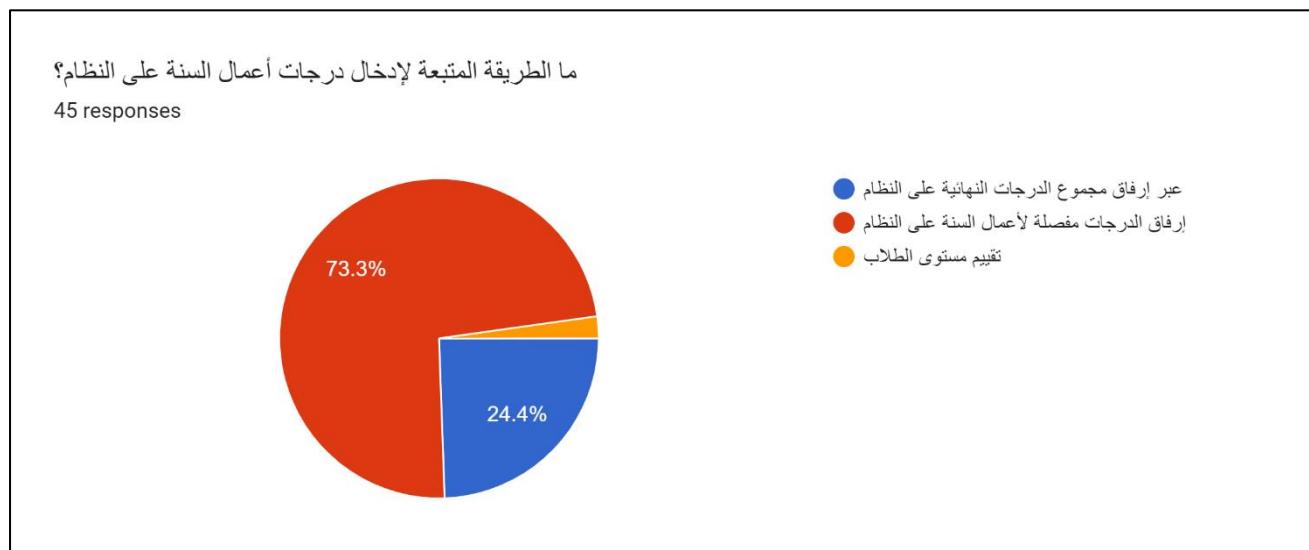


Figure 31: Responses for question 19: What is the method currently used to enter the grades of the year's work into the system?

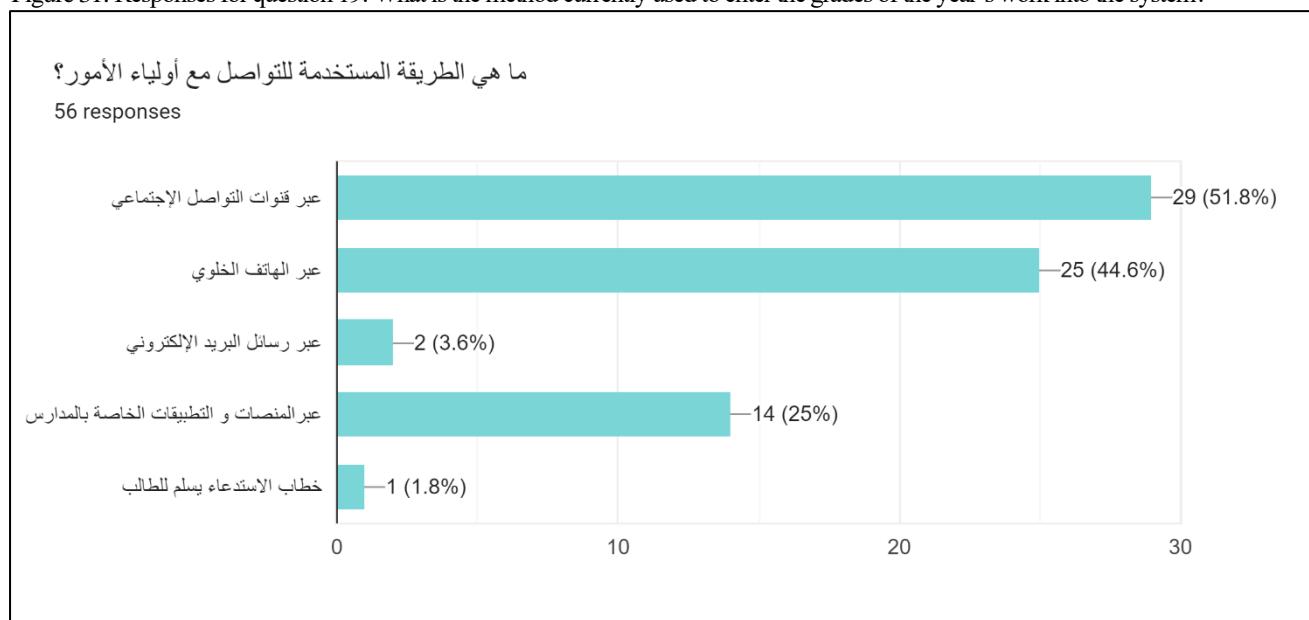


Figure 32: Responses for question 20: What are the methods used to communicate with the student parents?



## أختير التصنيفات المتبعة لتسجيل الغياب والحضور للطلاب

56 responses

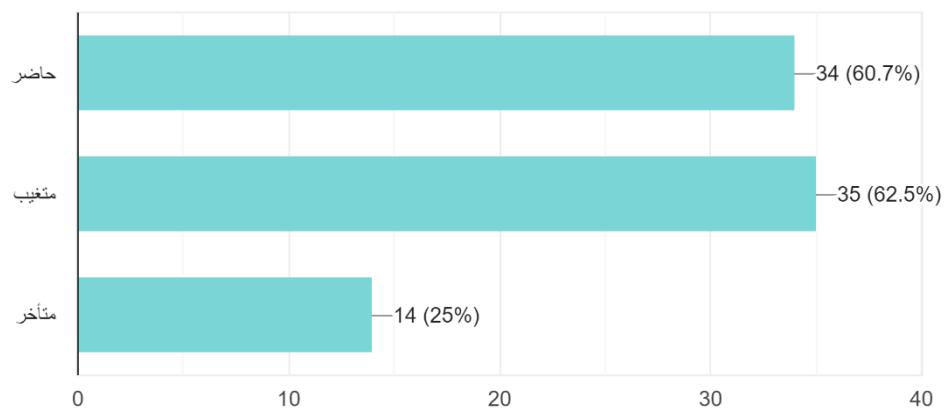


Figure 33: Responses for question 21: Choose the categories to be followed to record the attendance and absence?

## متى يتم تسجيل الحضور والغياب للطلاب للدراسة خلال اليوم الدراسي؟

56 responses

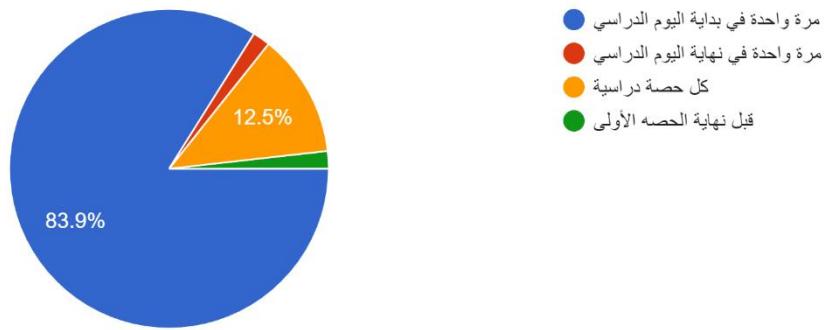


Figure 34: Responses for question 22: At which time does the attendance and absence of students get recorded during the school day?

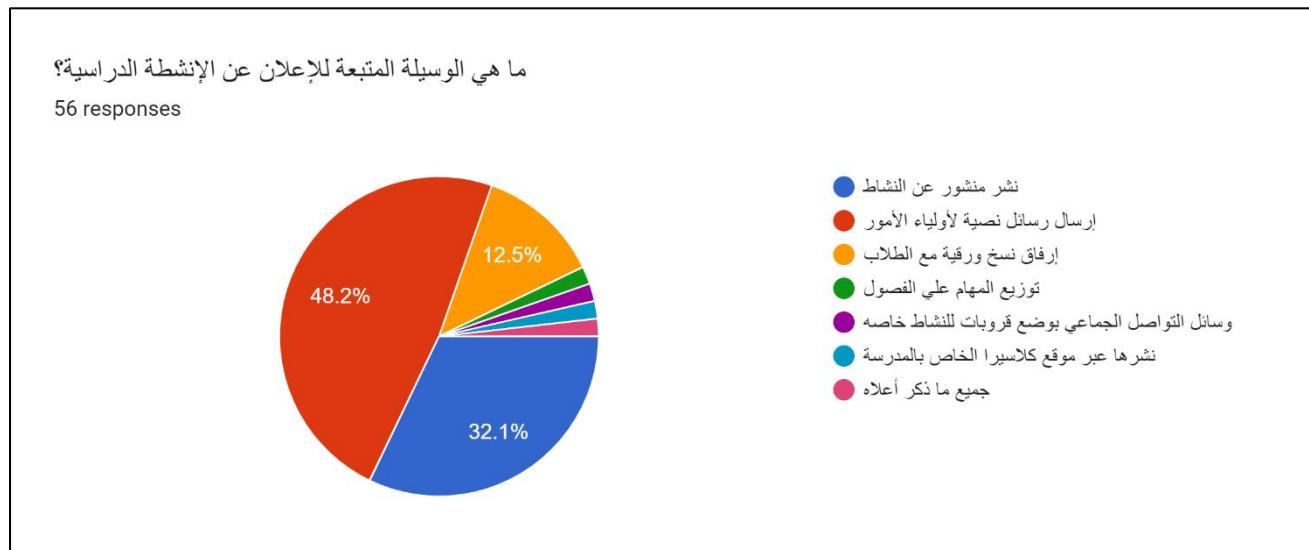


Figure 35: Responses for question 23: What is the method used to announce the school activities?

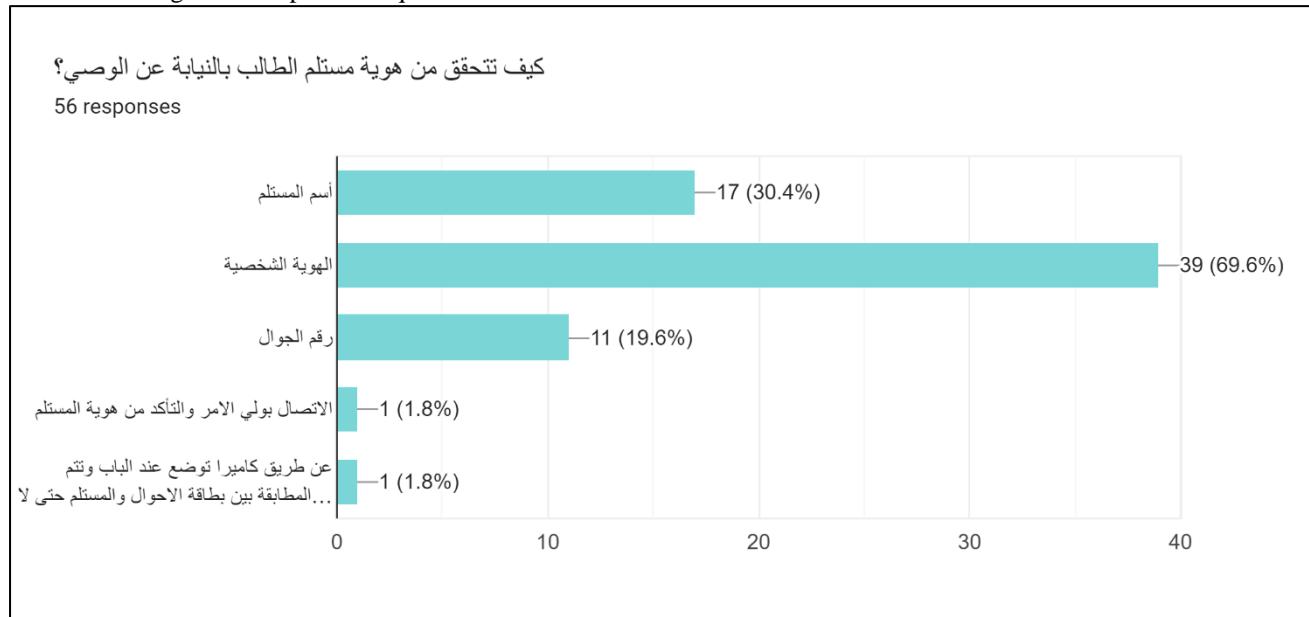


Figure 36: Responses for question 24: How do you verify the identity of a student recipient on behalf of their guardian?



## حلقة

من وجهة نظرك ما مدى أهمية التواصل بين المدرسة وأولياء الأمور؟

230 responses

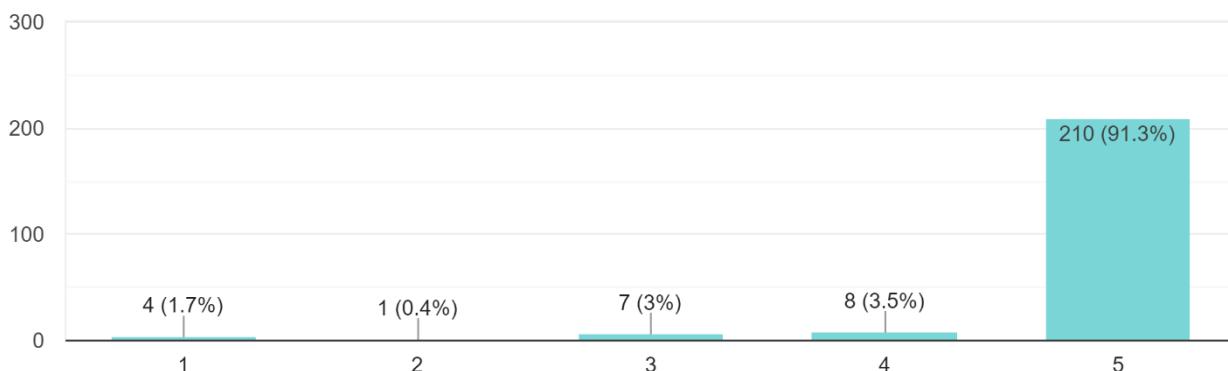


Figure 37: Responses for question 25: In your point view, how important is communication between the school and parents?

من وجهة نظرك ما مدى أهمية وجود وسيلة تواصل مباشرة بين المعلمين وأولياء الأمور؟

230 responses

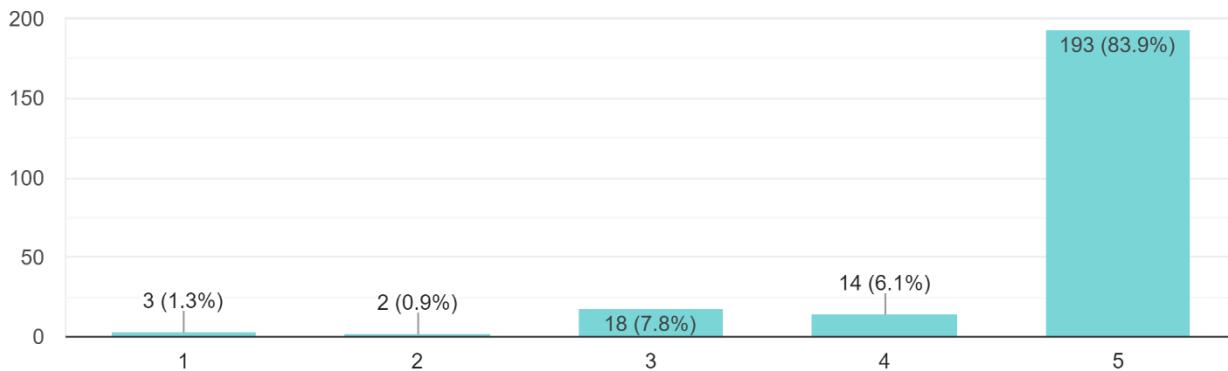


Figure 38: Responses for question 26: In your point of view, how important is it to have a direct means of communication between teachers and parents?



هل تؤمن بوجود حاجة لتطبيق ينظم عملية الإنصراف والخروج للطلاب؟

230 responses

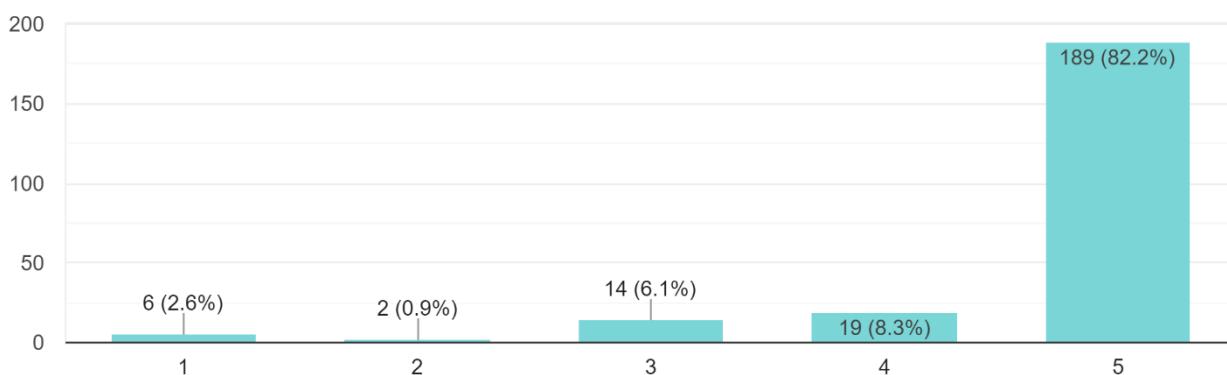


Figure 39: Responses for question 27: Do you believe that there is a need for an application that regulates the departure and exit process for students?

هل تفضل إسلام وتسليم التقارير إلكترونياً عوضاً عن إسلامها ورقياً؟ (درجات الطالب، أذار الغياب، الانشطة المدرسية، الخ)

230 responses

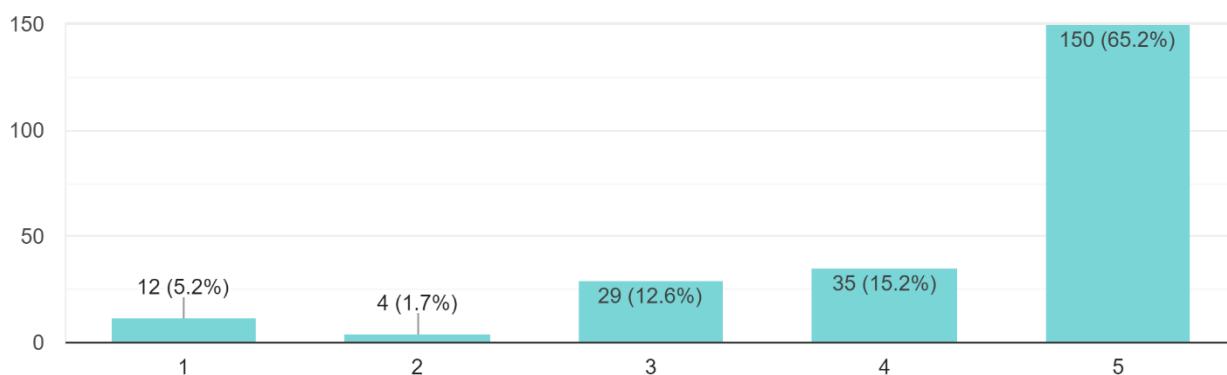


Figure 40: Responses for question 28: Do you prefer receiving and submitting reports electronically instead of receiving them as hard copy papers? (Such as, student grades, excuses for absence, school activities, etc.)

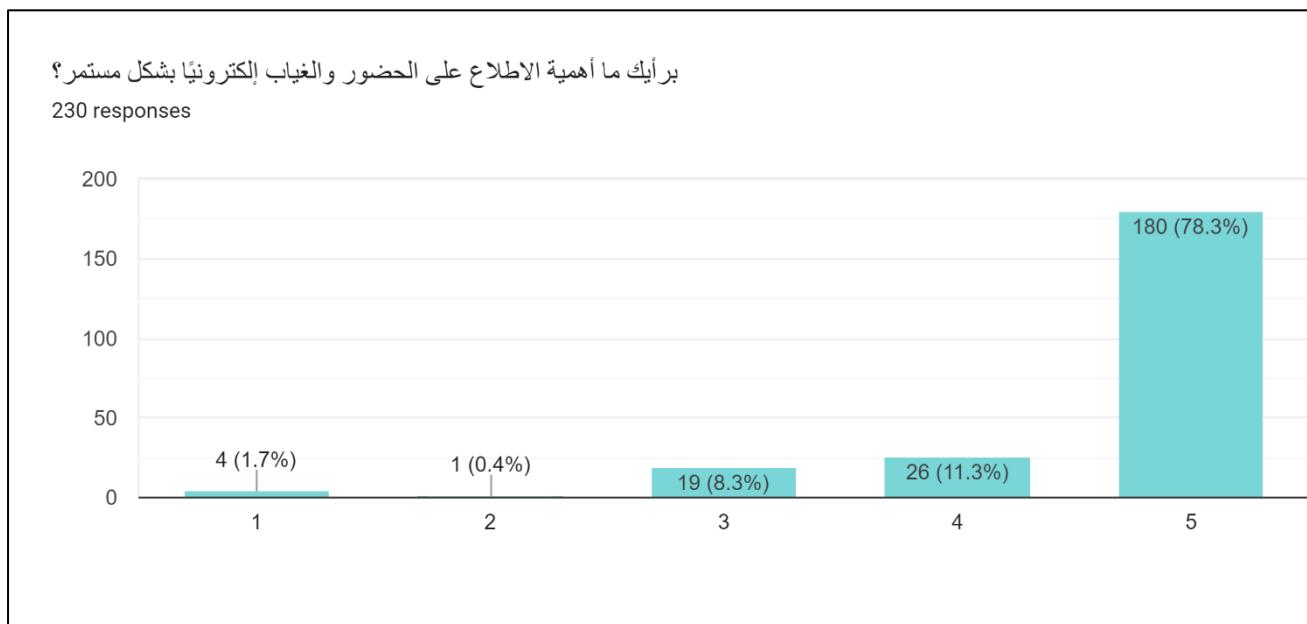


Figure 41: Responses for question 29: In your opinion, what is the importance of continuously viewing the attendance and absence of the student electronically?

#### 4.2.2.2 Questionnaire Results Summary

The first five questions in the questionnaire were concerned about the general characteristics of the users and their roles. Figure 13 showcases the gender classification of the respondents. 94.8% of them were females, while 4.3% of them were males, and 0.9% of them preferred to not disclose their gender. Figure 14 showcases the different age groups of the respondents, 36.1% of them fell in the “51 and above” age group, while 30.4% of them were in the age group of “41-50”, 27.4% of them were in the age group “31-40”, and lastly 6.1% fell in the “20-30” age group. Figure 15 indicates that only 16.1% of the respondents are using a mobile device that supports android operating system, while 83.4% of them uses a mobile device that supports IOS operating system. This implies that the majority of the targeted users’ mobile devices support only the IOS platform, which we should take into consideration whilst developing our solution. Figure 16 analyzed the capabilities of the respondents on using mobile devices applications. 40.4% of them had high capabilities and knowledge on how to use mobile applications, while 28.3% had good capabilities on using them, and 25.7% had average capabilities. On the other hand, 4.3% of them had low capabilities on using mobile applications, while 1.3% had very low capabilities. This indicates that developing our project as a mobile application will be the most suitable solution for our targeted users, since the majority are capable of using mobile applications. Figure 17 classifies the roles of the respondents in the



academic community. 56.1% of the respondents were parents, whilst 24.3% of them were part of the school administrative staff, and 19.6% were teachers.

Questions from question 6 all through question 14 were addressed to the students' parents. 129 of the respondents were student parents. The questions were attentive for the parents' opinions on some of our suggested solutions, whilst also curious about their activities with their child school and their preferences. Figure 18 demonstrates the different methods used by the parents to communicate with the school. 45.8% of the parents chose social media applications (such as WhatsApp, Telegram, Instagram, Snapchat, etc.) as a method to communicate with the school, 65.9% of the parents also use the school official phone number as a way to contact them, 7.8% have chosen e-mails as one of the methods they use to communicate with the school faculty, 29.5% chose systems and mobile applications that were specialized to serve schools and the educational field in general. At the same time two of the parents have described school visitations as a method to get in touch with the school, whilst one of the parents didn't have any mean of communication with their child's school. The analysis has shown that the most common method of communication with the school is through the school official phone number since it was chosen by 64.3% of the parents. This is an inefficient method, since the school will not be able to handle more than one concerned parent at a time as a single phone number cannot handle two separate phone calls at the same time. Figure 19 demonstrates the parents' satisfaction with the number of the parent teacher meetings and their effect. 10.1% of the parents were very satisfied, 12.4% of the parents were satisfied, while a greater proportion of the parents, which is 43.4%, had an average opinion on them. On the contrary, 18.6% were unsatisfied, and 15.5% were very unsatisfied. In consideration of how low the number of satisfied and very satisfied parents with the number of parent teacher meetings, this indicates that parents need more methods to get in touch with the teachers. Considering the number of meetings are not enough for them to discuss their concerns and their child's progress with the teacher. Figure 20 analyzed the success of the schools on indulging the parent with their child progress. 9.3% of the parents classified it as very successful, 26.4% classified it as successful, 34.1% classified it as average, whilst 19.4% said it was not successful, and 10.9% said it was very unsuccessful. Due to the low number of parents that classified it as successful, this means that schools lack the capabilities of informing parents about their child's progress regularly. This could be either due to schools not finding a suitable solution to aid them in the process, or they don't find the time within their work schedule to update each parent on their child



periodically. Figure 21 illustrated how often parents check the messages that are sent from their child's school. 90.7% of them always check their messages, whilst 7% of them never check on the messages, and 2.3% sometimes check their messages. This indicates that a great number of parents care for the messages they receive from their child's school and are interested on the new updates from the school. Figure 22 showcased the percentage of parents that would prefer a mean of direct communication with the teachers. 87.6% preferred to have a direct way to contact the teachers, this is a mass precent of immediate contact desire which pinpoints the need of providing a type of direct contact between the two parties. At the same time, 11.6% somewhat prefer it, and 0.8% does not prefer to have direct contact with the teacher. Figure 23 portrays the percentage of parents that prefer to view the pre-planned school activities posts. 78.3% of the parents preferred to view them, 18.6% somewhat preferred to view them, and 3.1% of them were not interested at all to be indulged in the pre-planned school activities. Figure 24 presents the percentage of parents that has agreed or somewhat agreed on the previous question on their preferences on receiving notifications about the pre-planned activities. 94.5% preferred getting notifications, whilst 5.5% do not prefer it. This means that a great number of parents like to be pre-hand informed and involved in school activities. Figure 25 shows that 51.2% of the parents had delegated someone else to pick up their children from school on their behalf before, while 48.8% had never authorized someone else for picking up their child. Since the two numbers were quite close to each other, in our product we are going to facilitate both answers by allowing parents to inform the school when they have arrived themselves or when someone else has arrived at the school gates. Figure 26 showcases that 78.3% of the parents (which is the majority) prefer to submit their child's absence excuses electronically, whilst 13.2% somewhat prefer it, and 8.5% doesn't prefer it at all.

Questions from question 15 all through question 19 were addressed to teachers at schools. 45 of our respondents were teachers. The questions were attentive for the teachers' opinions on some of our suggested solutions, whilst also curious about their usual work activities. Figure 27 demonstrates the different methods used by the teachers to communicate with the parents. 60% of them chose social media applications (such as WhatsApp, Telegram, Instagram, Snapchat, etc.) as a method to communicate with parents, 37.8% also use the school official phone number as a way to contact them, 2.2% has chosen e-mails as one of the methods they use to communicate with parents, whilst 37.8% chose systems and mobile applications that were specialized to serve schools and the educational field in general as a way of



communication, and 2.2% has chosen the school administrative staff as a link of communication between them and the parents. Figure 28 shows that 37.8% of the teachers do not prefer to let parents have access to their personal phone number, whilst 40% somewhat prefer it, and 22.2% doesn't prefer it at all. Figure 29 demonstrated that 80% of the teachers prefer to have a direct means of communication between them and the student parent, whilst 20% didn't prefer it. This means that teachers are interested in reaching out and directly contacting the parents as they do not find it an issue. It is a necessity for parents to get feedback about their child from teachers as they are one of the school faculty members that interacts the most with the students and are familiar with the students' habits and behaviors. Following that, Figure 30 shows that 93.3% of the teachers prefer to send direct mass messages to parents from time to time, while 6.7% do not prefer to do so. Figure 31 shows that 73.3% of the teachers upload the student total year grades of by entering each evaluation/work grade separately into the system, while 24.4% of the teachers enter the total grade out of 100 in the system, and 2.2% update them continuously depending on the student progress and level. Since the majority has chosen to upload the student grade separately, our product will be developed in a way that allows them to enter the grades using this method.

Questions from question 20 all through question 24 were addressed to the school administrative staff. 56 of our respondents were administrative staff members. The questions aimed to get an insight into their usual work activities and habits. Figure 32 demonstrates the different methods used by the administrative staff to communicate with the parents. 51.8% of them chose social media applications (such as WhatsApp, Telegram, Instagram, Snapchat, etc.) as a method to communicate with them, 44.6% also use the school landline phone number as a way to contact them, 3.6% has chosen e-mails as a methods to communicate with parents, whilst 25% chose systems and mobile applications that were specialized to serve schools and the educational field in general as a way of communication, and 1.8% has chosen a “parent summon letter” that is sent with the student as a way of reaching out to the parent. Figure 33 shows the different categories the administrative staff use to follow and record the attendance and absence of students. 60.7% of them use the term ‘attended’, and 62.5% also use the term ‘absent’, while the term ‘late’ is used by 25% of them. We are going to take the most frequent terms chosen into consideration when developing our solution to provide the most suitable product for the users. Figure 34 shows the time and the frequency of recording the attendance and absence of the students. 83.9% record the attendance once at the start of the school day, 12.5% record it



at every class, 1.8% record it at the end of the school day, and 1.8% record it before the end of the first period. This means that most schools prefer to record the student attendance once during the school day. The attendance functionality in our application will describe whether the student has attended to school in general rather than whether they attended each class, in hopes of mimicking the schools' regular activities as much as possible. Figure 35 shows the most used methods to announce the school activities. 48.2% announce the school activities by sending a text message to the student parent, while 32.1% announce them through publishing a post, 12.5% hand the student flyers about the activities to deliver them to the parent, and 1.8% use all the methods that has been mentioned above. In addition, 1.8% create specialized chat groups to discuss and announce the activities, plus 1.8% has mentioned the usage of the school official website as a method to announce the activities, and 1.8% announce them by informing the students in different classes of the activities they are part of. Figure 36 shows the methods used by the school administrators to verify the identity of a student recipient on behalf of their guardian. Verifying the identity by the recipient's name was chosen by 30.4% of them, verifying the identity by using the ID card was chosen by 69.6% of them, using the phone number as a form of identification was chosen by 19.6% of them, 1.8% contact the parents to verify the recipient identity, and 1.8% use security cameras that records the recipient for the administrators to view them and compare with their IDs.

The remaining questions in the questionnaire were about the application goal and its features. All the different kinds of respondents were able to answer these questions. Figure 37 shows the respondents point view on how important communication between the school and parents, which our application intendeds on serving it. 91.3% of the respondents view it as very important, 3.5% view it as important, 3% view it as average, 0.4% view it as unimportant, and 1.7% view it as very unimportant. Figure 38 represents the respondents' point of view on how important it is to have a direct means of communication between teachers and parents. 83.9% of them have stated that it is very important to have it, 6.1% stated that is important, 7.8% view it as average, while 0.9% stated that it's unimportant, and 1.3% stated that it is very unimportant. This has shown that the number of users who want a method of direct communication with the teachers has predominated the number of users who do not view it as important. It appears that direct contact with the teachers is demanded and preferred within the community. Figure 39 shows the classification of the respondents who believe on a need for an application that regulates the departure and exit process for students. 82.2% strongly believe



on its need, 8.3% believed on its need, 6.1% of them were neutral about the need of an application, 0.9% didn't consider the neediness of it, while 2.6% strongly disagree on the needs of an application. The greater part of the respondents has showed their aspiration to have an application that makes the process of picking up the students more systemic and efficient. Our application will provide a feature that aims to make the pickup manner more organized and proficient. Figure 40 shows whether the respondents prefer to receive and submit papers/forms electronically instead of receiving them as hard copies. 65.2% of the respondents strongly preferred to completely dispense the usage of hard copied papers and replace it with technology, 15.2% has preferred using technology on receiving and submitting forms/papers, 12.6% were neutral about it, while 1.7% didn't prefer to use technology over paper usage, and 5.2% didn't prefer it at all. The numbers proved that a great portion of the targeted users prefer and are willing to replace paperwork with technology. Our application is going to provide the ability of publishing and uploading most of the paperwork/forms between the parents and the school electronically, in a faster and more reliable approach. Figure 41 shows the respondent opinion on the importance of continuously viewing the attendance and absence of the student electronically. 78.3% viewed it as a very important gesture, 11.3% viewed it as important, 8.3% had neutral opinion, 0.4% viewed it as unimportant, and 1.7% view it as very unimportant. More than half of the respondents has agreed to the fact that viewing the attendance of the student is highly important, which our application intends to provide a functionality that allows the parents and the school faculty to handle the absence and attendance regularly in an easier and efficient manner.

The last two questions in the questioner were open ended and optional. The first question was about if the respondent has ever used one of the available applications to communicate with schools, and what is their experience with it? The following are some of the responses:

- “No, there wasn’t.”
- “Yes, the Madrasati platform”
- “Yes, Telegram, it was a good.”
- “WhatsApp and email”
- “Yes, through using WhatsApp group chats.”
- “Yes, WhatsApp and it is good and effective.”



- “Yes WhatsApp, it provides a direct communication.”
- “Yes, a program to send absence notices to the parents. The idea is good, but the application was boring, suffered from performance issues, heavy, and the functionalities were basic.”
- “Yes, the application interface was unorganized and unfriendly.”
- “WhatsApp is very good and annoying at the same time; I need to communicate with the school administrators in general and the teachers. But the large number of groups and messages is annoying, especially since I have family group chats, relatives and friends on it, so I feel that I am confused and missing the important messages due to their large number, especially those belonging to the school, although I know they are important, and I need them.”
- “WhatsApp, but it was a bad experience because they contact me through there which is the same application I use for my personal activities”
- “No, because the school doesn’t use a specialized application.”
- “No, only through WhatsApp or phone calls”

Most of the respondents have testified that they use WhatsApp as the main communication method between them and the school. But some of the respondents have described their experience with it as “bad” or “annoying”. Due to the fact that they use the application for their private social life, this has made separating personal life and the school community difficult, thus making the experience aggravating for them. Some respondents have described their experience with other applications as imperfect or faulty. Either due to the application suffering from performance issues, or the application being basic and inflexible, or the user interface was unfriendly and unorganized.

The last question was about if the respondents have other suggestions for features that should be provided on our application. The following are some of the responses:

- “Making the application easy to use.”
- “Providing private chats.”
- “Smoothness and the easiness in using the application, even making it available on mobile devices.”



- “An application that sends the students activities of a class and the duties of each scheduled class.”
- “Making the school own a special channel to notify all students parents by an announcement via the channel of any special event such as, the student parent council.”
- “Making a group chat between teachers and the parents.”
- “Daily report of the students’ performance in each class”
- “Adding the academic calendar to the application.”
- “It should be easy and suitable for all ages to make it beneficial for everyone.”
- “Establishing a private group chat between teachers and students, also a group chat between parents and teachers.”
- “Communicating directly and periodically with the school psychologist.”
- “Providing a functionality to know the student level in each subject and direct conversation with the teachers.”
- “Adding the weekly homework’s and plans.”

Many of the suggestions can be categorized as functionalities that our application is already planning to provide such as, providing a private chat between teachers and parents, making the school able to notify the parents of any special events, which is provided through our publish event functionality in the admins account, and knowing the student level in each subject by making teachers upload the student grades in the application for parents to view them periodically.

Some of the comments were about the easiness and smoothness of using the application, the friendliness of the user interfaces, and making the application available on all mobile devices. These are all non-functional requirements that our project plans to meet. Part of the suggestions could be considered as a future work for our product. As time is limited in the project, it only aims to focus on the main and critical features. The suggestions that can be added to our future work are providing a group chat between teachers and the parents, adding the academic calendar, a group chat between teachers and students, a mean of communication with the school psychologist, and lastly expanding the scope of the project by adding the students as users to share with them their weekly homework’s and plans.



#### 4.2.3 User Interactions

Due to the high number of use cases in this project, the use case diagram is divided into five diagrams based on the user type to be more readable and understandable.

##### 4.2.3.1 Principal Use Case Diagram



Figure 42: Principal use case diagram



#### 4.2.3.2 Admin Use Case Diagram

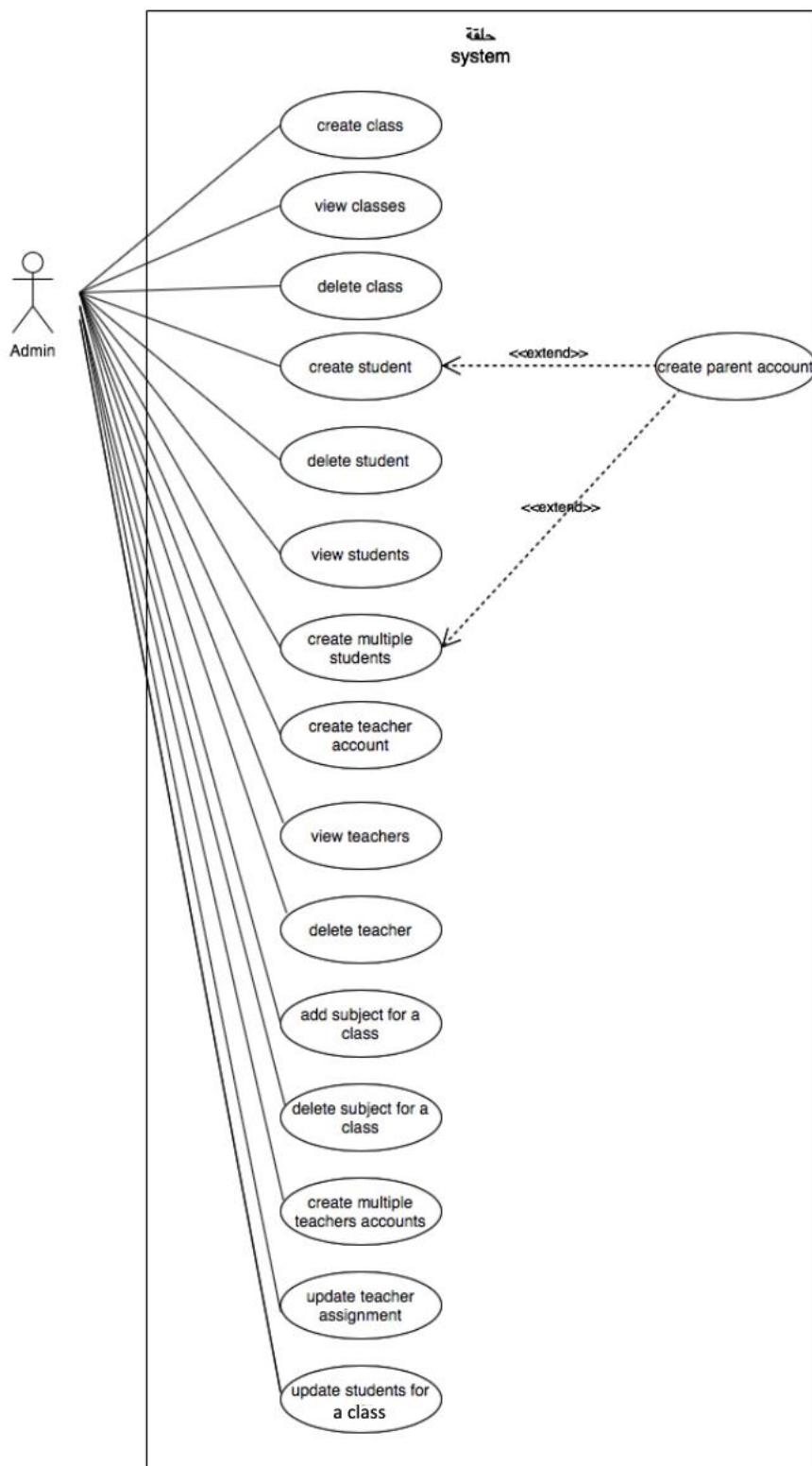


Figure 43: Admin use case diagram part-1

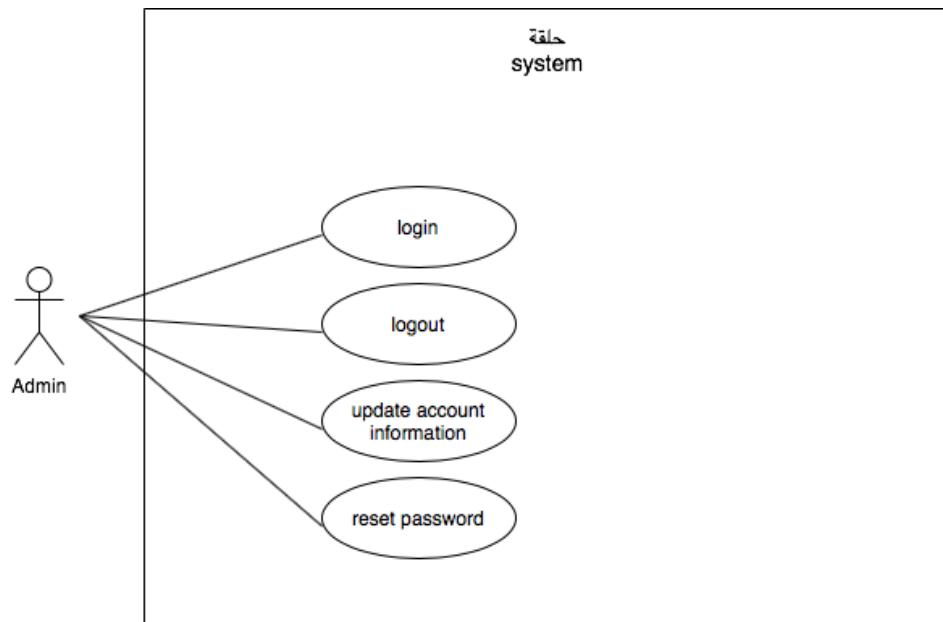


Figure 44: Admin use case diagram part-2

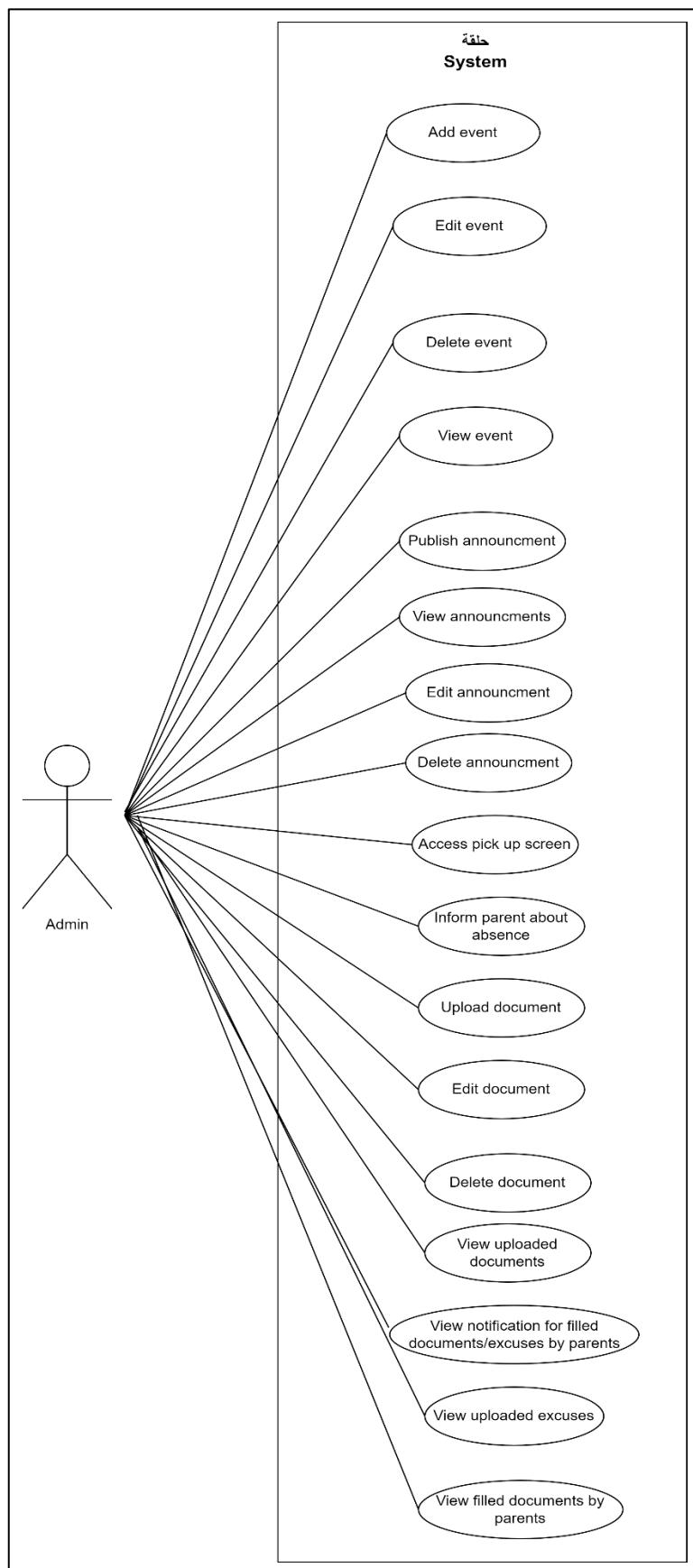


Figure 45: Admin use case diagram part-3



#### 4.2.3.3 Teacher Use Case Diagram



Figure 46: Teacher use case diagram



#### 4.2.3.4 Parent Use Case Diagram

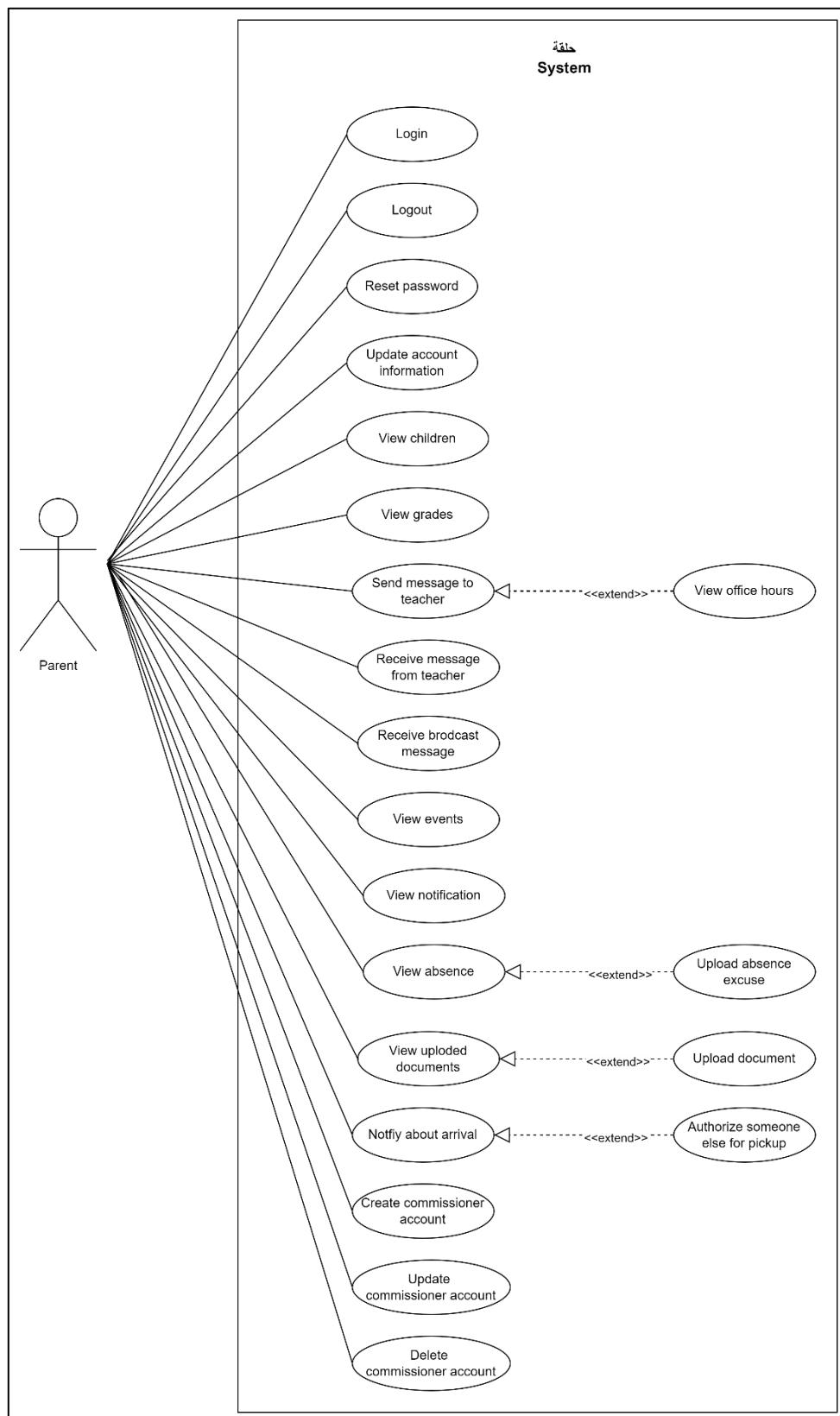


Figure 47: Parent use case diagram



#### 4.2.3.5 Authorized Commissioner Use Case Diagram

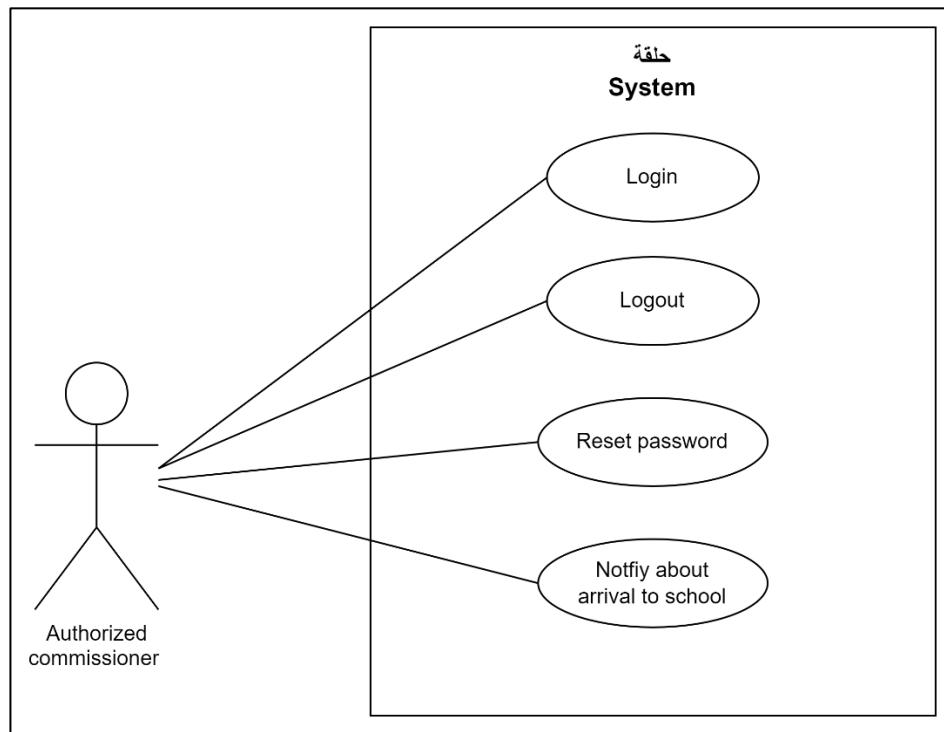


Figure 48: Authorized commissioner use case diagram.



#### 4.2.4 Roadmap And Product Backlog

A software product roadmap is a visual representation of the plan for developing and releasing a software product. It outlines the key milestones, features, and deliverables that need to be completed to bring the product to market. Figure 49 shows the roadmap for this project which consists of 5 sprints. **Table 3** lists the product backlog for this project.

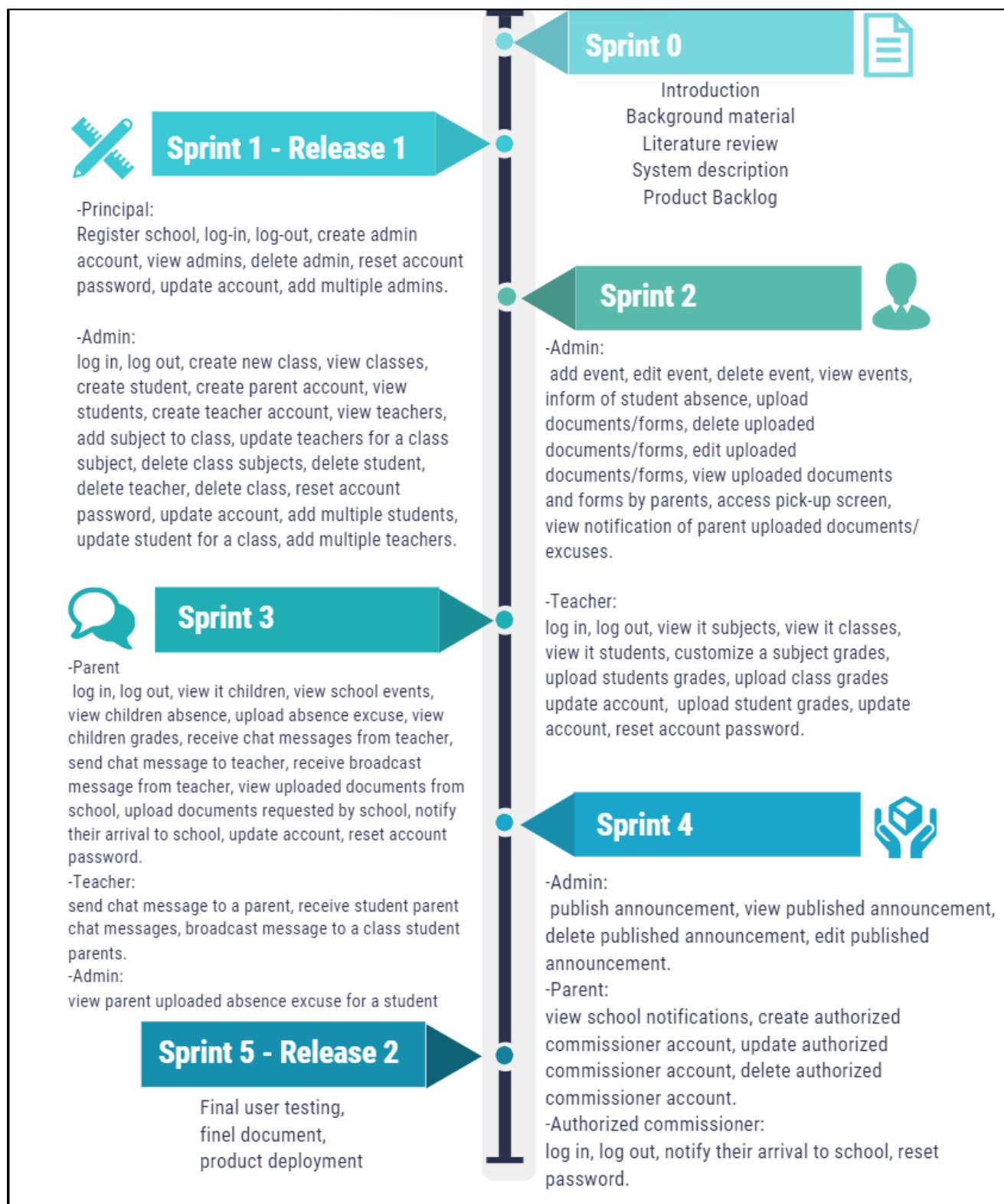


Figure 49: Product roadmap



Table 3: Product backlog

#	PBI (User story)	Size (Story points)	Type (Feature, defect, technical work, knowledge acquisition)	Status (To do, in progress, or done)	Acceptance Criteria The conditions of satisfaction that must be met for that item to be accepted.
1	As a principal, I want to be able to register so that I can create an account for the school and use the system.	2	Feature	Done	<ul style="list-style-type: none"> <li>-If the principal is in the log in page and clicks on the registration link, then the system will navigate to the registration page.</li> <li>-If the principal goes to the registration page and enters a valid email and a valid password and fills out the required information (school details and contact information) and clicks on the 'Register' button, then the system will navigate to the home page and the corresponding record will be added in the database.</li> <li>-If the principal goes to the registration page and enters an invalid email or password and clicks on 'Register' button, then registration fails with an error message that says, "The email is used" or "The password is short, please try again", and enable re-entering.</li> <li>- If the principal goes to the registration page and leaves the email field or the password field or any required field empty and</li> </ul>



					<p>clicks on the ‘Register’ button, then registration fails with an error message that says, “Please fill in all the required fields” and enable re-entering.</p>
2	As a principal, I want to be able to login with my email and password so that I will be able to perform my functions.	1	Feature	Done	<p>-If the principal goes to the log in page and enters a valid email, a valid password and selects the principal role then clicks on the ‘Log in’ button, the system will navigate to the home page.</p> <p>-If the principal goes to the log in page and enters an invalid email or password, or selects a wrong role, then clicks on ‘Log in’, then log in fails with an error message that says, “The username or password is wrong, please try again” or “There is no user with that role” and enable re-entering credentials.</p> <p>-If the principal goes to the log in page and leaves the email field or the password field empty and clicks on the Log in button, then log in fails with an error message that says, “Please fill in all the required fields” and enable re-entering credentials.</p>
3	As a principal, I want to be able to log out so that I can protect my account from unauthorized users.	2	Feature	Done	If the principal clicks on the logout button, then the system will navigate to the login page.
4	As a principal, I want to be able to create an admin account so that I	3	Feature	Done	-If the principal clicks on the add admin link from the add admin dropdown menu in the home page,



	can setup the environment for my school.				<p>then the system will show a form of the required information (first name, last name, email) to complete the addition. After filling it out and clicking on the 'Add' button a message will appear saying "The admin was added successfully" and an email will be sent to the admin email address that requires password reset for security issues.</p> <p>The corresponding records shall be added in the database.</p> <p>-If the principal clicks on the add admin link from the add admin dropdown menu in the home page, then the system will show a form of the required information (first name, last name, email). After leaving an empty field and clicking on the 'Add' button, then the addition process fails with an error message that says, "Please fill in all the required fields."</p> <p>-If the principal filled out the email field in the add admin form with a previously used email, then an error message will appear saying "The email is already used" and enable re-entering.</p>
5	As a principal, I want to be able to view admins so that I can maintain them.	2	Feature	Done	If the principal is on the home page, then a list of the added admins will appear.



6	As a principal, I want to be able to delete admins so that I can manage the environment properly.	3	Feature	Done	If the principal clicks on the delete button next to an admin, a confirmation message will appear saying “Do you confirm deleting the admin and all its corresponding records?” If the principal selects “Yes”, then a message will appear saying “The admin was deleted successfully” and the corresponding records in the database will be deleted.
7	As a principal, I want to be able to reset my password so that I can log in to my account when I forget it.	2	Feature	Done	<p>-If the principal is in the log in page and clicks on “Forgot password?”, then the system will navigate to the reset password page where they can enter their email. If the email entered was registered in the system, then a link will be sent to the email that enables him/her to reset it.</p> <p>-If the principal is in the log in page and clicks on “Forgot password?”, then the system will navigate to the reset password page where they can enter their email. If the email entered was not registered in the system, then an error message will appear saying “The email is not registered. Enter a registered email” and enable re-entering.</p>
8	As a principal, I want to be able to update my account information so that I can edit my account.	2	Feature	Done	-If the principal clicks on the account icon in the navigation bar, then the system will enable him/her to change the account information, including the login information and contact



					<p>information. When the principal clicks on 'Save', the system will ask the principal to enter the password of the account. Following that, the new account information will then be saved.</p> <p>-If the principal clicks on the account icon in the navigation bar, then the system will enable him/her to change the account information, including the login information and contact information. When the principal deletes the content in any field and leaves it empty and clicks on 'Save', the system will show an error message saying, "all fields are required" and enables re-entering.</p> <p>- If the principal clicks on the account icon in the navigation bar, then the system will enable him/her to change the account information, including the login information and contact information. When the principal clicks on 'Save', the system will ask the principal to enter the password of the account. If the principal entered a wrong password, the system will show an error message saying, "The password is wrong please try again" and enables re-entering.</p>
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					<p>- If the principal clicks on the account icon in the navigation bar, then the system will enable him/her to change the account information, including the login information and contact information. When the principal enters invalid values and clicks on ‘Save’, the system will show an error message corresponding to the field whether it’s an email or password or school name and enables re-entering.</p>
9	As an admin, I want to be able to login with my email and password so that I will be able to perform my functions.	2	Feature	Done	<p>-If the admin goes to the log in page and enters a valid registered email, a valid password, and correct role, and clicks on ‘Log in’ button, then the system will navigate to the home page.</p> <p>-If the admin goes to the log in page and enters an invalid email or password, or selects a wrong role, then clicks on ‘Log in’, then log in fails with an error message that says, “The username or password is wrong, please try again” or “There is no user with that role” and enable re-entering credentials.</p> <p>- If the admin selects the principal role, then clicked on ‘Log in’, then log in fails with an error message that says, “There are no record of a principal with the provided</p>



					<p>credentials” and enable re-entering credentials.</p> <p>-If the admin goes to the log in page and leaves the email field or the password field empty and clicks on ‘Log in’ button, then log in fails with an error message that says, “Please fill in all the required fields” and enable re-entering credentials.</p>
10	As an admin, I want to be able to log out so that I can protect my account from unauthorized users.	1	Feature	Done	If the admin clicks on the logout button, then the system will navigate to the login page.
11	As an admin, I want to be able to create classes so that I can setup the environment for my school.	3	Feature	Done	<p>-If the admin clicks on the add class button in the home page, then the system will show a form of the required information to complete the addition, which are the class name and the level of the class. After filling it out and clicking on the ‘Add’ button, a message will appear saying “The class was added successfully”.</p> <p>-If the admin leaves an empty field and clicks on the ‘Add’ button, then the addition process fails with an error message that says, “Please fill in all the required fields” and enable re-entering.</p> <p>-If the admin enters a class name and selects a level that their combination already exists in the school and clicks on the ‘Add’ button, then the addition process fails with an error message that</p>



					says, “There is a class created with the same name and level” and enable re-entering.
12	As an admin, I want to be able to view classes so that I can maintain them	2	Feature	Done	If the admin is in the home page, then a list of the added classes will appear.
13	As an admin, I want to be able to create a student account so that I can setup the environment for my school.	5	Feature	Done	-If the admin clicks on the ‘Add student’ link from the dropdown menu in the home page, then the system will show a form of the required information to complete the addition. The information is the student first name, student last name, student class, student’s parent number, parent first name, parent last name, and parent email. After filling in the phone number of the parent, the system will check if the parent had a previous account in the system. If yes, and the student is not registered in the system before, the system will automatically fill the parent information field. If the parent is not previously registered, the system will ask the admin to complete the parent information fields. After filling it out and clicking on the ‘Add’ button, a message will appear saying “The student was added successfully” and an email will be sent to the parent’s email address that contains a link to allow the parent to reset the password for their account. The corresponding record will be added to the database.



					<p>-If the admin clicks on the ‘Add students’ link from the dropdown menu in the home page, then the system will show a form of the required information to complete the addition which are student first name, student last name, student class, student’s parent number, parent first name, parent last name, parent email. After leaving an empty field and clicks on the ‘Add’ button, addition process fails with an error message that says, “Please fill in all the required fields” and enable re-entering.</p>
14	As an admin, I want to be able to create a parent account so that they can use the system.	3	Feature	Done	<p>-If the admin adds a new student to the system and their parent phone number is not yet registered, then an account for the parent will be created and a reset password email will be sent to their email.</p>
15	As an admin, I want to be able to view students so that I can maintain them.	3	Feature	Done	<p>If the admin selects a class, then the system will navigate to the student’s page and a list of the students registered in the class will appear.</p>
16	As an admin, I want to be able to create a teacher account so that I can setup the environment for my school.	3	Feature	Done	<p>-If the admin clicks on the ‘Add teacher’ link from the add teacher dropdown menu in the home page, then the system will show a form of the required information to complete the addition, which are the teacher’s first name, last name, and email. After filling it out and clicking on the ‘Add’ button a message will appear saying</p>



					<p>"Teacher is added successfully" and an email will be sent to the teacher's email address that requires password reset for security issues.</p> <p>The corresponding record will be added to the database.'</p> <p>-If the admin clicks on the 'Add teacher' link in the add teacher dropdown menu in the home page, then the system will show a form of the required information. After leaving an empty field and clicking on the 'Add' button, then the addition process fails with an error message that says, "Please fill in all the required fields" and enable re-entering.</p> <p>-If the entered email address in the add teacher form is previously registered, then an error message will appear saying "email exists" and enable re-entering.</p>
17	As an admin, I want to be able to view teachers so that I can maintain them.	2	Feature	Done	If the admin is in the home page, then a list of added teachers will appear.
18	As an admin, I want to be able to add a subject for a class, so that I can reflect the current subjects taken by the class.	5	Feature	Done	<p>-If the admin clicks on the 'Assign teacher' button beside a class, then the system will navigate to the subject's page. The class subjects, and their corresponding assigned teacher will appear.</p> <p>-If the admin fills in the 'Subject name' field and clicks on the 'Add</p>



					<p>subject' button, then a message will appear saying "The subject is added successfully". The corresponding record will be added to the database.</p> <p>-If the admin clicks on the 'Add subject' button without filling out the 'Subject name' field, then a message will appear saying "To add a subject, the subject name field must be filled" and enable re-entering.</p> <p>-If the admin adds a subject with the same name as an already added subject to the class, then a message will appear saying "The subject was previously added to the class".</p>
19	As an admin, I want to be able to update the teacher's assignment for the subjects of a class, so that I can reflect the new teacher assignments.	3	Feature	Done	<p>-If the admin clicks on the 'Assign teacher' button beside a class, then the system will navigate to the subject's page and the class subjects, and their corresponding assigned teacher will appear.</p> <p>-If the admin selects a teacher from the dropdown list of a subject and clicks on 'Save changes' then a confirmation message will appear saying "Do you want to save all the changes?". If the admin selects yes, then a message will appear saying "All changes are saved" and the corresponding records in the database will be updated.</p>



20	As an admin, I want to be able to delete subjects for a class, so that I can reflect the current subjects taken by the class.	2	Feature	Done	<p>-If the admin clicks on the 'Assign teacher' button beside a class, then the system will navigate to the subject's page. The class subjects, and their corresponding assigned teacher will appear.</p> <p>-If the admin selects a subject/subjects and clicks on the delete button, then a confirmation message will appear saying "Do you confirm deleting the subject/subjects and all their corresponding data?". If the admin selects 'Yes', then a message will appear saying "The subjects are deleted". The corresponding records will be deleted in the database.</p>
21	As an admin, I want to be able to delete students so that I can manage the environment properly.	3	Feature	Done	If the admin selects a class from the home page, then the system will navigate to the student's page and a list of the students registered in the class will appear. The admin then will select the student/students to be deleted. After clicking on the 'Delete' button, a confirmation message will appear saying "Do you confirm deleting the student/students and their corresponding records?". If the admin selects 'Yes', then a message will appear saying "The student/students was/were deleted successfully". The corresponding



					<p>records in the database will be deleted.</p> <p>-If an admin deletes a student and their corresponding parent does not have any other children, then the parent account will be deleted.</p>
22	As an admin, I want to be able to delete a teacher so that I can manage the environment properly.	2	Feature	Done	If the admin clicks on the 'Delete' button besides a teacher, then a confirmation message will appear saying "Do you confirm deleting the teacher and all its corresponding records?". If the admin selects 'Yes', then the corresponding records in the database will be deleted.
23	As an admin, I want to be able to delete classes so that I can manage the environment properly.	3	Feature	Done	<p>If the admin clicks on the 'Delete' button besides a class, then a confirmation message will appear saying "Do you confirm deleting the class?" If the admin selects 'Yes', then a message will appear saying "The class was deleted successfully". The corresponding records in the database will be deleted.</p> <p>- If the admin clicks on the 'Delete' button beside a class that has students associated with it, then a message will appear saying "The class can't be deleted because it has students associated within it".</p>



24	As an admin, I want to be able to reset my password so that I can log in to my account when I forget it.	2	Feature	Done	<p>-If the admin is in the log in page and clicked on “Forgot password?”, then the system will navigate to the reset password page where they can enter their email. If the email entered was registered in the system, then a link will be sent to the email that enables him/her to reset it.</p> <p>- If the admin is in the log in page and clicked on “Forgot password?”, then the system will navigate to the reset password page where they can enter their email. If the email entered was not registered in the system, then an error message will appear saying “The email is not registered. Enter a registered email” and enable re-entering.</p>
25	As an admin, I want to be able to update my account login information so that I can edit my account.	3	Feature	Done	<p>-If the admin clicks on the account icon in the navigation bar, then the system will enable him/her to change the account information, including the login information and contact information. When the admin clicks on ‘Save’, the system will ask the admin to enter the password of the account. Following that, the new account information will then be saved.</p> <p>-If the admin clicks on the account icon in the navigation bar, then the system will enable him/her to</p>



					<p>change the account information, including the login information and contact information. When the admin deletes the content in any field and leaves it empty and clicks on ‘Save’, the system will show an error message saying, “all fields are required” and enables re-entering.</p> <p>- If the admin clicks on the account icon in the navigation bar, then the system will enable him/her to change the account information, including the login information and contact information. When the admin clicks on ‘Save’, the system would ask the admin to enter the password of the account. If the admin entered a wrong password, the system will show an error message saying, “The password is wrong please try again” and enables re-entering.</p> <p>- If the admin clicks on the account icon in the navigation bar, then the system will enable him/her to change the account information, including the login information and contact information. When the admin enters invalid values and clicks on ‘Save’, the system will show an error message corresponding to the field whether it’s an email or password and enables re-entering.</p>
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26	As an admin, I want to be able to add multiple students at one time so that I can save my time and effort.	5	Feature	Done	<p>-If the admin clicks on the ‘Add students’ link from the add student dropdown menu in the home page, then the system will show a form that allows the admin to upload a file of type “.xls/.xlsx”.</p> <p>-If the admin uploads a file that is not empty, then a table will appear that showcases the file data. After that, each student will be added to the system.</p> <p>- If the student parent was not previously registered in the school, then both the student and parent will be added to the system. When they are added successfully in the system, a message will appear next to the student row on the table saying “Added”.</p> <p>- If the student parent was previously registered in the school and the student was not registered before, then the student will be added to the parent. When the student is added successfully, a message will appear next to the student row on the table saying, “Added to a parent registered in the system”.</p> <p>- If the student was not added successfully then a message will appear next to the student row saying, “Did not add.”</p>



					<p>-If the admin uploads a file with a file extension other than “.xls/.xlsx”, then a message will appear saying “Only files with type .xls or .xlsx are allowed to be uploaded”.</p> <p>-If the admin uploads a file with a different column field other than the shown column in the template, then a message will appear saying “the column number # need to be modified, please check the template to check the correct format”.</p>
27	As an admin, I want to be able to update students for a class so that they can reflect their new class assignment.	3	Feature	Done	If the admin selects a class from the home page, then the system will navigate to the student's page and a list of the students registered in the class will appear. Besides the student's name, a list of the school classes will appear. If the admin selects a new class for a student, a confirmation message will appear saying “Do you confirm transferring the student to another class?” if the admin selects ‘Yes’, then the student will be transferred to the other class.
28	As an admin, I want to be able to add multiple teachers at one time so that I can save my time and effort.	5	Feature	Done	<p>-If the admin clicks on the ‘Add teachers’ link from the add teacher dropdown menu in the home page, then the system will show a form that allows the admin to upload a file of type “.xls/.xlsx”.</p> <p>-If the admin uploads a file that is not empty, then a table will appear that showcases the file data. After</p>



					<p>that, each teacher will be added to the system. If the teacher was added successfully, then a message will appear next to the teacher row on the table saying “Added” and the teacher will be added in the database.</p> <p>-If the admin uploads a file that is not empty, then a table will appear that showcases the file data. After that the teachers will be added to the system. If the teacher was not added successfully then a message will appear next to the teacher row saying, “Did not add”.</p> <p>- If the admin uploads a file that is not empty, then a table will appear that showcases the file data. If a teacher’s email is already registered, then a message will appear next to the teacher row saying, “email is already in use, did not add”.</p> <p>-If the admin uploads a file with a file extension other than “.xls/.xlsx”, then a message will appear saying “Only files with type .xls or .xlsx are allowed to be uploaded”.</p>
29	As a principal, I want to be able to add multiple admins at one time so that I can save my time and effort.	5	Feature	Done	<p>-If the principal clicks on the ‘Add admins’ link from the add admin dropdown menu in the home page, then the system will show a form that allows the principal to upload a file of type “.xls/.xlsx”.</p> <p>-If the principal uploads a file that is not empty, then a table will</p>



					<p>appear that showcases the file data.</p> <p>After that, each admin will be added to the system. If the admin was added successfully then a message will appear next to the admin row on the table saying “Added” and the admin will be added in the database.</p> <p>-If the principal uploads a file that is not empty, then a table will appear that showcases the file data.</p> <p>After that, the admins will be added to the system. If the admin was not added successfully, then a message will appear next to the admin row saying, “Did not add”.</p> <p>-If the principal uploads a file that is not empty, then a table will appear that showcases the file data.</p> <p>If the admin’s email is already registered, then a message will appear next to the admin row saying, “email is already in use, did not add”.</p> <p>-If the principal uploads a file with a file extension other than “.xls/.xlsx”, then a message will appear saying “Only files with type .xls or .xlsx are allowed to be uploaded”.</p>
30	As an admin, I want to be able to add events so that I can make sure that I reached as much parents as possible.	5	Feature	Done	<p>-If the admin is on the homepage and clicks on the event tab and clicks the ‘Add event’ button, a window will appear with fields of the required information, which is the event name, event description and additional information which</p>



					<p>is an image of the event. After completing the form and clicking on ‘Submit’, a confirmation message will appear saying “The event was added successfully”.</p> <p>-If the admin is on the home page and clicks on the events tab and clicks on the ‘Add event’ button, a window will appear with fields of the required information. After leaving an empty required field and clicking on ‘Submit’, an error message will appear that says, “Please fill in all the required fields” and enable re-entering</p>
31	As an admin, I want to be able to edit events so that I can manage them effectively.	3	Feature	Done	<p>-If the admin is in the events tab and clicked on the ‘Edit’ button next to a specific event, then the system will enable the admin to edit the event information. After clicking on ‘Save changes’ the system will show a message saying, “all changes have been saved”.</p>
32	As an admin, I want to be able to delete events so that I can manage them effectively.	3	Feature	Done	<p>-If the admin is in the events tab and clicked on the delete icon next to a specific event, then the system will show a confirmation message saying, “event is deleted successfully”.</p>
33	As an admin, I want to be able to view events so that I can manage them effectively.	3	Feature	Done	<p>-If the admin is in the events tab, then a list of added events will appear.</p>
34	As an admin, I want to be able to inform students’ parents about their child absence so that I can work more efficiently.	5	Feature	Done	<p>-If the admin selects a class from the home page, then a list of students in that class will appear. After clicking on the ‘absent’ or</p>



					<p>'attended' button next to the students and clicking on 'Save attendance' button, a confirmation message will appear saying "The attendance has been marked successfully".</p> <p>-If the attendance has been marked previously in the day and the admin clicked on the 'Save attendance' button, then the system shall not allow the admin to take the attendance again and it will show an error message saying, 'The attendance has been marked previously'.</p>
35	As an admin, I want to be able to upload documents and forms so that the parents can view them and fill them in timely manner.	5	Feature	Done	<p>-If the admin clicks on the 'Add document' button in the documents tab, a window will appear with fields of the required information, which are the classes to be uploaded to, the document name, a field for uploading a document, and a field to either grant the student parent to upload a document to it or not. After filling in the form and clicking on 'Submit', a confirmation message will appear saying "The document was uploaded successfully".</p>
36	As an admin, I want to be able to delete uploaded documents and forms so that I can manage them probably.	3	Feature	Done	<p>-If the admin is in the documents tab and clicked on the delete icon next to a specific document/form under a class, then the system will show a confirmation message. After clicking on 'Yes', the system will delete the document for that class. The corresponding record of</p>



					the document will be deleted in the database if there are no other classes associated to it.
37	As an admin, I want to be able to edit uploaded documents and forms so that I can manage them effectively.	3	Feature	Done	<p>-If the admin is in the documents tab and clicked on the ‘Edit’ button next to a specific document then, the system will enable the admin to edit the document. After clicking ‘Save changes’ the system will show a message saying, “all changes have been saved”.</p> <p>-If the document was uploaded to multiple classes, then the document will be updated to all of them.</p>
38	As an admin, I want to be able to view the uploaded documents and forms by the parents so that I can manage them effectively.	5	Feature	Done	<p>-If the admin is in the homepage and clicks on a class, then a list of students registered in that class would appear. If the admin clicks on a specific student name, then their uploaded documents by their parents will appear in a new window.</p>
39	As an admin, I want to be able to access the pickup screen so that I can manage pickup easily.	3	Feature	Done	<p>-If the admin is in the homepage and clicks on pickup tab, then the system will navigate to the screen and the admin will be able to view the students’ names as they will appear in the screen when their parents/commissioner clicks on the pickup button in the application.</p> <p>If it has not been more than five minutes since the pickup button was clicked by the parent/commissioner, then the student names will appear in</p>



					<p>green, otherwise it will appear in white.</p> <p>-The screen will refresh every fifteen minutes and if the student name has been displayed for more than fifteen minutes then it will not be viewed again until the parent/commissioner presses the pickup button again.</p> <p>If the admin clicks on the commissioner button, then they will be navigated to view the one-time commissioner designated to pick up the student for today in the page. After the day ends the one-time commissioner information will be removed from view.</p>
40	As an admin, I want to be able to view notifications about uploaded documents and excuses from parents so that I can save my time.	3	Feature	Done	<p>-If the admin is in the homepage and clicks on a class, a list of students in that class will appear. A notification mark will appear next to a student name with the number of unchecked uploaded documents and excuses.</p>
41	As a teacher, I want to be able to login with my email and password so that I will be able to perform my functions.	2	Feature	Done	<p>-If the teacher goes to the log in page and enters a valid registered email and a valid password and chooses “Teacher” from the drop-down list, that indicates which type of user is logging in, then clicks on the ‘Log in’ button, then the system will navigate to the teacher’s home page.</p> <p>-If the teacher goes to the log in page and enters an invalid email or password and clicks on the ‘Log in’ button, then log in fails with an</p>



					<p>error message that says, “The username or password is wrong, please try again”, and enable re-entering credentials.</p> <p>- If the teacher selected the “Parent” user, then clicked on the ‘Log in’, then log in fails with an error message that says, “There are no record of a parent with the provided credentials” and enable re-entering credentials.</p> <p>- If the teacher selected the “Commissioner” user, then clicked on the ‘Log in’ button, then log in fails with an error message that says, “There are no record of a commissioner with the provided credentials” and enable re-entering credentials.</p> <p>-If the teacher goes to the log in page and leave the email field or the password field empty and clicks on the ’Log in’ button, then log in fails with an error message below the text field that was left empty that says, “Please fill in all the required fields” and enable re-entering credentials.</p>
42	As a teacher, I want to be able to log out so that I can protect my account from unauthorized users.	2	Feature	Done	<p>-If the teacher clicks on the logout button, then a confirmation message will pop up that says “Are you sure you want to log-out?”. If the teacher clicks on “Yes”, then the system will navigate to the login page.</p> <p>-If the teacher clicks on the ‘logout’ button, then a</p>



					confirmation message will pop up that says “Are you sure you want to log-out?”. If the teacher clicks on “No”, then the system will navigate to the teacher’s home page.
43	As a teacher, I want to be able to view my subjects so that I can perform my duties.	3	Feature	Done	-If the teacher is in the home page, then a list of assigned subjects will appear.
44	As a teacher, I want to be able to view classes so that I can perform my duties.	3	Feature	Done	If the teacher is in the home page, then a list of assigned classes will appear with it specified subject.
45	As a teacher, I want to be able to view students so that I can perform my duties.	3	Feature	Done	If the teacher clicks on the student’s button under a subject/class, then a list of added students in that subject/class will appear.
46	As a teacher, I want to be able to customize a subject’s grade distribution so that I can assess the students of the class appropriately.	3	Feature	Done	If the teacher is on the homepage and clicks on the grades button under a subject/class, then click on “customize grades”, a window will open to add, modify, and delete the assessments and their assigned grades. After the modifications and clicking on ‘Save’, a confirmation message will appear saying “The class assessment has been updated”.
47	As a teacher, I want to be able to upload class grades so that I can help parents keep track of their children’s grades.	3	Feature	Done	If the teacher is on the homepage and clicks on the grade button under a subject/class, then clicks on “upload class grades”, a window will open to enter the grades. After typing in the grades and clicking on post, a confirmation message will appear saying “The class students’ grade



					has been uploaded”, and all the students in the class will have unified grades.
48	As a teacher, I want to be able to upload student grades so that I can help parents keep track of their children’s grades.	5	Feature	To do	If the teacher is in the homepage and clicks on the grade button under a subject/class, then clicks on “upload student grades” a window will open showing the registered students in the subject/class. After clicking on a specific student name, a window will appear allowing the teacher to enter the student grades based on the specified distribution. After typing in the grades and clicking on ‘Post’, a message will appear saying “The student grade has been uploaded”.
49	As a teacher, I want to be able to update my account login information so that I can edit my account.	3	Feature	Done	<ul style="list-style-type: none"><li>- If the teacher is on the homepage and clicks on the profile icon, then the system will enable him/her to update her account information.</li><li>- If the teacher is on the update account page, then he/she will be able to change his/her office hours information.</li><li>- If the teacher is in the update account page and left one of the fields empty and clicks on the “Save” button, then the update fails with an error message below the text field that was left empty that says, “Please fill in all the required field” and enable re-entering.</li></ul>
50	As a teacher, I want to be able to reset my password so that I can	2	Feature	Done	-If the teacher is in the log in page and clicked on “Forgot



	log in to my account when I forget it.				<p>password?”, then the system will navigate to the reset password page where they can enter their email. If the email entered was registered in the system, then a link will be sent to the email that enables him/her to reset it.</p> <p>- If the teacher is in the log in page and clicked on “Forgot password?”, then the system will navigate to the reset password page where they can enter their email. If the email entered was not registered in the system, then an error message will appear saying “The email is not registered. Enter a registered email” and enable re-entering.</p>
51	As a parent, I want to be able to login with my email and password so that I will be granted the ability to perform my functions.	3	Feature	Done	<p>-If the parent goes to the log in page and enters a valid registered email and a valid password and chooses “Parent” from the drop-down list that indicates which type of user is logging in, then clicks on Log in button, then the system will navigate to the Parent’s home page.</p> <p>-If the parent goes to the log in page and enters an invalid email or password and clicks on Log in, then log in fails with an error message that says, “The username or password is wrong, please try again”, and enable re-entering credentials.</p> <p>- If the parent selected the “teacher” user, then clicked on</p>



					<p>Log in, then log in fails with an error message that says, “There are no record of a teacher with the provided credentials” and enable re-entering credentials.</p> <p>- If the parent selected the “Commissioner” user, then clicked on Log in, then log in fails with an error message that says, “There are no record of a commissioner with the provided credentials” and enable re-entering credentials.</p> <p>-If the parent goes the log in page and leave the email field or the password field empty and clicks on Log in button, then log in fails with an error message below the text field that left empty that says, “Please fill in all the required fields” and enable re-entering credentials.</p>
52	As a parent, I want to be able to log out so that I can protect my account from unauthorized user.	2	Feature	Done	<p>-If the parent clicks on the logout button, then a confirmation message will pop up that says, “Are you sure you want to log-out?”. If the parent clicks on “Yes”, then the system will navigate to the login page.</p> <p>-If the parent clicks on the logout button, then a confirmation message will pop up that says, “Are you sure you want to log-out?”. If the parent clicks on “No”, then the system will navigate to the parent’s home page.</p>



53	As a parent, I want to be able to view my children names so that I can differentiate between them.	3	Feature	Done	If the parent is in the homepage, then a list of their registered children will appear.
54	As a parent, I want to be able to view school events and activities so that I can know what they are doing at school and their needs.	2	Feature	Done	If the parent selects the events tab in the navigation bar, then a list of recent events will appear.
55	As a parent, I want to be able to view my child absence so that I can keep up with their attendance.	2	Feature	Done	If the parent, clicks on a child attendance button, then a list of unexcused absences will appear.
56	As a parent, I want to be able to upload excuses for absence so that I can help the school receiving them faster.	3	Feature	Done	<p>-If the parent clicks on the child attendance button, a list of unexcused absences will appear. The parent can press the paper-pencil icon and upload either a document or a written excuse. After clicking on 'Submit' a confirmation message will appear saying "The absence excuse has been uploaded".</p> <p>- If the parent clicks on the child attendance button a list of unexcused absences will appear, then the parent can press the paper-pencil icon and upload either a document or a written excuse. After clicking on 'Submit' and both fields are empty an error message will appear saying "Please fill in one of the fields" and enable re-entering.</p>
57	As an admin, I want to be able to view the students uploaded absence excuses, so that I can be informed about their absence reason.	5	Feature	Done	-If the admin is in the homepage and clicked on a class, then a list of students registered in that class will appear. If the admin clicks on a specific student name, then a



					table will appear with their absence and their corresponding excuses.
58	As a parent, I want to be able to view my child's grades so that I can keep track of his/her educational progress.	3	Feature	Done	If the parent clicks on the child's subjects' button, then a list of all the subjects that the student takes will appear. If the parent clicks on the 'Grades' icon, then the child grades in the subject will appear.
59	As a teacher, I want to be able to send a chat message to student's parents privately so that I can protect each student privacy.	5	Feature	Done	-If the teacher selects a class from the homepage and clicks on the "Chat" icon, the system will navigate to "viewing students for chat" page, that shows a list of students in that class. After clicking on one of the students, a private chat window with the students' parent will open.
60	As a parent, I want to be able to receive the messages my child's teacher so that I can be aware of everything the teacher sends.	5	Feature	Done	If the parent is in the homepage and received a message from teacher, then a red bubble will appear next to the "Chat" icon that is inside the child's subjects page, and in the home page, also a notification of the message will appear. After clicking on the 'Chat' icon, the system will navigate to the chat window with the subject's teacher.
61	As a parent, I want to be able to send messages to my child's teacher privately so that I can keep track of his/her progress or problems.	5	Feature	Done	- If the parent is on the home page and clicks on the child's subjects' button, a list of all the subjects that the child takes will appear and next to each one is a chat icon and a grades icon. After clicking on the chat icon next to a subject, a chat



					window will appear with the teacher of the subject.  - If the parent is on the private chat window, then the teacher office hours can be shown by clicking on the calendar icon.
62	As a teacher, I want to be able to receive students' parents chat messages so that I can be aware of any necessary situation.	5	Feature	Done	-If the teacher is in the homepage and received a message from a parent, then a red bubble will appear next to the student's name that is inside the “viewing students for chat” page, and a notification of the message will appear. After clicking on a student name, the system will navigate to the chat window with the student's parent.
63	As a teacher, I want to be able to broadcast a message with student's parents in the same class so that I can save time and effort.	5	Feature	Done	-If the teacher selects a class from the homepage, then clicks on the “Chat” icon, the system will navigate to “viewing students for chat” page that shows a list of students in that class. If the teacher clicks on the “Send to all” button, a text window will open. After typing the message and clicking on “Send”, the message will be sent to all student's parent in that class.
64	As a parent, I want to be able to receive broadcast messages from my child's teachers so that I can be aware of everything the teachers send.	5	Feature	Done	-If the parent is in the homepage and received a broadcast message from a teacher, then a red bubble will appear next to the “Chat” icon that is inside the child's subjects page and a notification of the message will appear. After clicking on the chat icon, the system will navigate to the private chat window with the subject's



					teacher which displays the broadcast message.
65	As a parent, I want to be able to view the documents uploaded from the schools' admins so that I can respond to them and fill them if needed.	3	Feature	Done	If the parent is in the homepage and clicks on the documents button under a specific child, then a list of uploaded documents from the school will appear.
66	As a parent, I want to be able to upload documents that were requested by the school so that I can submit it to them in a timely manner.	3	Feature	Done	-If the parent is in the homepage and clicks on the documents button under a specific child, then a list of uploaded documents by the school will appear. When the parent clicks on the upload icon next to a specific document then the page will navigate to the upload page where the parent can upload a document. After clicking on the upload button, if the parent uploaded document is submitted successfully, then a confirmation message will appear.
67	As a parent, I want to be able to notify the school about my arrival or someone else I delegated, so that I can save my time and keep the school aware of my child pickup status.	5	Feature	Done	<p>-If the parent is in the homepage and clicks on the pickup button, then a window will appear. After choosing "Me" and clicking on inform, a message will appear saying "The school has been informed".</p> <p>-If the parent is in the homepage and clicks on the pickup button and clicked on someone else, then a form will appear. After entering the required information of the delegated person for pickup and then clicking 'Inform', a message will appear saying "The school has been informed".</p>



					<p>-If the parent is in the homepage and clicks on the pickup button, then a window will appear. After clicking on ‘Inform’ without choosing any of the required information, an error message will appear saying “You should choose a form of pick up” and enable re-entering.</p>
68	As a parent, I want to be able to update my account login information so that I can edit my account.	3	Feature	Done	<p>- If the parent is in the homepage and clicks on the profile icon, then the system will enable him/her to update the account information. After clicking on “Save” button, a confirmation message will pop-up that says “Changes has been updated successfully”.</p> <p>- If the parent is in the update account page and left one of the fields empty and clicks on “Save” button, then the update fails with an error message below the text field that was left empty, says “Please fill in all the required field” and enable re-entering.</p>
69	As a parent, I want to be able to reset my password so that I can log in to my account when I forget it.	2	Feature	Done	<p>-If the parent is in the log in page and clicked on “Forgot password?”, then the system will navigate to the reset password page where they can enter their email. If the email entered was registered in the system, then a link will be sent to the email that enables him/her to reset it.</p> <p>- If the parent is in the log in page and clicks on “Forgot password?”, then the system will navigate to the</p>



					reset password page where they can enter their email. If the email entered was not registered in the system, then an error message will appear saying “The email is not registered. Enter a registered email” and enable re-entering.
70	As an admin, I want to be able to publish announcements so that I can inform the parents immediately.	2	Feature	Done	<p>-If the admin is in the home page and clicks on announcement tab then clicks publish announcement button, a window will appear with fields of the required information. After completing it and clicking on submit, a confirmation message will appear saying “The announcement was published successfully”.</p> <p>-If the admin is in the home page and clicks on announcement tab then clicks publish announcement button, a window will appear with fields of the required information. After leaving an empty field and clicking on submit, then an error message will appear that says, “Please fill in all the required fields” and enable re-entering.</p>
71	As an admin, I want to be able to view published announcements so that I can manage them properly.	3	Feature	Done	If the admin is in the announcement tab, then a list of published announcements will appear.
72	As an admin, I want to be able to delete published announcements so that I can manage them properly.	3	Feature	Done	If the admin is in the announcement tab, a list of published announcements will appear. After clicking on delete button next to a specific announcement, then the system



					will show a confirmation message. After clicking on confirm, the system will show a message saying “announcement has been deleted successfully”.
73	As an admin, I want to be able to edit published announcements so that I can manage them properly.	5	Feature	Done	If the admin is in the announcement tab, a list of published announcements will appear. After clicking on the edit button next to a specific announcement, the system will allow the admin to edit. After clicking ‘Save’, the system will show a message saying, “announcement has been changed successfully”.
74	As a parent, I want to be able to view the school’s notifications so that I don’t forget their updates.	5	Feature	Done	If the parent is in the homepage and clicks on the announcements tab, then a list of notifications from the school will appear.
75	As a parent, I want to be able to create authorized commissioner account so that I can assign him to pick up the child from the school.	3	Feature	Done	<p>-If the parent is in the homepage and clicks on “Commissioners” in the bottom navigation bar, the system will navigate to viewing current commissioners page with an “Add” button. After clicking on it, the system will show a form of the required information to complete the creation of an account for the commissioner. After filling it out and clicking on the “Add commissioner” button a message will appear saying “the commissioner has been added successfully”.</p> <p>-If the parent is in the homepage and clicks on “Commissioners” in</p>



					<p>the bottom navigation bar, the system will navigate to viewing current commissioners page with an “Add” button. After clicking on it, the system will show a form of the required information to complete the creation of an account for the commissioner. Leaving an empty field and clicking “Add commissioner” button, the creation process then fails with an error message below the empty text field that says, “Please fill in all the required fields” and enable re-entering.</p>
76	As a parent, I want to be able to update the authorized commissioner account so that I can manage their information.	3	Feature	Done	<p>-If the parent is in the homepage and clicks on “Commissioners” in the bottom navigation bar, the system will navigate to viewing current commissioners’ page. After clicking on the edit icon next to a specific commissioner, the system will show a pre-filled form of the account information of the commissioner. After editing the information and clicking on “Save” button, a message will appear saying “the commissioner information has been updated successfully”.</p> <p>-If the parent is in the homepage and clicks on “Commissioners” in the bottom navigation bar, the system will navigate to viewing current commissioners’ page. After clicking on the edit icon next to a specific commissioner, the system will show a pre-filled form</p>



					<p>of the account information of the commissioner. If a field was left empty and “Save” button was clicked, then the editing process fails with an error message below the empty field says, “Please fill in all the required fields” and enable re-entering.</p>
77	As a parent, I want to be able to delete the authorized commissioner account so that I can manage my children authorized commissioners.	3	Feature	Done	<p>-If the parent is in the homepage and clicks on “Commissioners” in the bottom navigation bar, the system will navigate to viewing current commissioners’ page. After clicking on the delete icon next to a specific commissioner, a confirmation message will appear saying ‘Do you confirm deleting the commissioner?’. After clicking yes, a confirmation message will appear saying ‘The commissioner is deleted successfully’.</p> <p>The corresponding record in the database will be deleted.</p>
78	As a commissioner, I want to be able to login with my username and password so that I will be able to perform my functions.	3	Feature	Done	<p>-If the commissioner goes to the log in page and enters a valid registered email and a valid password and chooses “Commissioner” from the drop-down list that indicates which type of user is logging in, then clicks on Log in button, then the system will navigate to the commissioner’s home page.</p> <p>-If the commissioner goes to the log in page and enter an invalid username or password and clicks on Log in, then log in fails with an</p>



					<p>error message that says, “The username or password is wrong, please try again”, and enable re-entering credentials.</p> <p>- If the commissioner selected the “teacher” user, then clicked on Log in, then log in fails with an error message that says, “There are no record of a teacher with the provided credentials” and enable re-entering credentials.</p> <p>- If the commissioner selected the “parent” user, then clicked on Log in, then log in fails with an error message that says, “There are no record of a parent with the provided credentials” and enable re-entering credentials.</p> <p>-If the commissioner goes to the log in page and leaves the username field or the password field empty and clicks on Log in button, then log in fails with an error message that says, “Please fill in all the required fields” and enable re-entering credentials.</p>
79	As a commissioner, I want to be able to log out so that I can protect my account from unauthorized users.	2	Feature	Done	<p>-If the commissioner clicks on the logout button, then a confirmation message will pop up that says “Are you sure you want to log-out?”. If the commissioner clicks on “Yes”, then the system will navigate to the login page.</p> <p>-If the commissioner clicks on the logout button, then a confirmation message will pop up that says, “Are you sure you want to log-</p>



					out?”. If the commissioner clicks on “No”, then the system will navigate to the commissioner’s home page.
80	As a commissioner, I want to be able to notify the school about my arrival, so that I can save my time.	5	Feature	Done	<p>-If the commissioner is in the homepage and clicks on the inform of arrival button next to a child, then a confirmation message will appear saying “The school has been informed”.</p>
81	As a commissioner, I want to be able to reset my password so that I can log in to my account when I forget it.	2	Feature	Done	<p>-If the commissioner is in the log in page and clicked on “Forgot password?”, then the system will navigate to the reset password page where they can enter their email. If the email entered was registered in the system, then a link will be sent to the email that enables him/her to reset it.</p> <p>- If the commissioner is in the log in page and clicks on “Forgot password?”, then the system will navigate to the reset password page where they can enter their email. If the email entered was not registered in the system, then an error message will appear saying “The email is not registered. Enter a registered email” and enable re-entering.</p>
82	As a user, I want the application to be available 99% of the time I try to access it, so that I don’t get frustrated and find another application to use.	NA	Feature	Done	-If there were more than 50 visitors on the application, then the application should be running.



					-If the application becomes unavailable, then it should re-operate within 24 hours.
83	As a user, I want to be able to learn how to use the application in less than an hour, so that I won't get frustrated and confused.	NA	Feature	Done	<ul style="list-style-type: none"><li>- If the user was going to use buttons or read labels then he/she should understand the meaning and idea of them.</li><li>- If the user was navigating through the system, then he/she shouldn't take more than 15 minutes.</li><li>- If a warning or a message was displayed, then it shouldn't have an unambiguous meaning.</li><li>- If the user was using one of the application pages, then the page layout should be organized and clear.</li></ul>
84	As a user, I want the application to support the Arabic language so that I can understand the terminologies.	NA	Feature	Done	The language in the interface of the application is written in Arabic.
85	As a user, I want the application to be provided on IOS and Android platform so that I can use it freely on different types of gadgets.	NA	Feature	Done	The application can run on both IOS and Android platform.
86	As a user, I want the application to show and return the results within 5-10 seconds of performing an action, so that I don't get impatient and frustrated.	NA	Feature	Done	<ul style="list-style-type: none"><li>-If the system is operating in high quality network it should return the results within 5-10 seconds.</li></ul>



					-If the system is operating in a poor-quality network, it should return the results in less than 2 minutes.
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## 4.3 System Design

This chapter displays and discusses our system design. First, the system architecture section showcases the product's organizational style by presenting the major systems/ subsystems and their inter-connections in a high-level view of how the responsibilities of the system were divided. Then, the second section presents the class diagram of the project. Finally, the component level section shows the key component logic and implementation using flowcharts and pseudocodes.

### 4.3.1 Architectural Diagram

In spite of all the different system architectures designed, the Client-Server architecture suited our needs in developing our application Halaqa. According to [4], Client-Server architecture is an architecture of a computer network in which several remote clients request a service from a hosting server. The client is any computing device that provides the interface to allow the user to request services from the server. While on the other hand, the server hosts, delivers and manages the resources to be consumed by the client. Servers typically wait for requests to arrive from clients and then respond to them accordingly. When the client machine receives the response it either re-represents the result that is returned by the server or uses it to render other results. Typically, the clients need not be aware of the hardware and software of the server.

In our Client-Server architecture shown in Figure 50, the client side is responsible for the presentation and graphical user interface as it interacts most closely with the user, and it is divided into two parts: the mobile application for parents and teachers, and the website for school administration staff and principal. The website makes it easier for school staff to manage the multiple classes and students in school settings. The mobile application is more suitable for parents and teachers for easier access and management on-the-go for their children. The client side is also responsible for storing and retrieving a partial set of necessary data. In the mobile application, data may be stored on the local storage of the mobile for the purpose of providing



a better user experience. The client side is also responsible for generating the communication with the server for data access.

The server side is responsible for data authentication, storing data, and retrieving data from the database. Servers are always listening to clients' requests. When the client requests to login into the application, the web server authenticates the client's entered information based on the stored data in the database. Also, the server retrieves any stored data that is needed for the application when the client requests them.

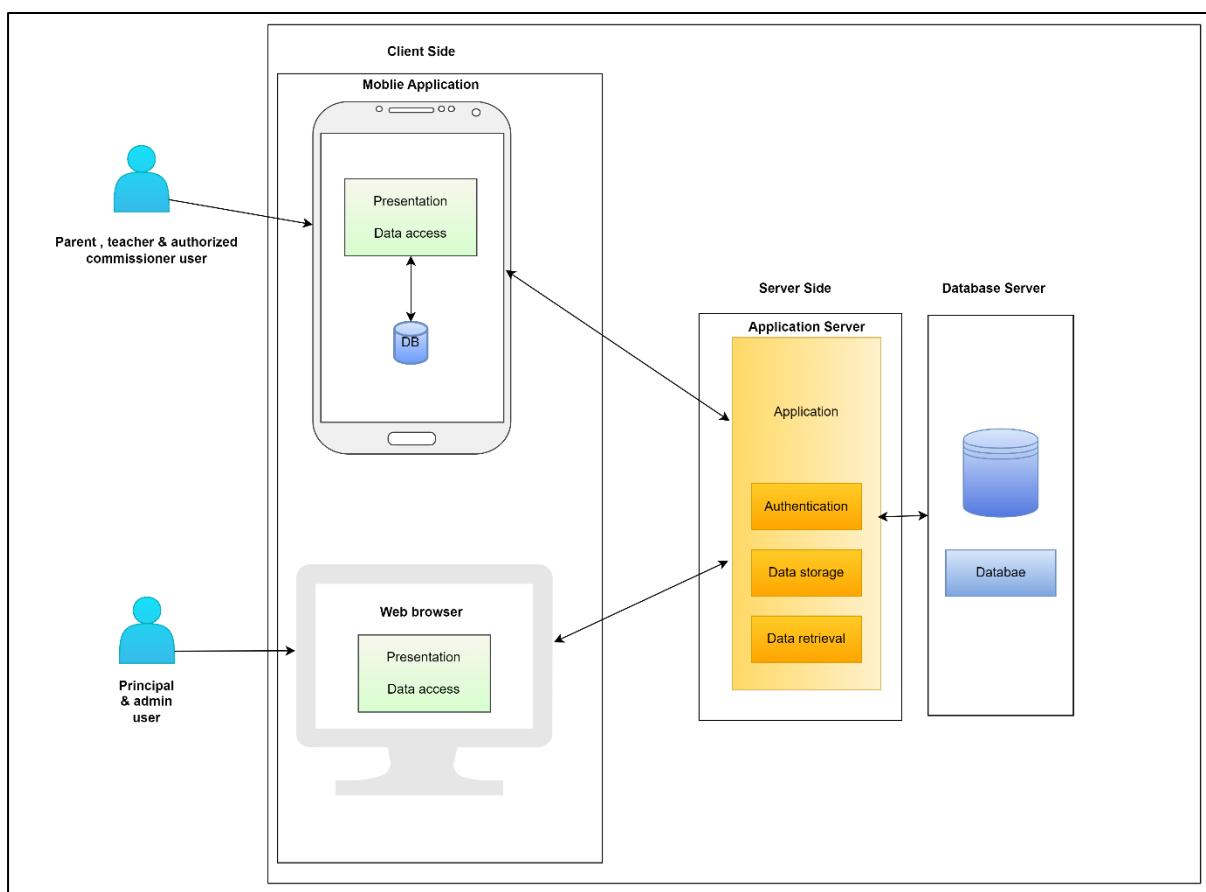


Figure 50: Halaqa system architecture



#### 4.3.2 Class Diagram

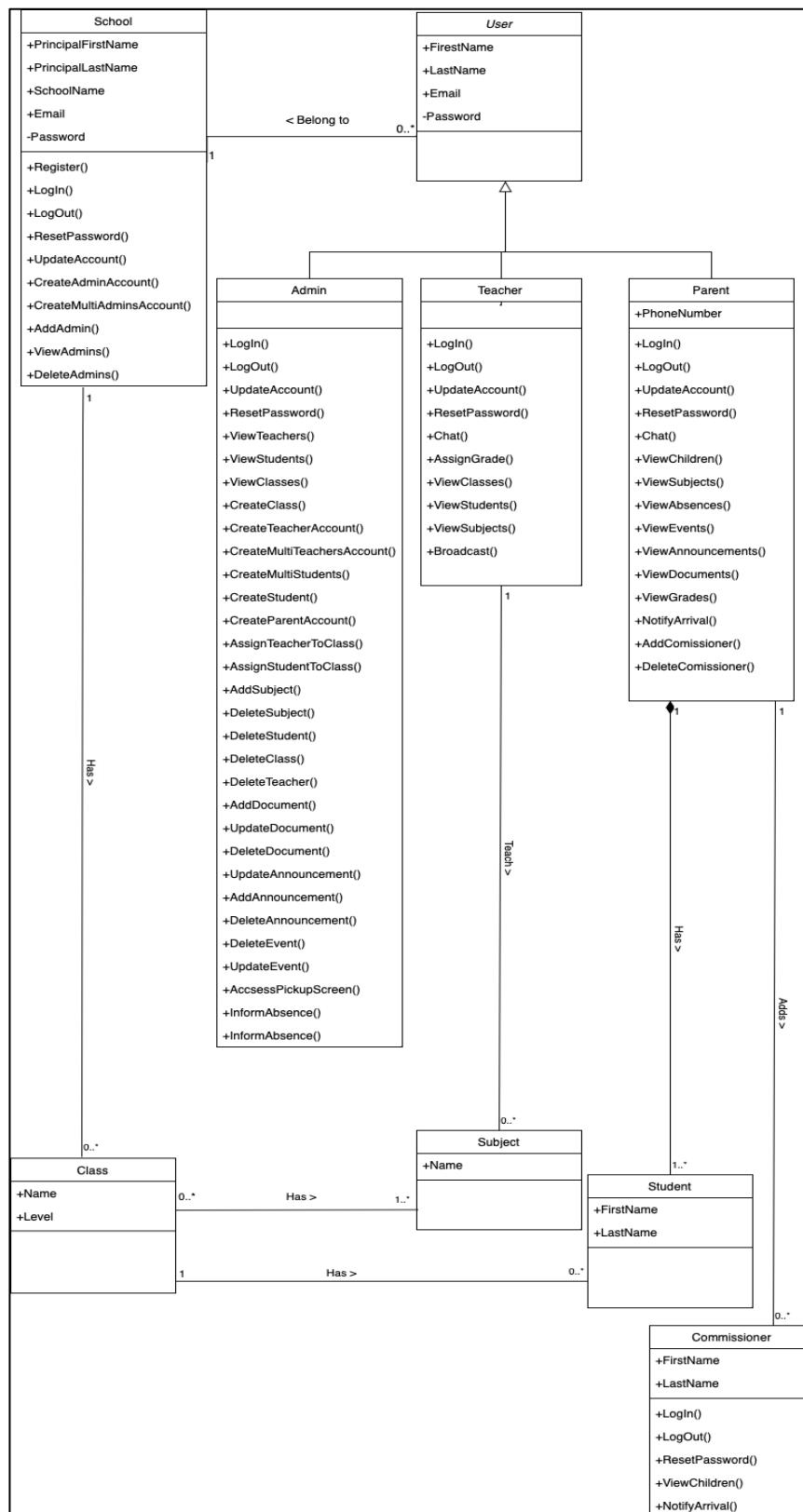


Figure 51: Halaqa class diagram



### 4.3.3 Component Level Design

In this section, (Halaqa) key components for this release are represented using flowcharts and pseudocodes. The four key components are adding a student, uploading class grades, displaying the pick-up screen, and informing the school about arrival for student pick-up.

#### 4.3.3.1 Add student Function Flowchart

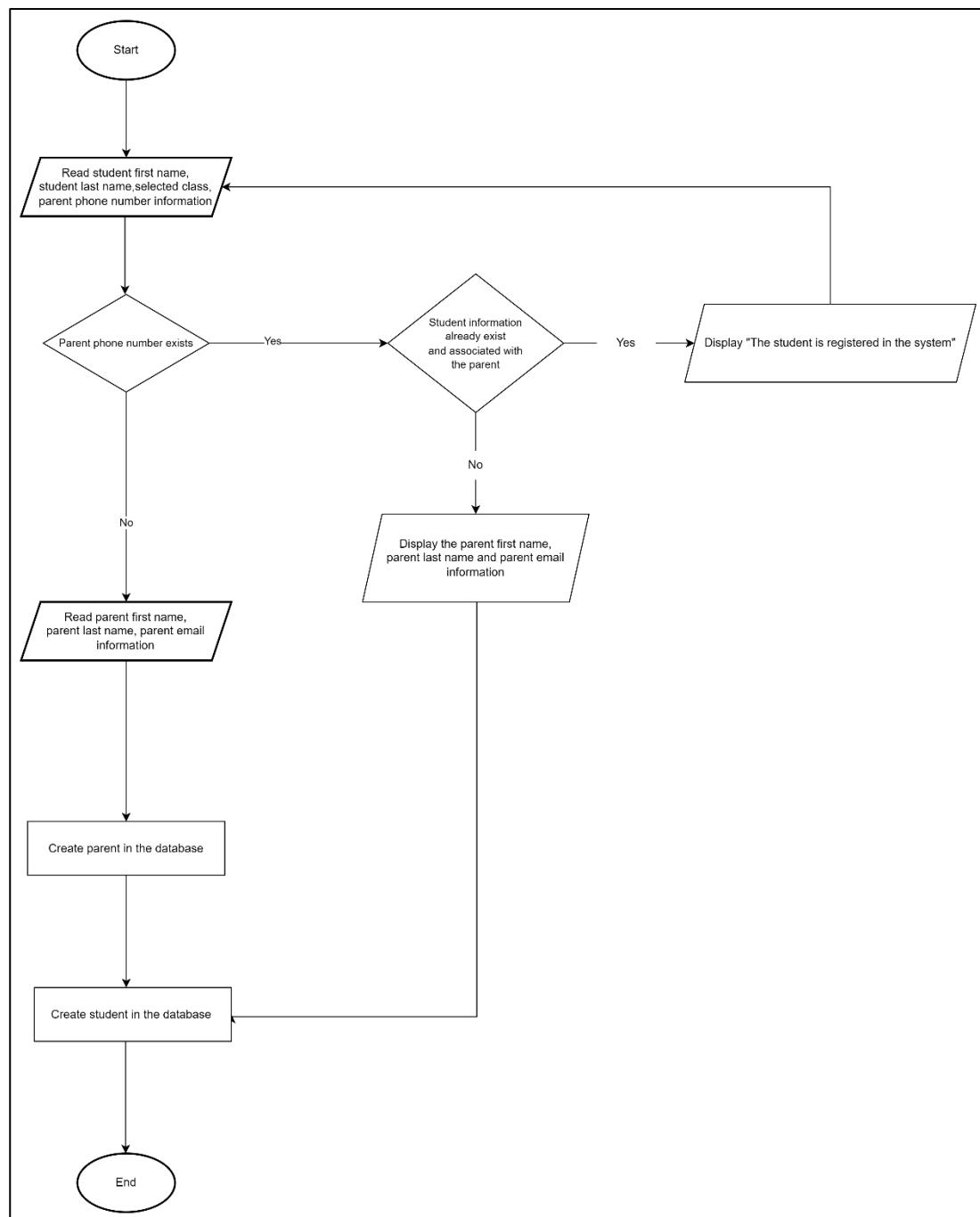


Figure 52: Add student function flowchart.



#### 4.3.3.2 Add Student Function Pseudocode

**Classification:** Function.

**Definition:** The admin will be able to add a student for a class in the school.

**Pre-condition:** no pre-condition.

**Post-condition:** The system shall add the student to the school.

**Pseudocode:**

1. **START**
2.   **INPUT** studentFirstName, studentLastName, parentPhoneNumber, selectedClass
3.   **IF** parentPhoneNumber exist in the school data, **THEN**
4.       **IF** student entered information already associated with the parent phone number  
**THEN**
5.           **DISPLAY** "The student is registered in the system."
6.       **ELSE**
7.           **DISPLAY** parentFirstName, parentLastName, parentEmail.
8.       **END IF**
9.       **ELSE**
10.      **INPUT** parentFirstName, parentLastName, parentEmail.
11.      Create parent in the database.
12.      **END IF**
13.      Create student in the database.
14. **END**



#### 4.3.3.3 Upload Class Grades Function Flowchart

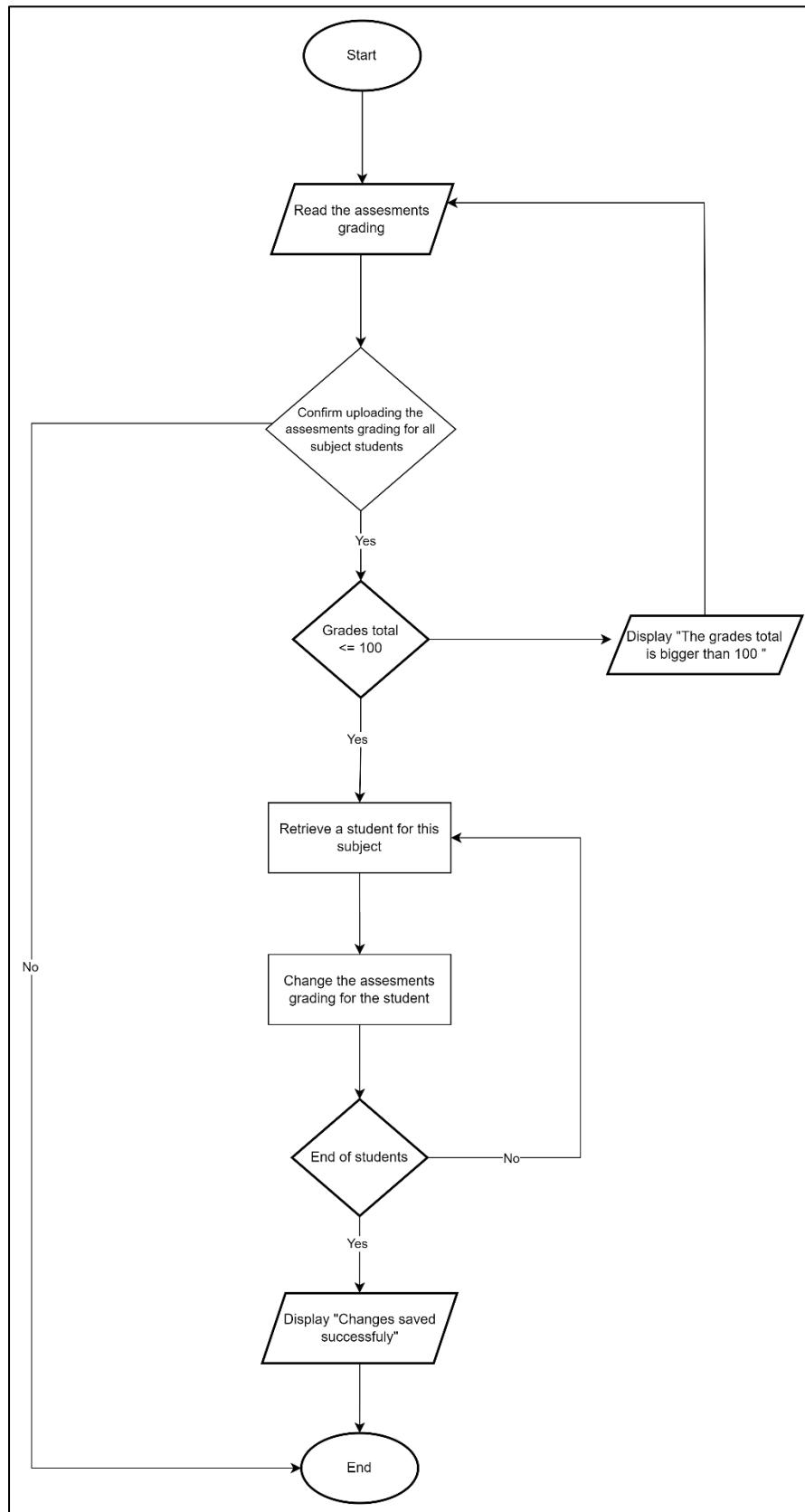


Figure 53:Upload class grades function flowchart



#### 4.3.3.4 Upload Class Grades Pseudocode

##### **Classification: Function**

**Definition:** The Teacher will be able to upload unified grades for all students in a class subject.

**Pre-condition:** no pre-condition.

**Post-condition:** The system shall upload unified grades for all students registered in a class subject.

##### **Pseudocode:**

- 1. START**
- 2. INPUT** assessments grading
- 3. IF** user confirm uploading the assessments grading for all subject students **THEN**
- 4. IF** grades total  $\leq 100$  **THEN**
- Retrieve the students of the subject
- 6. While** NOF subject students **THEN**
- Change the assessments grading for the student.
- 8. END WHILE**
- 9. DISPLAY** “Changes saved successfully”
- 10. ELSE**
- 11. DISPLAY** “The grades total is bigger than 100”
- 12. END IF**
- 13. END IF**
- 14. END**



### 4.3.3.5 Inform School About Arrival for Student Pick-up by Parent Function Flowchart

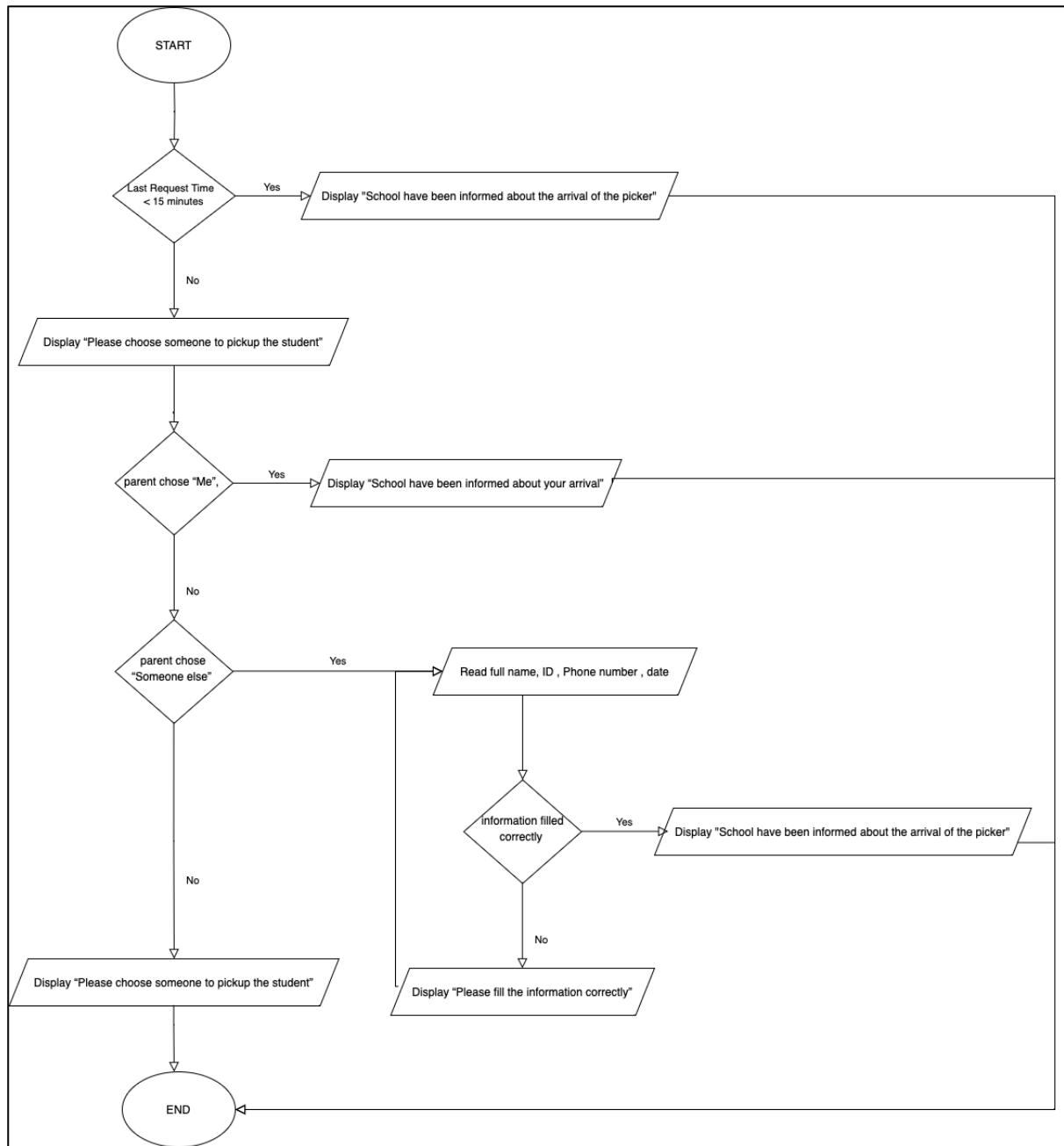


Figure 54 Inform school about arrival for student pick-up by parent function flowchart.



#### 4.3.3.6 Inform School About Arrival for Student Pick-up by Parent Function Pseudocode

**Classification:** Function.

**Definition:** The parent will be able to notify the school of their arrival or someone else to pick up their child.

**Pre-condition:** no pre-condition.

**Post-condition:** The system shall save the student pick up condition and notify the school of their arrival to pick up their child.

**Pseudocode:**

1. **START**
2.     **IF** request has not been made in the last 15 minutes **THEN**
3.         **DISPLAY** “Please choose someone to pick up the student.”
4.         **IF** parent chose “Me”, **THEN**
5.             **Display** “School have been informed about your arrival.”
6.         **ELSE IF** parent chose “Someone else” **THEN**
7.             **Read** Full name, ID, Phone number , Date
8.             **IF** information filled correctly **THEN**
9.                 **Display** “School have been informed about the arrival of the picker.”
10.          **Else**
11.             **Display** “Please fill the information correctly” and **Return** to Step 7
12.          **END IF**
13.          **ELSE**
14.             **DISPLAY** “Please choose someone to pick up the student.”
15.          **END IF**
16.          **END IF**
17.          **ELSE**
18.             **Display** “School have been informed about the arrival of the picker.”
19.          **END IF**
20. **END**



#### 4.3.3.7 Display Pick-up Screen (School side) Function Flowchart

The following figure shows the flowchart for displaying the pick-up page in the web application. Note that this page is automatically refreshed periodically to stay updated.

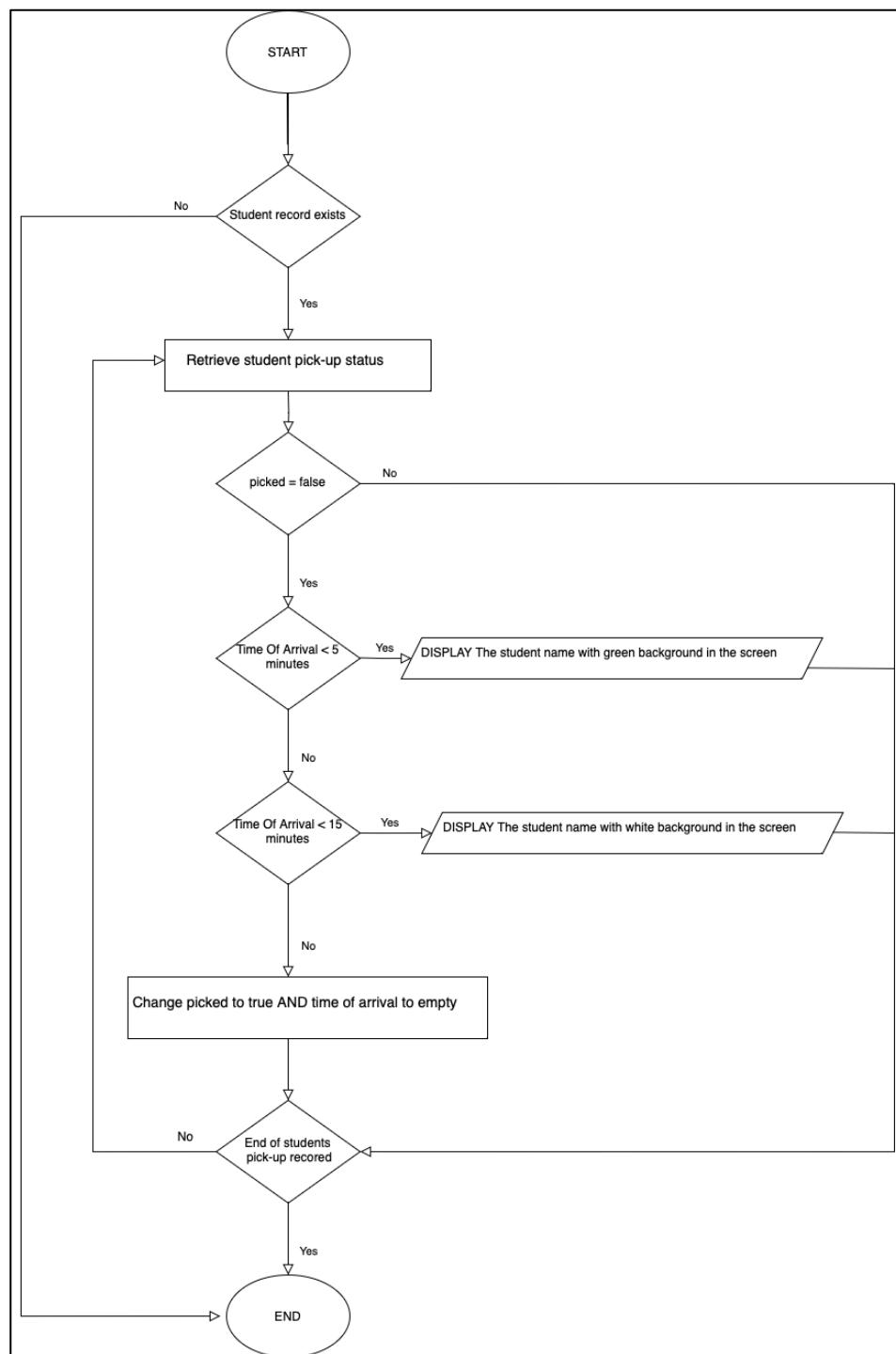


Figure 55 Display Pick-up Screen (School side) Function Flowchart



#### 4.3.3.8 Pick up Screen (School side) Function Pseudocode

**Classification:** Function.

**Definition:** The admin will be able to view students that are ready to be picked up.

**Pre-condition:** no pre-condition.

**Post-condition:** The system shall view the students in the pickup screen.

**Pseudocode:**

1. **START**
2.     **WHILE** student pick-up record exists **THEN**
3.         **Retrieve** student pick-up record
4.         **IF** picked is false, **THEN**
5.             **IF** time of arrival is less than 5 minutes **THEN**
6.                 **DISPLAY** The student name with green background in the screen
7.             **ELSE IF** time of arrival is less than 15 minutes **THEN**
8.                 **DISPLAY** The student name with white background in the screen
9.         **ELSE**
10.         **Change** picked to true **AND** time of arrival to empty
11.         **END IF**
12.         **END IF**
13.         **END WHILE**
14. **END**



## 4.4 Data Design

Our system uses a NoSQL database that is provided by firebase which is Firestore. Firestore stores data as documents inside of collections. Collections can be considered as the table and the documents as rows. In this section, the current data structure for its contents is visualized as an ER diagram and a hierarchical database model.

### 4.4.1 Data Models

#### 4.4.1.1 ER Diagram

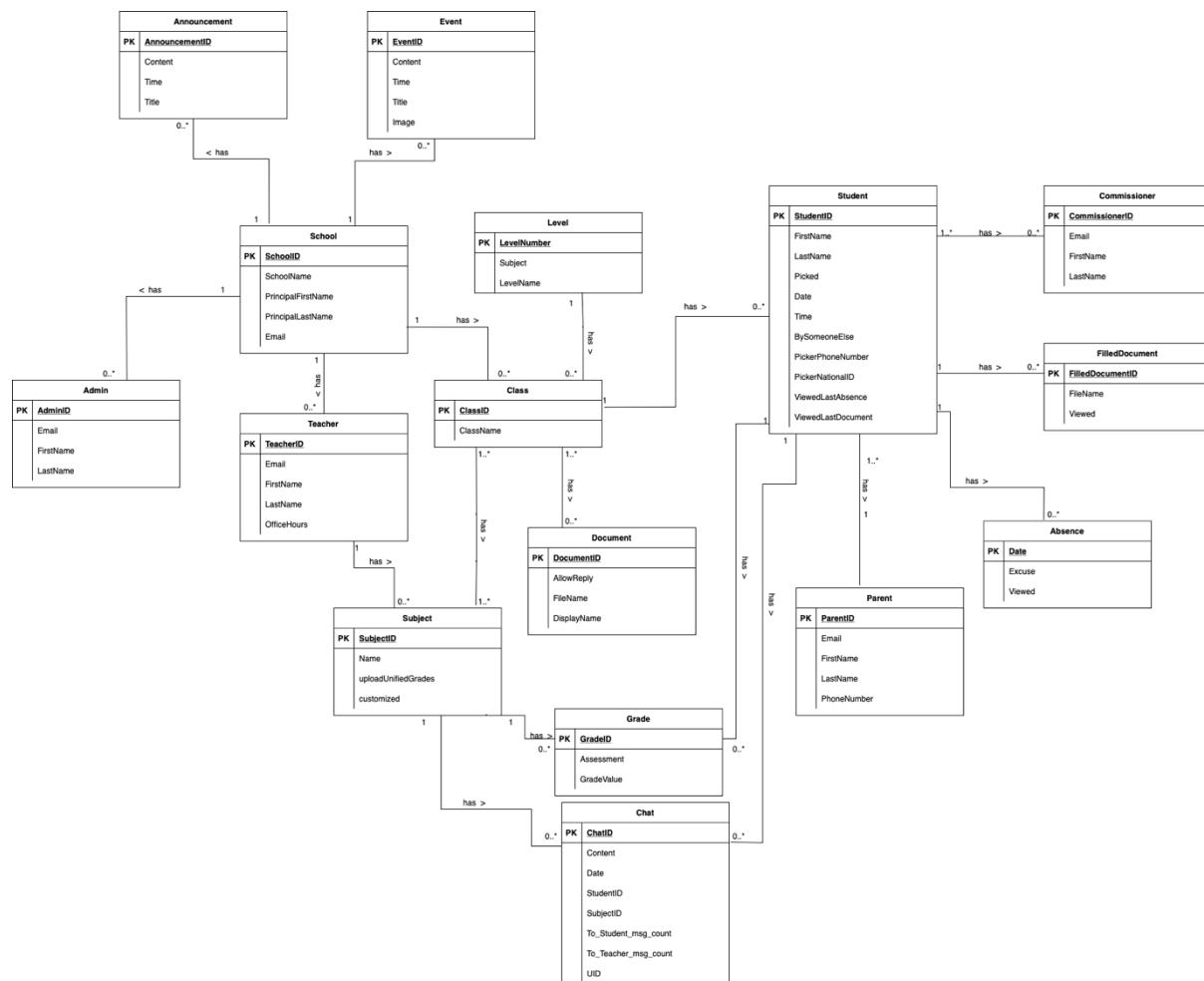


Figure 56 Halqa ER diagram



#### 4.4.1.2 The Hierarchical Database Model

Figure 57, In our system the main document is the “School” document which includes the fields that identify the school and the sub-documents that are embedded to it. The sub-documents are the Admin, Class, Teacher, Parent, Student, Event, Announcement, Documents, Chat and Commissioner documents. According to [23] in G11, “a document shouldn’t be embedded if it at one time will be accessed alone”. This is why the student document was not embedded in the parent and class document, as at multiple occasions the student document must be accessed alone, it was then referenced in the parent and class documents using an array of reference called “Students”. Also, that is why the Commissioner document was not embedded in the student document, as it could be accessed alone, however, the Student document contains an array of Commissioners references as a student can have more than one commissioner and in the Commissioner document there is an array of Student references as a commissioner can also be authorized to pick up more than one student. In addition, in the Class document an array of references is used for the Document document and in the Document document there is an array of Class references as a Class could have more than one document and a document can be posted for more than one class for that, the Document cannot be embedded inside the Class or the Class inside the Document as they at multiple occasions must be accessed alone. The Class document contains its own sub-document which is the Subject document. Following G5 in [23], Subject is embedded to a Class since it is dependent on it, as a subject of a class won’t exist if a class didn’t exist. The Class document also contains an array of references for the students that attend the class. Following that the Absence, FilledDocument and Grades sub-documents are embedded in the Student document as they strongly related and dependent on it. Moreover, in the Teacher document following G12 in [23], an array of reference is used for the subjects since the teacher is in the many sides of the relationship, as a teacher can teach multiple subjects, but a subject for a certain class can only be taught by one teacher. Outside of the School document there is a stand-alone document called Level which contains a static array of subject names for each level, according to Saudi schools. These names are used to populate the subject document for a class at the time of its creation as initial subjects. These subjects per level are stored in the database for easier maintainability to update when the Saudi schools change their subject for a level. Since the Level document is not dependent on one school it is not embedded inside the school document to avoid redundancy. However, inside



the Class document there is a level reference to make it possible for a Class to retrieve the subjects of its level.

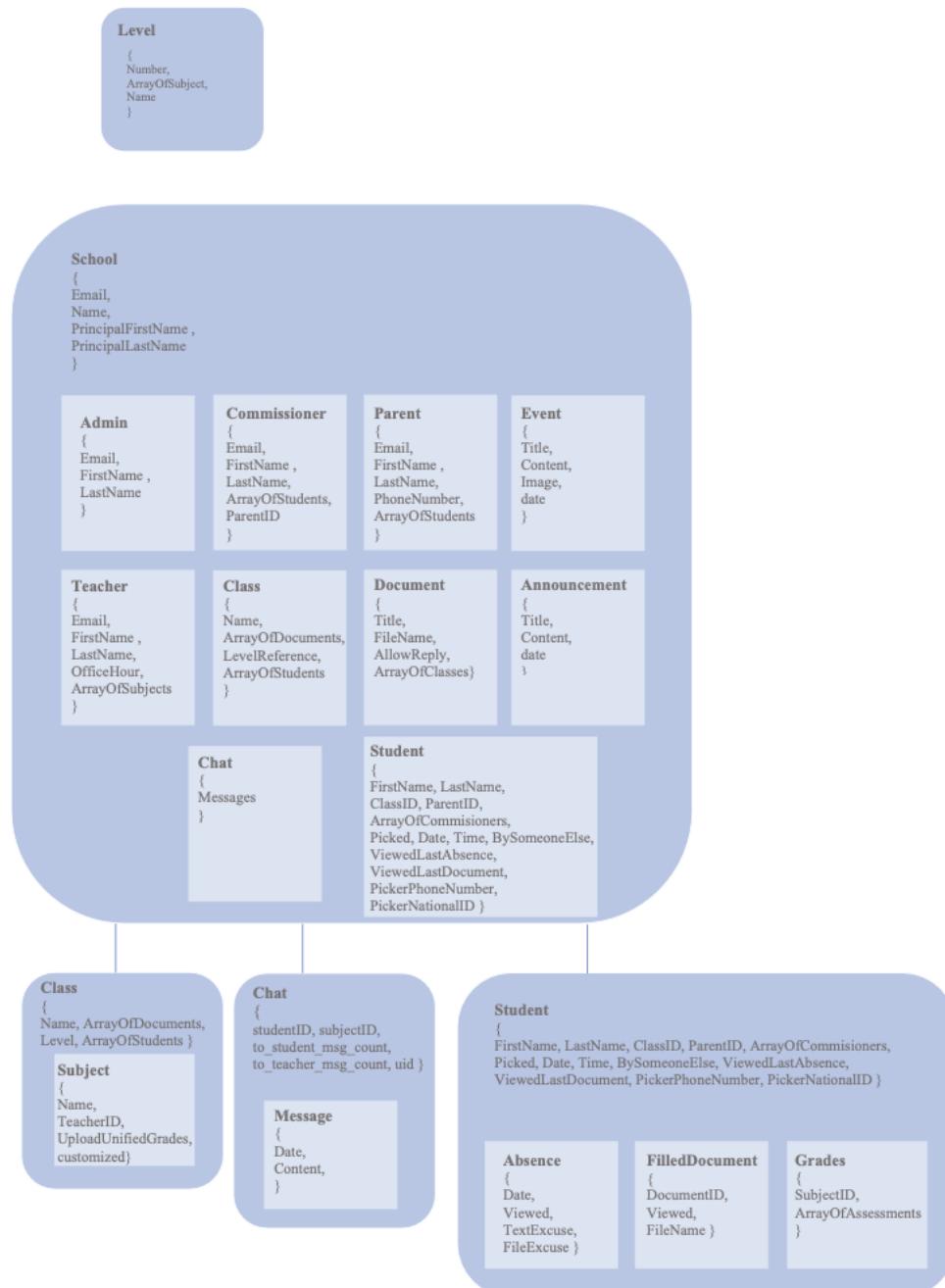


Figure 57 Level and School collections



Figure 58 clarifies the hierarchy of the collections and subcollections.

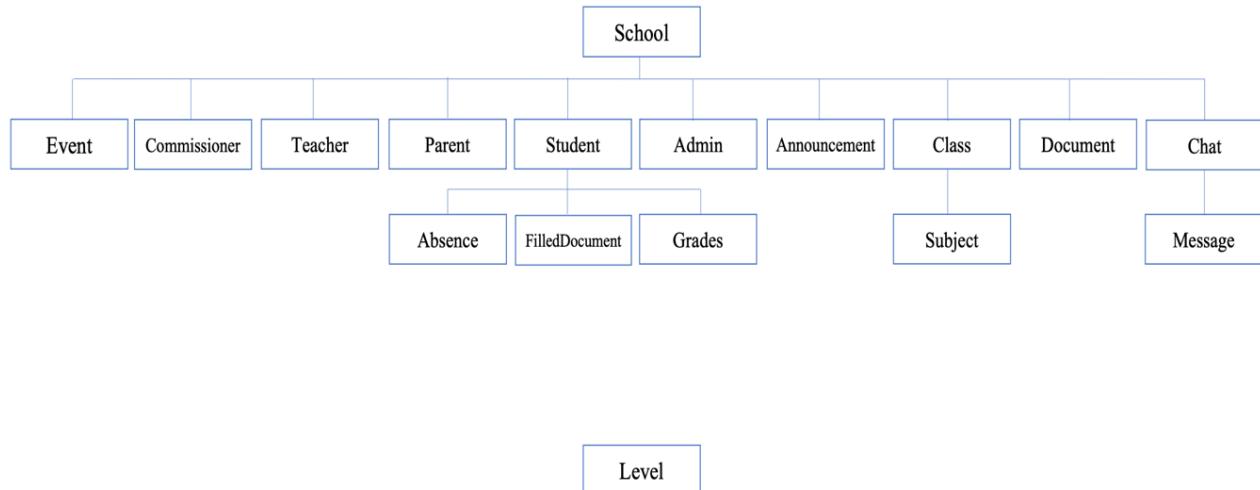


Figure 58 Halaqa Hierarchical diagram



## 4.5 Interface Design

This section shows the website's structure using a sitemap and a navigation diagram for both the principal and the admins interfaces. The mobile application structure is presented using a sitemap and a navigation diagram for the teacher, parent, and authorized commissioner. Following that, the user experience guidelines that are used in the implementation and design are listed and discussed. Finally, our design choices are explained to show the justification for some of the main parts of our interface design.

### 4.5.1 Sitemap

According to [19], a sitemap is hierarchical diagram of the pages on a website or application, that starts with the home page being at the top of the hierarchy. The following sections illustrate Halaqa page hierarchy for the principal, admin, teacher, parent, and authorized commissioner respectfully.

#### 4.5.1.1 Principal Interface Sitemap

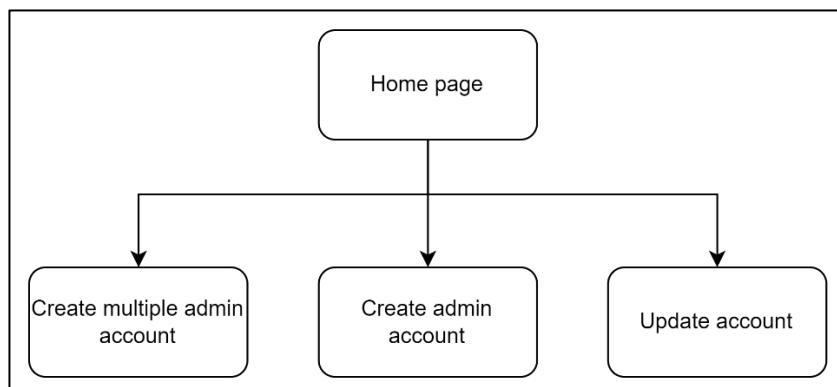


Figure 59: Principal sitemap



### 4.5.1.2 Admin Interface Sitemap

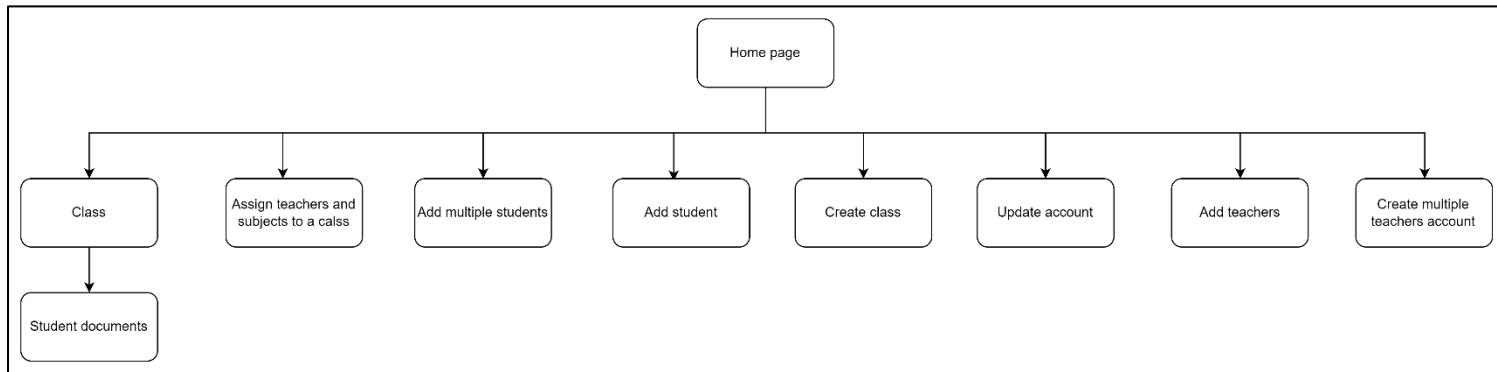


Figure 61: Admin interface sitemap part 1

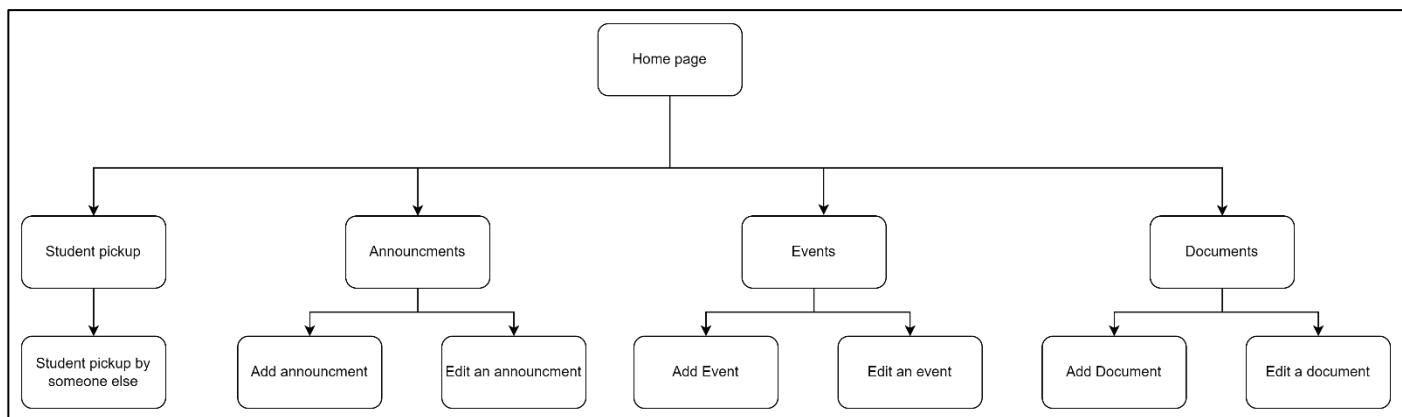


Figure 60: Admin interface sitemap part 2

### 4.5.1.3 Teacher Interface Sitemap

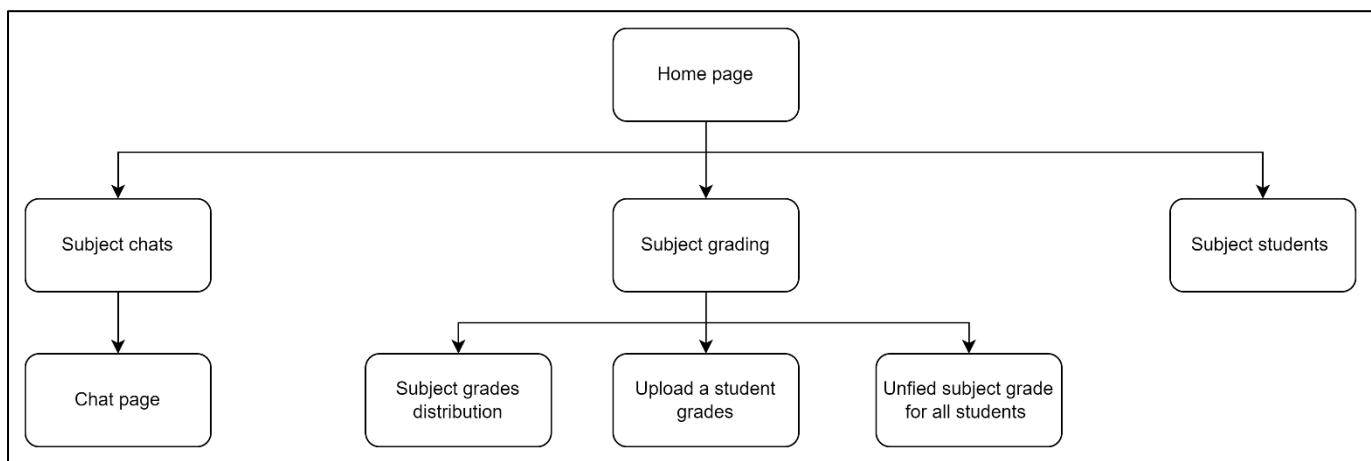


Figure 62: Teacher interface sitemap



#### 4.5.1.4 Parent Interface Sitemap

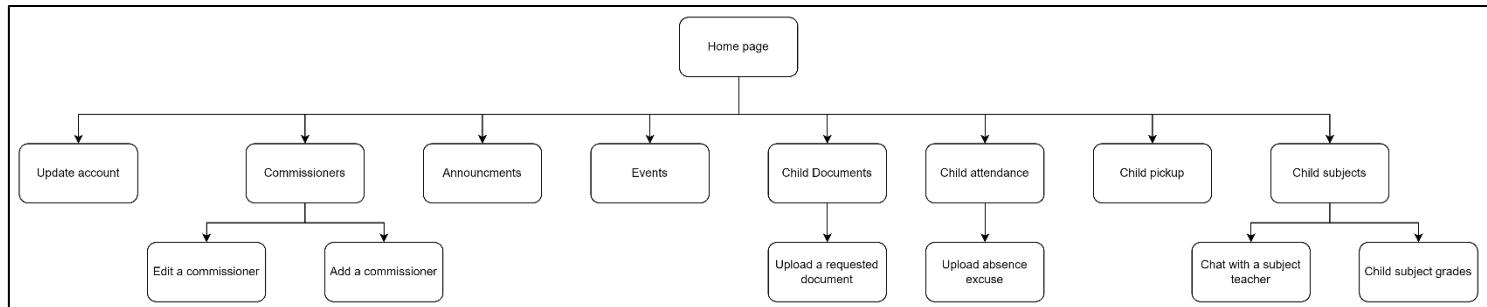


Figure 63: Parent interface sitemap

#### 4.5.1.5 Authorized Commissioner Interface Sitemap

Halaqa allows the authorized commissioners to only notify their arrival to the school to pick up a student. Therefore, it is suitable to provide a single page interface to perform their functionalities.



Figure 64: Authorized commissioner interface sitemap



#### 4.5.2 Navigation Diagram

According to [20], navigation diagrams are used to provide an overview of how the entire system will link together and how the user is expected to navigate between the different interfaces.

##### 4.5.2.1 Principal Interface Navigation

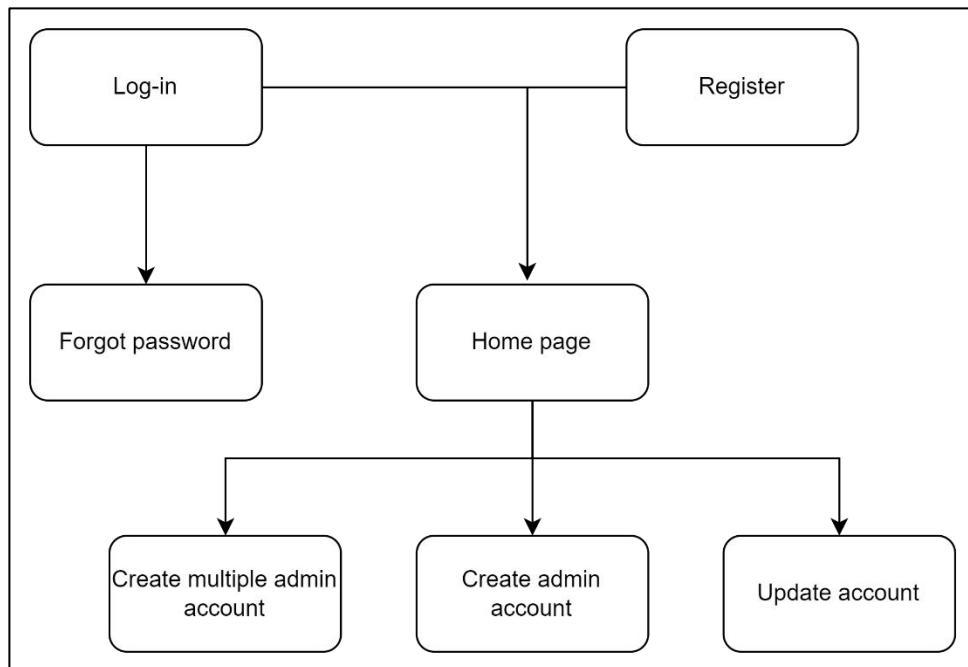


Figure 65: Principal navigation diagram



### 4.5.2.2 Admin Interface Navigation

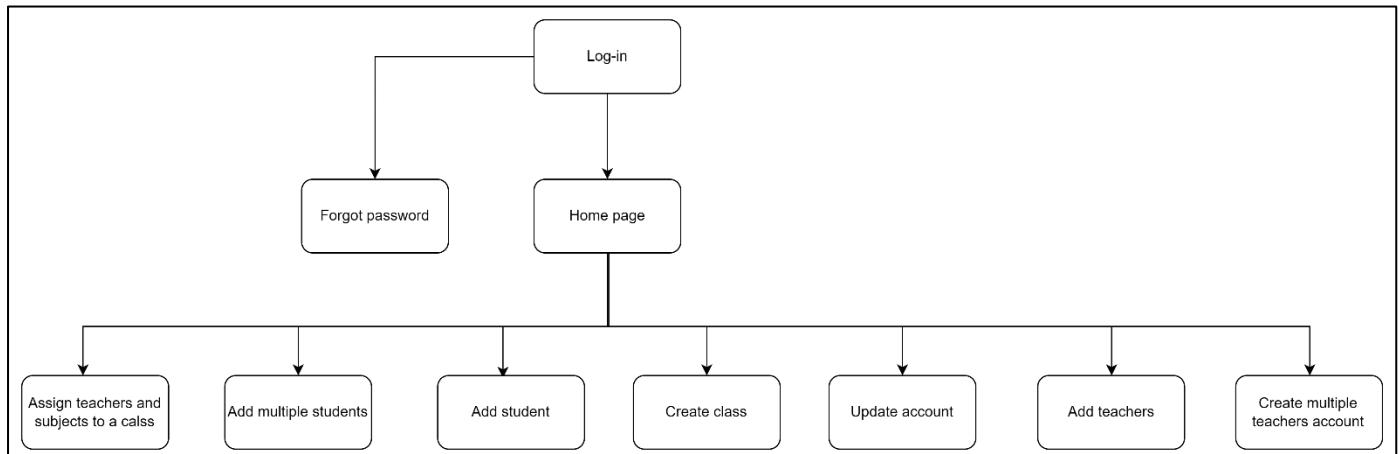


Figure 66: Admin interface navigation part 1

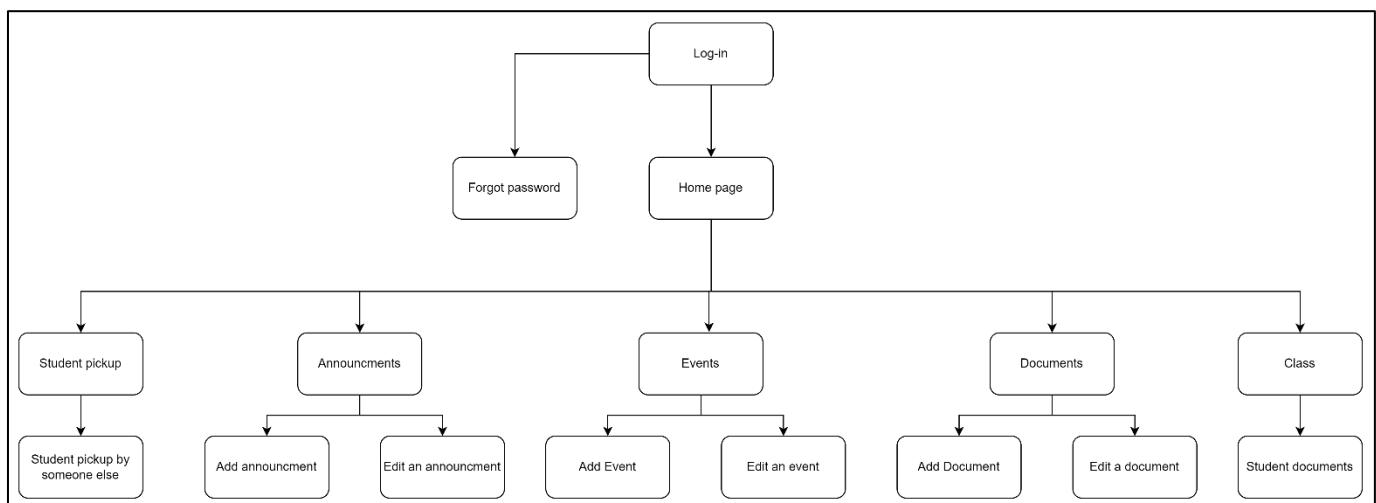


Figure 67: Admin interface navigation part 2



### 4.5.2.3 Teacher Interface Navigation

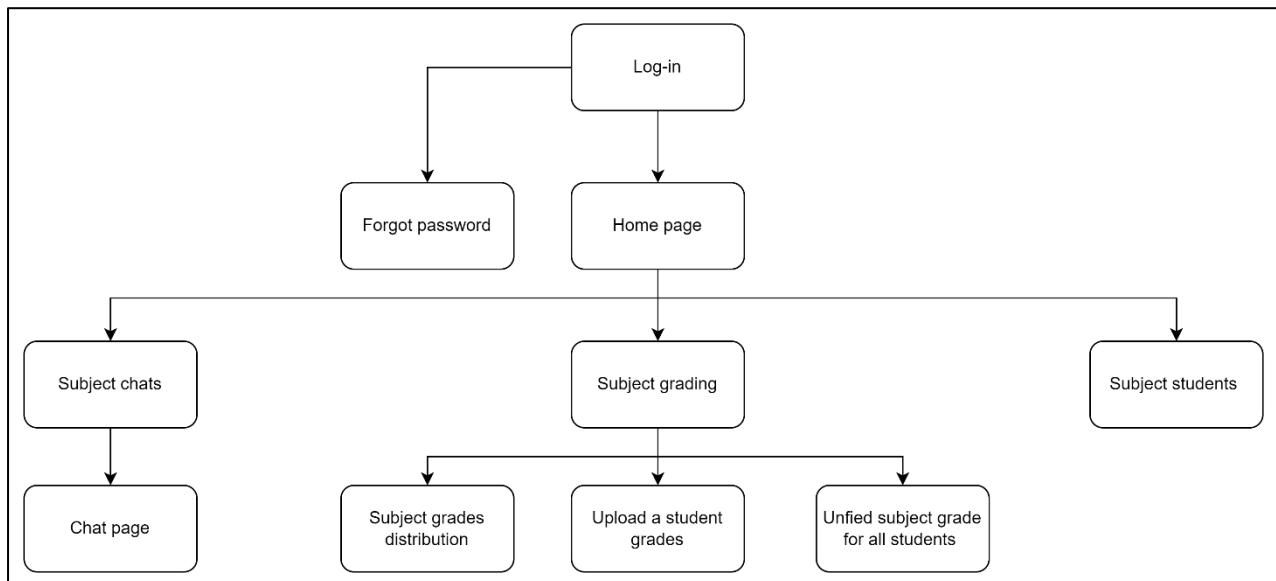


Figure 68:Teacher interface navigation

### 4.5.2.4 Parent Interface Navigation

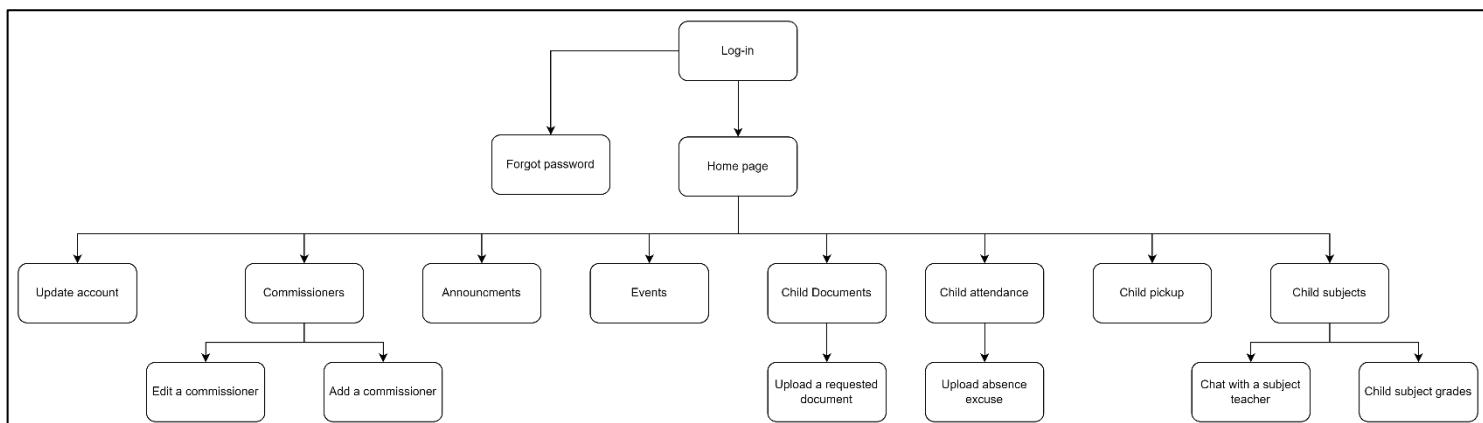


Figure 69:Parent interface navigation



#### 4.5.2.5 Authorized Commissioner Interface Navigation

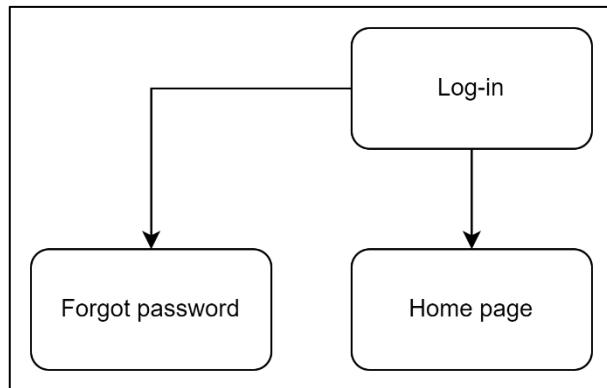


Figure 70:Authorized commissioner interface navigation



#### 4.5.3 User Experiences (UX) Guidelines

The following user experience guidelines are used to design the application:

- Match between the system with the real world:

According to [21], users don't understand technical jargon, it's essential to speak the users' language. This includes using words and phrases that are familiar. In our user interface, we have used the same phrases that are used by the educational field in order to make users familiar with the system.

- Consistency and standards:

By maintaining consistency in our user interface, we have avoided making users learn something new. According to [21], sticking to the industry standards reduces the cognitive load for the user. In our user interface, the icons and images corresponded to predictable outcomes and are consistent to external applications, such as the delete button, which is represented by a trash can symbol and log out button which is represented by an open door to exist.

- Error prevention:

As users usually tend to slip and make errors, in our user interface design we have provided clear alert and confirmation messages when the user slips in order to make them re-apply their actions correctly or back up from any unwanted action.

- Aesthetic and minimalistic design:

According to [21], minimalist designs are currently dominating the user interfaces as they streamline an interface that only includes relevant information for the user. Keeping unimportant components in the interface reduces the relative visibility and importance of the key elements. This is why in our user interface we have adopted a minimalist design as the components are minimal and vital to the user.

- Help users recognize, diagnose, and recover from errors:

According to [21], users want autonomy and control. Therefore, in our interface design we have helped the user to recognize, diagnose and recover from mistakes independently. As clear, plain language error messages are displayed which then offers a constructive solution for the user to follow and accomplish their task.



#### 4.5.4 Design Choices

This section focuses on the justification behind interface design decisions. Effective interface design requires not only aesthetically pleasing elements but also thoughtful and strategic choices that assist the user. In this section, we will examine the reasoning behind various design decisions and explore the benefits of those choices.

- Why students cannot be added before assigning them to a class?

Since our application focuses on communication between the parents and school, the only method to fully make the communication successful and fluid is through the classes. For example, teachers are assigned to classes not students. Also, if it was possible to add a student without a class, admins may forget to assign them to a class. Since most of the features depend on or support communicating through a class, this will make the application complicated and useless for the school and parents if the student was not assigned.

- Why must users choose their role in the login process?

When a user logs in, the system searches all the documents of that role in the database to check if the user exists. Then it redirects the user to the right interface. Since Halaqa has different types of users, if the user did not specify his/her role, the checking process will take longer time as it must search all the database documents and not only the related documents of their specified role. Many websites use this strategy, so it is familiar to many users, and an easy step that saves the user's time and thus improves the responsiveness and user experience of the application.

- Why are events and announcements separated?

Even though both features are important, announcements are timely urgent messages that need to be checked regularly. An example for an announcement is a change in time for start and end of classes. An example of an event is an upcoming open day in the school. We separated them to organize the admins and parents' tasks.



- Why is the pickup screen displayed as two columns?

Our goal is to display as many names as possible but also make it readable for everyone. After testing 3 columns on real screens, it was harder to read than 2 columns. When we tried using 1 column, there was so much empty space. Therefore, we decided that 2 columns are the ideal representation.

- Why are students' names displayed on the pickup screen for 15 minutes?

15 minutes is a common time frame used for this type of feature in many similar systems. This time period is typically considered long enough to give the school sufficient notice of student's readiness for pickup, without causing too much inconvenience for the parents or the school. Additionally, displaying the names for a fixed period of time helps ensure that the system is efficient and does not cause any unnecessary delays or confusion. It helps to create a clear and predictable schedule for both parents and school staff, which can ultimately lead to a smoother pickup process overall.

From the feedback we collected during the interviews with school staff, the average duration for the pickup process is between 5 and 10 minutes. Thus the 15 minutes time window is usually enough to finish the pickup process. In the case when this time is not enough, the parent or the commissioner can renew this time window by informing the school again about the pickup.

We have considered adding a button for the parent or the commissioner in the pickup page to inform the school that they have finished picking-up the child. In this case, the pickup time window could be open, and the child's name will remain in the pickup screen, until this button is clicked. However, we thought that this task could be a burden for the parent or the commissioner, so they will probably not do it since it does not affect them directly or they forget to do it. The problem here is that their names stay in the pickup screen and clutter it, preventing a clear view for the students who actually need it because they were not picked-up yet.

In the pickup screen, names that were informed about pickup in the last 5 minutes are colored green, while the remaining names are white. This is to make it easier for students following the screen to see the newly added names and arrived parents and commissioners. Thus, the application prevents a parent or a commissioner for a student



from clicking the arrival informing button multiple times in a row in the 15 minutes time window after the last arrival information, to prevent the student's name keep appearing in green, misleading the people who are following the pickup screen.

- Why can parents schedule pickups on weekends?

Some schools may offer extracurricular activities or weekend events that require students to stay on campus outside of normal school hours. Allowing parents to schedule pickups on weekends can make it easier for them to participate in these activities without worrying about transportation logistics. Overall, providing the option for weekend pickups can be a useful feature for parents who require flexibility in their schedules, and can help ensure that students are picked up in a timely and safe manner.

- Why when an admin adds a subject for a class, it is not added for other classes of the same level?

We conducted research by surveying potential users and experts in the Saudi education field and discovered a different study approach in which students at the same school and same level but in different classes study different subjects at each semester and by the end they all have studied all the required subjects for that level. For example, one class may take physics in the first semester while another class takes it in the second semester, and by the end of the year all classes have studied physics. This approach is currently being implemented for students at level 10 and above. For that we provided the ability for the school to add and delete subjects based on their plan. After specifying a level, all common subjects of that level will be listed for the class, and it is editable.

- Why can't admins add events or announcements for one class?

The events feature was inspired by observing the social media posts and flyers that schools publish for parents to see. We have decided to mimic this communication by allowing the admins to publish those posts on our platform to make all sorts of communication between those two parties in one application.



As for the announcement feature, by observing the school accounts in twitter and discussing with various school admins, we have deduced that urgent decisions and dates from the school principal/ decision makers are not made for a specific class. For example, the announcement can be a day off or a change in the end of school daytime.

- Why do principals don't have the same features as admins?

As pointed out by the project examination committee, principals are very busy and don't have enough time to manage the school account in the system. Thus, school account management tasks should be delegated to the administration staff in the school. The principal's primary task is to create the school account and add the school's admins to it. If admins were allowed to register themselves, security issues would rise since they are not verified. To avoid security issues, only the principal can add admins to the school's account. Since the number of admins in a school is relatively low, compared with the number of teachers and students, it is a manageable task for the principal.

In the case where the principal would like to have the same privileges as admins, the principal can add herself/himself as an admin in the current version of the application. Future work will add the admin features to the principal account.



## 4.6 Implementation

This section explains how our system is implemented, connects to existing APIs, data sources, and third-party applications. First, our database connection is discussed. Then, it discusses how we have jQuery in our web implementation, and its use in the two functions: add student and delete teacher. After that, the implementation of four major functions in the application are shown: create multiple teachers accounts, inform school of arrival, private chat between teacher and parent, and upload unified grades for a subject in a class. Finally, the Admin SDK and Cloud Functions used with Firebase are presented. At the end of the section, a link is provided to the project GitHub repository.

### 4.6.1 Database Connection

Halaqa provides the school principal and admins the opportunity to access the system through a web portal, while the teachers, parents, and authorized commissioners through a mobile application. The programming languages that were used to implement the client-side in the website were HTML, CSS, and JavaScript, while dart was used to build the mobile application. Node.js was used to implement the server-side of the application. In addition, in order to store the user's data, we used an online database service provided by Firebase which is the cloud database service, also known as Firestore. The connection between the application and Firebase can be initiated from both the server-side and the client-side of the application.

When it comes to the server-side, Node.js is used to implement the backend of the application by using Firebase Cloud Functions. The server-side code is written in Node.js and it connects to the Firebase Authentication database. It utilizes the necessary libraries and methods provided by Firebase, such as the firebase-admin library, to establish the connection and perform operations.

On the other hand, the client-side of the application, which includes both the website (implemented using HTML, CSS, and JavaScript) and the mobile app (built with Dart), can also initiate the connection to the Firebase Firestore database. The client-side code is responsible for interacting with the database directly from the user's device.

In the case of the website, JavaScript is used to handle the client-side functionality. It uses the Firebase JavaScript SDK, which is the firebase-firebase.js library, to connect to the Firestore database.



For the mobile application, the client-side code uses the Firebase Dart SDK, specifically the `cloud_firestore.dart` and `firebase_core.dart` libraries. These libraries provide the necessary methods to establish a connection to the Firestore database.

Firebase Firestore provides security to access the database from the client-side-code by adjusting the Firebase security rules. According to [28], for mobile and web client libraries, Firebase Authentication and Cloud Firebase Security Rules are used to handle and control serverless authentication and data validation. The rules are made with the shape of database paths integrated with custom conditions to allow access to the data at those paths.

#### 4.6.2 jQuery

jQuery is used for multiple event handling and manipulation throughout the implementation. According to [22], jQuery is a framework developed from JavaScript. It is one of the most popular free and open-source JavaScript libraries that also has cross-browser compatibility and HTML event handling and manipulation. The following shows how it is used in the two functions: add student, and delete teacher.

##### 4.6.2.1 Add Student Function

One of its most significant uses in our implementation is in the add student functionality which can be seen in Figure 71. This function's main role is to validate the parent's phone number entered by the user, and to automatically fill the parent information in the form when a newly added student has its parent information stored on the database beforehand. The function starts with the (on change) event as it checks first if the entered phone number exactly contains 10 digits, where if it didn't satisfy this condition the rest of the parent related fields will be disabled until the phone number is entered correctly. Following that, the function searches the database for the parent phone number if it is registered in the school and then makes sure that the parent child is not added beforehand in the system by comparing the student first name with the parent registered students. Furthermore, if the student's first name was not found associated with the parent, then the parent information fields are automatically filled after retrieving the parent data. If the parent is not previously stored, the system will require the user to fill the remaining fields. This has made the process of adding a new student faster and more practical for the user.



```

$(".phone").change(async function () {
  var phoneNumber = parseInt(addStudentForm.phone.value);
  var phoneNo = document.getElementById("phone");
  var phoneno = /^[^\d]{10}\$/;
  if (!phoneNo.value.match(phoneno)) {// validate Phone Number
    alert('يلزم ان يتكون رقم الهاتف [١٠] ارقام باللغة الانجليزية');
    phoneNo.focus();
    notValidated = true;
    document.getElementById("FnameParent").disabled = true;
    document.getElementById("LnameParent").disabled = true;
    document.getElementById("emailP").disabled = true;
    $("#FnameParent").val("");
    $("#LnameParent").val("");
    $("#emailP").val("");
    return;
  } else {
    document.getElementById("FnameParent").disabled = false;
    document.getElementById("LnameParent").disabled = false;
    document.getElementById("emailP").disabled = false;
  }
  $(".loader").show();

  var q = query(collection(db, "School", schoolID, "Parent"), where("Phonenumber", "==", phoneNumber));
  var querySnapshot = await getDocs(q);
  var ParentId = "null";
  if (!querySnapshot.empty) {
    querySnapshot.forEach(async (d) => {
      if (!d.empty) {// the parent is registered in the system previously
        ParentId = d.id;
        //no parent for the same child
        var ref = doc(db, "School", schoolID, "Parent", ParentId);
        var Query = query(collection(db, "School", schoolID, "Student"), where("ParentID", "==", ref));
        var snapshot = await getDocs(Query);

        if (!snapshot.empty) {
          snapshot.forEach(async (doc) => {
            var FName = doc.data().FirstName;
            if (FName != addStudentForm.Fname.value) {
              // to check if the admin has added the same student for the parent same parent before
              $("#FnameParent").val(d.data().FirstName);
              $("#LnameParent").val(d.data().LastName);
              $("#emailP").val(d.data().Email);
              $(".loader").hide();
            } else{
              $(".loader").hide();

              alert("الطالب مسجل بالنظام");
              addStudentForm.phone.value = "";
              addStudentForm.Fname.value = "";
              addStudentForm.Fname.focus();
            } //else if(FName != addStudentForm.Fname.value )
          })//forEach
        } //if snapshot not empty
      }
    })
    $(".loader").hide();
  } //end on change phone number function
}
  
```

Figure 71: Part of checking whether parent and student exist in the add student function code.



#### 4.6.2.2 Delete Teacher Function

Another use of jQuery is in the delete teacher function as seen in Figure 72. When the delete button is clicked beside a certain teacher, a confirmation message is displayed for the user to confirm the teacher's deletion. After the user confirms it, the function checks if there are any assigned subjects to the teacher. If the teacher is assigned to subjects, each subject it assigned to is then updated by assigning the TeacherID field with an empty string. Following that, the teacher is then deleted.

```
683 //delete teacher
684     $(document).on('click', '.deletebtnTeacher', async function () {
685         var teacherID = $(this).attr('id');
686         const docRef = doc(db, teacherID);
687         if(confirm("هل تأكيد حذف المعلم وجميع البيانات المتعلقة به؟")){
688             $(".loader").show();
689             var deleted =true;
690             const d = await getDoc(docRef);
691             if(d.data().Subjects.length >0){
692                 for(var s=0; s<d.data().Subjects.length; s++ ){
693                     var data = {
694                         TeacherID: ""
695                     }
696                     await updateDoc(d.data().Subjects[s], data)
697                     .then(docRef => {
698                         deleted = true;
699                     })
700                     .catch(error => {
701                         deleted= false;
702                         console.log(error);
703                     })
704                 }
705             }
706             if(deleted){
707                 ///////////////////////////////////////////////////
708                 $.post("https://us-central1-halaqa-89b43.cloudfunctions.net/method/deleteUser",
709                 {
710                     uid: docRef.id,
711                 },
712                     function (data, stat) {
713                         if(data.status == 'Successfull'){
714                             deleteDoc(docRef).then(() => {
715                                 
```

Figure 72:Part of the delete teacher code



#### 4.6.3 Create Multiple Teachers Accounts Function

In the function for create multiple teacher accounts, the admin can add multiple teachers at once by uploading an Excel sheet containing the teachers' information that follows a certain given format. This function uses an object of type FileReader in order to read the sheet file uploaded by the admin. As seen in the below code in Figure 73, files of type .xls/.xlsx are read then the data is stored in an array. Following that, a loop is created to loop through the rows and cells that have been stored in the array. Each column title is then validated for obeying the provided addition template on the website. After validation, each row is then displayed to the user. If the validation was true, then AuthAdminS function is called that takes all the row data as parameters and creates a new teacher account by using the provided data. To inform the user of the addition process result, a new cell is integrated next to the row that is currently being added to indicate the addition failure or success.

```
98 //Add Teachers
99 const excel_file = document.getElementById('excel_file');
100 excel_file.addEventListener('change', (event) => {
101   if(!['application/vnd.openxmlformats-officedocument.spreadsheetml.sheet', 'application/vnd.ms-excel'].includes(event.target.files[0].type))
102   {
103     document.getElementById('excel_data').innerHTML = '

.xls او .xlsx خطأ في ترجمة الملف حاول تغيير المIME

';
104     excel_file.value = '';
105     return false; //.xls .xlsx
106   }
107
108   var reader = new FileReader();
109   reader.readAsArrayBuffer(event.target.files[0]);
110   reader.onload = function(event)
111   {
112     var data = new Uint8Array(reader.result);
113     var work_book = XLSX.read(data, {type:'array'});
114     var sheet_name = work_book.SheetNames;
115     sheet_data = XLSX.utils.sheet_to_json(work_book.Sheets[sheet_name[0]], {header:1});
116
117     //View tabel/
118     if(sheet_data.length > 0)
119     {
120       var table_output = '<table id="table" class="table table-striped table-bordered">';
121
122       for (var row = 0; row < sheet_data.length ; row++)
123       {
124         table_output += '<tr id="row">';
125         for (var cell = 0; cell < sheet_data[row].length; cell++)
126         {
127           if (row == 0)
128             table_output += '<th>' + sheet_data[row][cell] + '</th>';
129           else
130             if(typeof sheet_data[row][cell] === "string" && sheet_data[row][cell].trim() !== "" && (sheet_data[row][cell] === undefined && sheet_data[row][cell] === undefined ))
131               table_output += '<td id="row' + cell + '">' + sheet_data[row][cell] + '</td>';
132             else
133               table_output += '</td>';
134         }
135       }
136       table_output += '</table>';
137       document.getElementById('excel_data').innerHTML = table_output;
138     }
139     excel_file.value = '';
140     table_output += '</tr >';
141   }
142 }
```



## حلقة

```

139
140    //validate
141    //*****
142    if (sheet_data.length > 0) {
143        for (var row = 0; row < 1; row++) {
144            for (var cell = 0; cell < 3; cell++) {
145                registerFname = sheet_data[0][0];
146                registerName = sheet_data[0][1];
147                registerEmail = sheet_data[0][2];
148                if (row == 0) {
149                    //does not ignore while sapces in Arabic
150                    if (registerFname == "جَلْدِيَّهُ" || registerFname == "جَلْدِيَّهُ" || registerFname == "جَلْدِيَّهُ" || registerFname == "جَلْدِيَّهُ")
151                    {
152                        validate1 = true;
153                        //break;
154                    }
155                    if (registerName == "الْجَلْدِيَّهُ" || registerName == "الْجَلْدِيَّهُ" || registerName == "الْجَلْدِيَّهُ" || registerName == "الْجَلْدِيَّهُ")
156                    {
157                        validate2 = true;
158                        // break;
159                    }
160
161                    if (registerEmail == "الْجَلْدِيَّهُ@جَلْدِيَّهُ.كُوٰئِنْ") || registerEmail == "الْجَلْدِيَّهُ@جَلْدِيَّهُ.كُوٰئِنْ")
162                    {
163                        validate3 = true;
164                        // break;
165                    }
166                }
167            }
168        }
169    }
170
171
172    //*****
173    if (validate1 == false){
174        document.getElementById('excel_data').innerHTML = '<div style="width: 500px; margin: 0 auto;"> <div class="alert error"> <input type="checkbox" id="alert1"/> <label class="close" title="close"> </div> </div>';
175        setTimeout(() => {
176
177            document.getElementById('excel_data').innerHTML = '';
178        }, 9000);
179        // break;
180    }
181    if(validate2 == false){
182        document.getElementById('excel_data').innerHTML = '<div style="width: 500px; margin: 0 auto;"> <div class="alert error"> <input type="checkbox" id="alert1"/> <label class="close" title="close"> </div> </div>';
183        setTimeout(() => {
184
185            document.getElementById('excel_data').innerHTML = '';
186        }, 9000);
187        // break;
188    }
189    if(validate3 == false){
190        document.getElementById('excel_data').innerHTML = '<div style="width: 500px; margin: 0 auto;"> <div class="alert error"> <input type="checkbox" id="alert1"/> <label class="close" title="close"> </div> </div>';
191        setTimeout(() => {
192
193            document.getElementById('excel_data').innerHTML = '';
194        }, 9000);
195        // break;
196    }
197
198
199    //*****
200    if(validate1 && validate2 && validate3){
201        // alert("true");
202        const table = document.getElementById("table");
203        var x = table.rows[0].insertCell(3);
204        x.innerHTML = "تم";
205    }
206
207
208
209
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214
215
216
217
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219
220
221
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294

```

Figure 73: Part of the create multiple teachers accounts function code.



#### 4.6.4 Inform School Of Arrival Function

This feature allows parents to inform the school about their arrival to pick up their children, or someone else. Here's an explanation of this function's implementation details, which is shown in Figure 74. At the beginning of the code, the student pickup status is checked to make sure that the request has not been made in the last 15 minutes or that the parent have not authorized someone else for the pickup for the day. If a request has been made in the last 15 minutes, then the flag buttonVisible will be set to false which means that the confirmation message and cancel button appear, while the radio and confirm buttons will be hidden. If not, as shown in Figure 75, the system will show a question to choose the picker of the day using radio buttons with two options which are 'Me' or 'Someone else'. If the user chose 'Me', then the value of the variable x will be one which indicates what option the user did choose, and the formVisible flag will be set to false which means that the form of the picker information will be hidden. If the user chose 'Someone else', then the value of the variable x will be two which indicates what option the user did choose, and the formVisible flag will be set to true which means that the form of picker information will be visible to the user as shown in Figure 76. In this case, the user will be asked to provide the picker full name, phone number, identification number, and the date of which he/she is authorized. After clicking confirm, as seen Figure 77, if the user option is zero which means the user have not chosen a picker and clicked confirm, then a message will appear asking the user to choose one. If the user option is one which corresponds to 'Me', then the picked attribute in the database at the student document will be false, the time attribute will save the current time of request, a confirming message will appear, and the buttonVisible flag will be set to false. If the user option is two which corresponds to 'Someone else', then the system will first validate the user input. After passing that, the selected date will be parsed and the attributes in the database will be updated to save the picker name, phone number, id, the parsed date and someone else flag which indicates whether a student will be picked by someone else or not. After that, a confirming message will appear, and the buttonVisible flag will be set to false and the selected date to null.



```

45   Widget build(BuildContext context) {
46     i = widget.stRef.path;
47
48     DocumentReference docRef =
49       | | FirebaseFirestore.instance.doc(widget.stRef.path);
50     final schoolID = docRef.parent.parent!.id;
51     docRef.get().then(
52       (DocumentSnapshot doc) {
53         var data = doc["picked"];
54         print(data);
55         if (data == 'no' ||
56             doc["someone"] == "yes" &&
57             doc["date"] == DateFormat(' MMM d').format(DateTime.now())))
58           setState(() {
59             if (data == 'no') {
60               _textToShow = "تم إبلاغ المدرسة بقدومك";
61               _buttonVisible = false;
62             } else {
63               _textToShow = "تم إبلاغ المدرسة بـ" + doc["fullname"];
64               _buttonVisible = false;
65               _cancel = true;
66             }
67           });
68         } else {
69           _buttonVisible = true;
70         }
71       // ...
72     },
73   );

```

Figure 74 Check student pickup status

```

120
121
122   if (_buttonVisible)
123     Padding(
124       padding: const EdgeInsets.all(5.0),
125       child: Text(
126         'اختر معلم الطالب ليتم',
127         style: TextStyle( // TextStyle ...
128           , // Text
129           // Padding
130           else
131           | | Container(), [ ], ), // Row
132           Row(
133             children: [
134               _buttonVisible
135               ? Radio(
136                 value: 1,
137                 groupValue: x,
138                 onChanged: (value) {
139                   setState(() {
140                     x = value!;
141                     _formVisible = false;
142                   });
143                 },
144               ) // Radio
145               : Container(),
146               _buttonVisible ? Text('') : Container(),
147               SizedBox(height: 10),
148             ],
149           ), // Row
150           Row(
151             children: [
152               _buttonVisible
153               ? Radio(
154                 value: 2,
155                 groupValue: x,
156                 onChanged: (value) {
157                   setState(() {
158                     x = value!;
159                   });
160                   setState(() {
161                     _formVisible = true;
162                   });
163                 },
164               ) // Radio
165               : Container(),
166               _buttonVisible ? Text('') : Container(),
167             ],

```

Figure 75 Initial interface

Figure 76 Picker form

```
309
310
311
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370 >
```

```
onTap: () async {
    if (x == 0) {
        Fluttertoast.showToast(
            msg: 'يرجى اختيار',
            toastLength: Toast.LENGTH_SHORT,
            gravity: ToastGravity.CENTER,
            backgroundColor: Color.fromARGB(255, 241, 2, 2), );
    }
    if (x == 1) {
        i = widget.stRef.path;
        DocumentReference docRef = await FirebaseFirestore.instance.doc(i);
        docRef.update([
            "picked": "no",
            "time": FieldValue.serverTimestamp(),
        ]);
        setState(() {
            _buttonVisible = false;
            _textToShow = "تم إبلاغ المدرسة بقدومك";
        });
    } else if (x == 2) {
        if (_formKey.currentState!.validate()) {
            i = widget.stRef.path;
            var dd;
            DocumentReference docRef = await FirebaseFirestore.instance.doc(i);
            if (selectedDate == "1") { ...
            } if (selectedDate == "2") { ...
            } if (selectedDate == "3") { ...
            } if (selectedDate == "4") { ...
            } if (selectedDate == "5") { ...
            } if (selectedDate == "6") { ...
            } if (selectedDate == "7") { ...
            }
        }
        docRef.update({
            "date": dd,
            "someone": "yes",
            "fullname": name,
            "nid": nid,
            "phone": phone,
        });
        setState(() {
            _buttonVisible = false;
            _textToShow =
                "تم إبلاغ المدرسة بقدومك" + name;
            selectedDate = null;
        });
    }
}
```

Figure 77 After clicking confirm



#### 4.6.5 Private Chat Between Teacher And Parent

The private chat feature provides a convenient way for teachers to communicate with parents regarding their children's education. In this implementation, we have used Flutter Firebase to build a real-time chat feature that provides seamless communication between teachers and parents. We faced several challenges along the way, such as: dealing with parents who have more than one child, designing an intuitive and user-friendly interface, and Real-time update. One of the unique challenges that we faced during the implementation was dealing with parents who have more than one child enrolled in the same class. To ensure that teachers can communicate with the correct parent, we had to use the student ID instead of the parent ID. This required additional work in the backend to link the students to their respective parents as seen in Figure 78 and Figure 79. As for designing an intuitive and user-friendly interface for the chat feature, we had to consider the specific needs of teachers and parents, so we have allowed the parent to view the teacher's office hours as seen in Figure 80. Also, one of the key challenges of implementing a chat feature is ensuring that messages are delivered and displayed in real-time, and we have overcome this issue by using StreamBuilder widget as seen in Figure 81, that builds itself based on the latest snapshot of interaction with a stream.

Despite this added difficulty, we were able to successfully build a robust and reliable chat feature that allows teachers to chat with specific parents regarding their child's education. We believe that this feature will greatly enhance the education program's communication and help teachers provide the best possible education for their students.

```
body: Container(
  color: Colors.white,
  child: CustomScrollView(
    slivers: [
      CupertinoSliverNavigationBar(
        largeTitle: Text(
          "${" + أباً " + className} - $levelName",
          style: const TextStyle(
            color: Color.fromRGBO(255, 68, 68, 68),
            fontSize: 25,
          ), // TextStyle
        ), // Text
      ), // CupertinoSliverNavigationBar
      SliverList(
        delegate: SliverChildListDelegate(
          snapshot.data!.docs.map((e) {
            return CupertinoListTile(
              onTap: () {
                callChatDetailScreen(
                  context,
                  e['FirstName'] + " " + e['LastName'], //Student Name
                  e.id, //Studen tID
                  e["ClassID"].id,
                  widget.subjectId);
              }
            );
          })
        )
      )
    ],
  )
),
```

Figure 78: Using the student ID instead of the parent ID.



```
void callChatDetailScreen(BuildContext context, String name, uid,
    String classID, String subjectId) {
    print("In function Student Name: $name");
    print(uid);
    print(classID);
    Navigator.push(
        context,
        CupertinoPageRoute(
            builder: (context) => Chatdetail(
                friendName: name, //Student Name
                friendUid: uid, //Student ID
                schoolId: widget.schoolId,
                classId: classID,
                subjectId: subjectId,

                ///after read msg update a variable
                msgCount: (s) {
                    msgCount = s;
                    // setState(() {
                    //   //
                    // });
                },
            )));
    setState(() {});
}
```

Figure 79: Use the student ID instead of the parent ID and send it to Chatdetail Screen.

```
192     getOfficeHours() async {
193         DocumentSnapshot ds = await FirebaseFirestore.instance
194             .collection('School/${widget.schoolId}/Teacher')
195             .doc("${widget.TeacherUid}")
196             .get();
197     }
198 }
```



```
241 | showDataCalender() {
242 |   return showDialog(
243 |     context: context,
244 |     builder: (_) => Dialog(
245 |       shape: RoundedRectangleBorder(
246 |         borderRadius: BorderRadius.circular(12), // RoundedRectangleBorder
247 |       child: StreamBuilder<DocumentSnapshot>(
248 |         stream: FirebaseFirestore.instance
249 |           .collection('School/${widget.schoolId}/Teacher')
250 |           .doc("${widget.TeacherUid}")
251 |           .snapshots(),
252 |         builder: (context, snapshot) {
253 |           if (!snapshot.hasData) {
254 |             return Text("...جار التحميل");
255 |           }
256 |
257 |           return Container(
258 |             decoration: BoxDecoration(
259 |               color: Colors.white,
260 |               borderRadius: BorderRadius.circular(12), // BoxDecoration
261 |             child: Padding(
262 |               padding: const EdgeInsets.all(12.0),
263 |               child: Column(
264 |                 mainAxisAlignment: MainAxisAlignment.min,
265 |                 children: [
266 |                   Row(
267 |                     mainAxisAlignment: MainAxisAlignment.end,
268 |                     children: [
269 |                       GestureDetector(
270 |                         onTap: () => Navigator.pop(context),
271 |                         child: Icon(
272 |                           Icons.clear,
273 |                           color: Colors.black,
274 |                         ), // Icon // GestureDetector
275 |                     ],
276 |                   ),
277 |                   Text(
278 |                     "الساعات المكتتبة",
279 |                     style: TextStyle(
280 |                       fontSize: 20, fontWeight: FontWeight.bold), // TextStyle
281 |                     ),
282 |                   Text(
283 |                     snapshot.data!.get("OfficeHours"),
284 |                     style: TextStyle(
285 |                       fontSize: 15, fontWeight: FontWeight.w600), // TextStyle
286 |                     ),
287 |                   ],
288 |                 ),
289 |               );
290 |             ); // Container
291 |           },
292 |         ); // StreamBuilder
293 |       ); // Dialog
294 |     });
295 | }
```

Figure 80:View Teacher's Office Hours.



```
274 Widget build(BuildContext context) {
275   return StreamBuilder<QuerySnapshot>(
276     //get schoolID
277     stream: FirebaseFirestore.instance
278       .collection('School/${widget.schoolId}/Chats')
279       .doc(chatDocID)
280       .collection('messages')
281       .orderBy('createdOn', descending: true)
282       .snapshots(),
283     builder: (BuildContext context, AsyncSnapshot<QuerySnapshot> snapshot) {
284       if (snapshot.hasError) {
285         return Center(
286           child: Text("Something went wrong"),
287         ); // Center
288       }
289
290       if (snapshot.hasData) {
291         var data;
292         return CupertinoPageScaffold(
```

Figure 81: Using StreamBuilder widget.

#### 4.6.6 Unified Grades For A Subject In A Class Function

This feature allows teachers to record unified grades for a group of students in a class for a subject at once. Here's an explanation of the implementation details, shown in Figure 82. The function "checkCustomization()" will run as soon as the page is loaded. It checks whether the grade distribution of this subject and class have already been customized (to have specified assessments with specified grades) or not. If not, the method notCustomized(), shown in Figure 83, will be called and will add a standard grade distribution for the subject in this class. The teacher then adds the grades for the assessments. In Figure 84, when the user clicks on "save" and confirms the function, the "updateDatabase()" method in Figure 85 will be called to update the grades for each student in the class for this subject.



```

  69
  70  checkCustomization() async {
  71    DocumentReference subjectRef =
  72      await widget.subjectRef.parent.parent as DocumentReference<Object?>;
  73    subjectRef.get().then((DocumentSnapshot ds) async {
  74      numOfStudentsInClass =
  75        ds['Students'].length; // get the number of Students in the Class
  76    });
  77    DocumentReference doc = await widget.subjectRef;
  78    await widget.subjectRef.get().then((value) async {
  79      setState(() {
  80        customized = value['customized'];
  81        subName = value['SubjectName'];
  82      });
  83      if (customized) {
  84        //if the grades are customized
  85        setState(() {
  86          numOfAssess = value['assessments'].length; // number of assessments
  87        });
  88
  89        for (int i = 0; i < numOfAssess; i++) {
  90          Future<List<assessment>> getAssessment() async {
  91            setState(() {});
  92            final snapshots = await Future.wait(
  93              [doc.get().then((value) => value['assessments'][i])]);
  94            return snapshots
  95              .map((snapshot) => assessment(
  96                snapshot['name'],
  97                snapshot[
  98                  'grade']));
  99            // get the name and the assigned grade for the assessments
 100           .toList();
 101         }
 102
 103         assessments = await getAssessment();
 104         setState(() {
 105           assessmentsList.addAll(assessments); // add it to a List
 106         });
 107       }
 108     }
 109   }
 110
 111   assessments = await getAssessment();
 112   setState(() {
 113     assessmentsList.addAll(assessments);
 114   });
 115
 116
 117
 118
 119
 120
 121
 122
 123
 124
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```

```

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```

Figure 82: CheckCustomization() method



```

63     notCustomized() async {
64       setState(() {
65         // initially add standard customization for grades
66         assessmentsList.add(assessment("درجة الحضور", 10));
67         assessmentsList.add(assessment("درجة المشاركة", 10));
68         assessmentsList.add(assessment("درجة الواجبات", 5));
69         assessmentsList.add(assessment("درجة المشاريع", 15));
70         assessmentsList.add(assessment("درجة الاختبار الشهري", 20));
71         assessmentsList.add(assessment("درجة الاختبار النهائي", 40));
72       });
73       for (int i = 0; i < assessmentsList.length; i++) {
74         studentAssessmentsList.add(assessment(assessmentsList[i].name,
75           || 0)); // students get the assessment with initail grade zero
76     }
77
78     await widget.subjectRef.update({
79       'customized': true,
80     });
81     assessmentsList.forEach((assessment) async {
82       await widget.subjectRef.update({
83         'assessments': FieldValue.arrayUnion([
84           {'name': assessment.name, 'grade': assessment.grade}
85         ])
86       });
87     });
88   }
89

```

Figure 83: NotCustomized() method.

```

.61   floatingActionButton:
.62     Row(mainAxisAlignment: MainAxisAlignment.spaceEvenly, children: [
.63       SizedBox(
.64         height: 50,
.65         width: 250,
.66         child: FloatingActionButton.extended(
.67           heroTag: null,
.68           backgroundColor: Colors.green,
.69           label: Row(
.70             children: [
.71               Icon(
.72                 Icons.done,
.73                 color: Colors.white,
.74               ), // Icon
.75               Text('حفظ')
.76             ],
.77           ), // Row
.78           // shape: BeveledRectangleBorder(borderRadius: BorderRadius.zero),
.79           onPressed: () async {
.80             var f = false;
.81             if (_formkey.currentState!.validate()) {
.82               f = await confirmDeleteStudentGrades();
.83             }
.84             if (f) {
.85               checked = false;
.86               changed = false;
.87               updateDatabase();
.88             }
.89           },
.90           // FloatingActionButton.extended
.91       ), // SizedBox

```

Figure 84: Save button.



```
379 updateDatabase() async {
380     int totalGrades = 0;
381     for (int i = 0; i < assessmentsList.length; i++) {
382         totalGrades += int.parse(studentAssessmentsList[i].grade.toString()); // get the total grades
383     }
384     if (totalGrades <= 100) {
385         DocumentReference subjectRef =
386             await widget.subjectRef.parent.parent as DocumentReference<Object?>;
387         subjectRef.get().then((DocumentSnapshot ds) async {
388             numOfStudents = ds['Students'].length;
389             for (var i = 0; i < numOfStudents; i++) {
390                 DocumentReference docu = ds['Students'][i];
391                 var studentRef = await docu
392                     .collection("Grades")
393                     .where('subjectID', isEqualTo: widget.subjectRef)
394                     .get();
395                 if (studentRef.docs.length > 0) { // if student has a recorded grades
396                     await docu
397                         .collection("Grades")
398                         .where('subjectID', isEqualTo: widget.subjectRef)
399                         .get()
400                         .then((querySnapshot) {
401                             querySnapshot.docs.forEach((documentSnapshot) {
402                                 documentSnapshot.reference.update(
403                                     "assessments": studentAssessmentsList
404                                         .map<Map>((e) => e.toMap())
405                                         .toList(),
406                                         );
407                                         );
408                                         );
409                         } else { // if student doesn't have a recorded grades then add
410                             docu.collection("Grades").add({
411                                 "assessments":
412                                     studentAssessmentsList.map<Map>((e) => e.toMap()).toList(),
413                                     "subjectID": widget.subjectRef,
414                                     });
415                         }
416                         ...
417                         }
```

Figure 85: UpdateDatabase() method.



#### 4.6.7 Admin SDK and Cloud Functions

Firebase provides a service called cloud functions where developers can write functions on the backend using JavaScript or TypeScript or Node.js. According to [25], cloud functions are a serverless framework that runs backend code that responds to events triggered by Firebase features and HTTPS requests. The functions are stored in Google's cloud and run in a managed environment. Since Halaqa allows some of its users to create accounts for other users and send notifications, these functionalities are considered an administrative privilege. To allow these users to perform these functionalities, an Admin SDK provided by firebase is used in our cloud function. The Admin SDK is a set of server libraries that lets it interact with Firebase to perform actions like, create a user in firebase authentication, delete a user from firebase authentication, update information for user in firebase authentication, and send Firebase Cloud Messaging messages which is a service by firebase that allows sending notification messages. Halaqa users can interact with the cloud functions using post requests in the code.

##### 4.6.7.1 Add and Delete User

As stated previously, to allow the users to create and delete other users, a cloud function that uses an Admin SDK library is used. As seen in Figure 86, to create a user, a post method is sent to Halaqas express API hosted by Cloud Functions. The post method sends data that consists of the new user email address. In our cloud function API, Admin SDK is used to create the new user whereas seen in Figure 87, it attempts to create the user in firebase authentication where all Halaqa users are created there. If the user is created successfully, it will send a JSON response that indicates the success of the addition. If it failed to attempt to create the user due to the email being used, a JSON response is sent that indicates that the status of the email is used. The same logic applies to when the user is being deleted as seen in Figure 88, as a JSON response is sent when the deletion is successful and another response if it was unsuccessful.

```
$.post("https://us-central1-halaqa-89b43.cloudfunctions.net/method/addUser",
{
  email: registerEmail,
  password: registerPass
},
```

Figure 86: Create user post request.



```
50 app.post('/adduser', async (req, res) => {
51
52   const userData = req.body;
53   console.log(userData);
54
55   if(typeof userData.email === "string" && userData.email.trim() !== ""){
56     getAuth()
57
58     //changes:
59     .createUser({
60       email: userData.email,
61       password: userData.pass,
62       disabled: false,
63     })
64     .then(userRecord) => {
65       // See the UserRecord reference doc for the contents of userRecord.
66       console.log('Successfully created new user:', userRecord.uid);
67       res.json({"status": "Successfull" , "uid": userRecord.uid});
68
69     })
70     .catch(error) => {
71       console.log(error.code);
72       const errorCode = error.code;
73       const errorMessage = error.message;
74       if (errorCode === "auth/email-already-exists"){
75         res.json({"status":'used'});
76       } else {
77         res.json({"status":'error'});
78
79       console.log('Error creating new user:', error);
80     });
81   }
82   else{
83     res.json({"status":'error'});
84   }
}
```

Figure 87: Add user function.

```
145 // Delete user
146 app.post('/deleteUser', async (req, res) => {
147
148   const userData = req.body;
149   console.log(userData);
150   getAuth()
151   .deleteUser(userData.uid)
152   .then(() => {
153     console.log('Successfully deleted user');
154     res.send({"status": "successfull" })
155   })
156   .catch(error) => {
157     console.log('Error deleting user:', error);
158     res.end(error);
159   }
})
```

Figure 88: Delete user function.

#### 4.6.7.2 Sending a Notification

Halaqa allows the admin to send notifications to the parents when they add or update an event or an announcement, when they upload a document, and when they mark a student as absent. To send notifications, the Admin SDK library is used where it sends Firebase Cloud Messaging messages to the designated parents using a token that identifies their mobiles which are stored in the database. A post request is sent to Halaqas express API hosted by Cloud Functions that sends data along with it. For example, in Figure 89, in the API takes the data sent by the request method and places the notification content, the receiver token, and extra data as payload then sends the notification using the admin.messaging().send() function.



## حلقة

```

164 //absence notification
165 app.post('/absence', async (req, res) => {
166   | console.log(req.body.token);
167   | const registrationTokens = req.body.token;
168
169   const message = {
170     notification: {
171       title: 'غيب',
172       body: 'تفيدكم بأنه تم احتساب غياب ابنكم/ابنته ' + req.body.studentName
173     },
174     token: registrationTokens,
175     data: {
176       type: 'absence-' + req.body.stuRef,
177     }
178   };
179
180
181 admin.messaging().send(message)
182   .then((response) => [
183     | res.json({status:'sent'});
184     | // Response is a message ID string.
185     | | console.log('Successfully sent message:', response);
186   ])
187   .catch((error) => {
188     | console.log('Error sending message:', error);
189   });
190 })

```

Figure 89: Absence notification request

**GitHub repository:** <https://github.com/reemashabibi/2022-GP1-06>



# Chapter 5

## System Evaluation



## 5 System Evaluation

This chapter is dedicated to evaluate the system and to conclude whether the project's final release is meeting the users' requirements, along with figuring out the bugs and errors of the code if they exist to fix them. For evaluation, user acceptance testing is used. The details of the test, demographics of the participants, the interview results, and discussion of the user acceptance testing results are presented in this chapter.

### 5.1 User Acceptance Testing

User acceptance testing is a method used to evaluate a system. This test aims to confirm the usability and the easiness of use of the application for the users and whether it fulfils the business requirements. Feedback and suggestions are also collected from the users with the goal of improving the system. The test was done by using a web browser and a mobile application. The web application was tested by six participants, where two of them were school principals and the remaining four were part of the school management staff. In addition, the mobile application was tested by fourteen participants, seven of them are teachers, two are commissioners and five are parents. The test contained the web application and mobile application trial phase where the participants were asked to perform a set of tasks, as well as answering a set of usability questions and giving their current opinions in the system.

#### 5.1.1 Demographics Of Participants

The test has been conducted with the target users of the system's second release, which are the school's principal and administration staff, teachers, parents, and commissioners. In Appendix A, the interview questions that were worded to the test participants about their demographic can be seen. In Figure 90, it can be seen that 18 of the participants were females, and 2 participants were males. Figure 91 demonstrates that 10 of the participants were in the age demographic of 41-50, while 8 of the participants were in the age demographic of 20-30 and 2 of the participants were in the age demographic of 31-40. As it can be seen in Figure 92, 3 of the testers had a neutral experience with using websites/mobile applications, while 7 of the testers had a very high experience using them, while 8 participants had a high experience, and 2 testers had a low experience with using websites/applications. Figure 93 illustrates that 7 of



the participants highly rely on websites/applications that facilitate their work in the educational field. Likewise, 7 participants had a neutral opinion, while 3 participants heavily rely on them, 2 participants have a little reliant on them, and only one participant has a very low reliant on these types of applications. Figure 94 demonstrates the classification of our participant users. There are five types of user testing participants, 2 of them are school principals, 4 testers work in schools in a position in the school management staff, 7 teachers of different academic teaching levels, 5 parents of students, and lastly 2 commissioners that always/ sometimes pick up the student from the school.

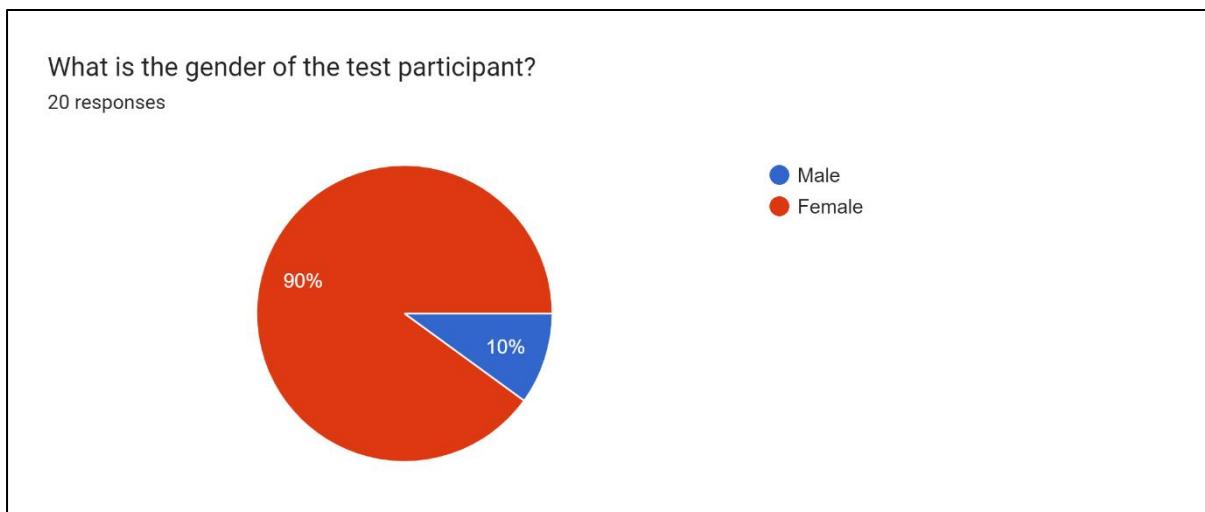


Figure 90: User testing participants' gender

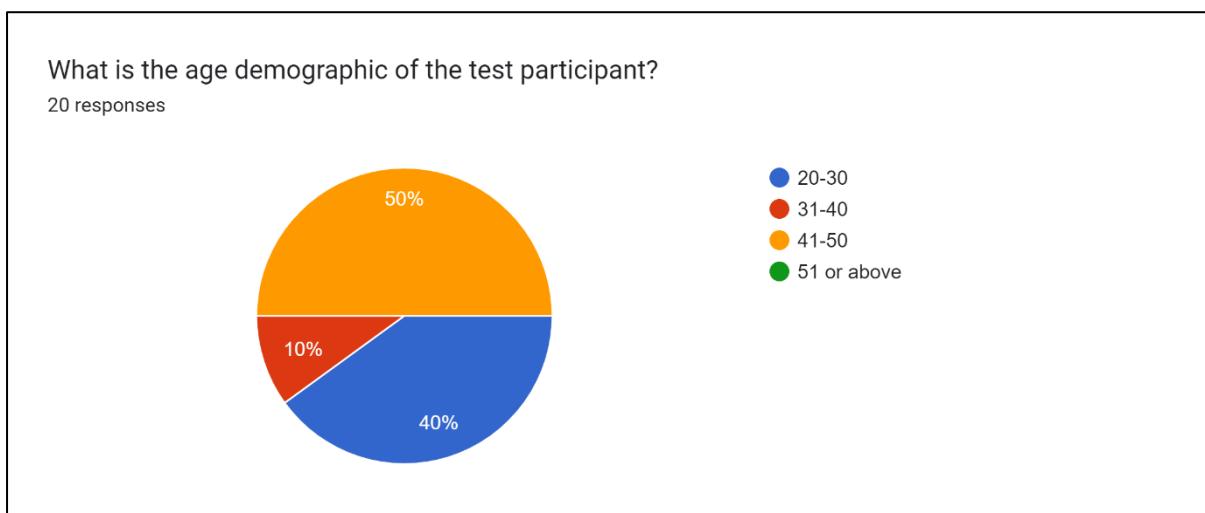


Figure 91: User testing participants' age



How experienced is the website/application tester with using websites/applications?

20 responses

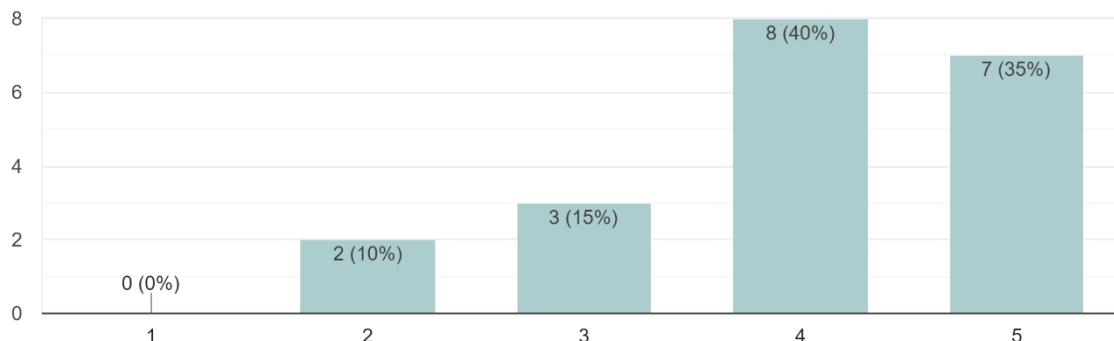


Figure 92: User testing participants' experience with websites/applications

How reliant is the test participants on using websites/applications that facilitate the educational field work?

20 responses

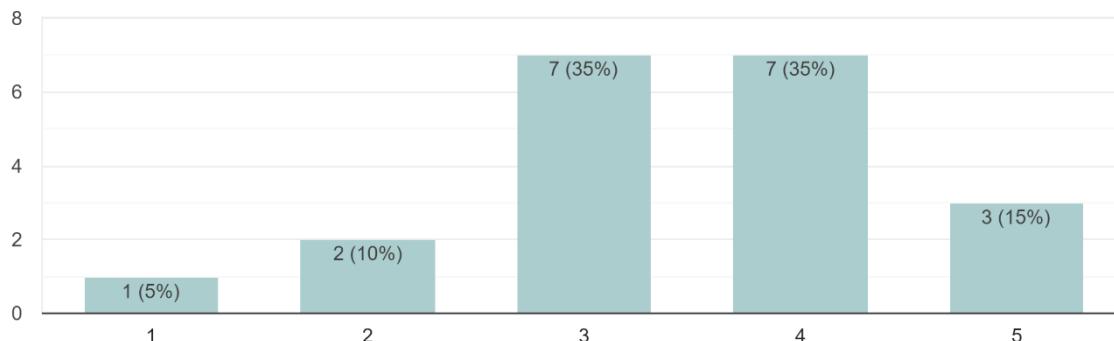


Figure 93: User testing participants' reliant on websites/applications



What is the role of the product tester?

20 responses

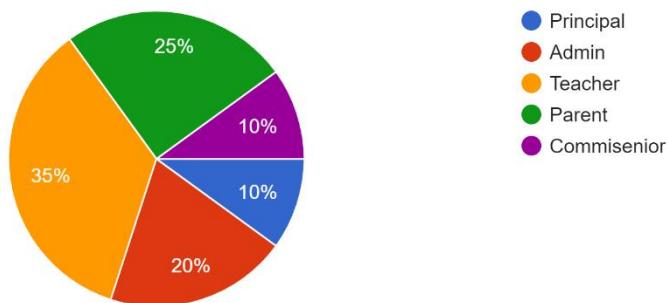


Figure 94: User testing participants' role classification

### 5.1.2 Questionnaire/Interview Results

In our user testing, we have requested the participants to perform some tasks in accordance with the user type. The tasks of the web application that the participants performed during the user testing are the following:

#### For the principal:

- 1-Register.
- 2-Log-in.
- 3-Log-out.
- 4-Update account.
- 5>Create an admin account.
- 6-Add multiple admins.
- 7-Delete an admin.
- 8-Reset password.



## For the admin:

- 1- Log-in.
- 2- Log-out.
- 3- Create a class.
- 4- Create a student.
- 5- Create a teacher.
- 6- Add a subject.
- 7- Update teacher assignment.
- 8- Delete subject.
- 9- Delete student.
- 10- Delete a teacher.
- 11- Delete a class.
- 12- Update student for a class.
- 13- Update account.
- 14- Reset password.
- 15- Add multiple students.
- 16- Add multiple admins.
- 17- Add multiple teachers.
- 18- Add event.
- 19- Delete event.
- 20- Edit event.
- 21- Publish an announcement.
- 22- Edit an announcement.
- 23- Delete an announcement.
- 24- Access pickup screen.



- 25- Inform parents about absence.
- 26- Upload documents.
- 27- Edit uploaded documents.
- 28- Delete document for a class.
- 29- View uploaded documents/excuses by parents for a student.

In Figure 95 and Figure 96, the tasks that the principal and admin participants have completed without any problems can be seen. For the following tasks, all participants were able to complete without showing any problems as the task completion rate was 100%: register, log in, create an admin account, add multiple admins, delete an admin, add event, delete event, edit event, publish announcement, edit announcement, delete announcement, access pickup screen, inform parents about absence, upload documents, edit uploaded document, delete uploaded document for a class, view uploaded documents/excuses by parents for a student. In Figure 95, for update account and reset password tasks for the principal role, the task completion rate was 50% as a participant has not completed the tasks due to the shortage of free time she had. On the other hand, in Figure 96, the admin tasks for log-in, create class, create a student, create a teacher, add a subject, update teacher assignment for a subject, delete subject, delete student, delete teacher, delete a class, update a student for a class, update account, reset password, add multiple students, and add multiple teachers, had a completion rate of 75%. The reason for this percentage is that a participant with the role of an admin has tested these functionalities in the previous release and didn't have the desire to re-test them again as the interface didn't change and the functionalities are the same but just has undergone through few bug fixes. As can be seen, the completion rate of the log-out task is 50%. As mentioned previously, a tester didn't have the desire to retest it again, and another participant has forgotten to achieve this functionality as they are used to being always logged in.



Please select all the tasks that you have accomplished

2 responses

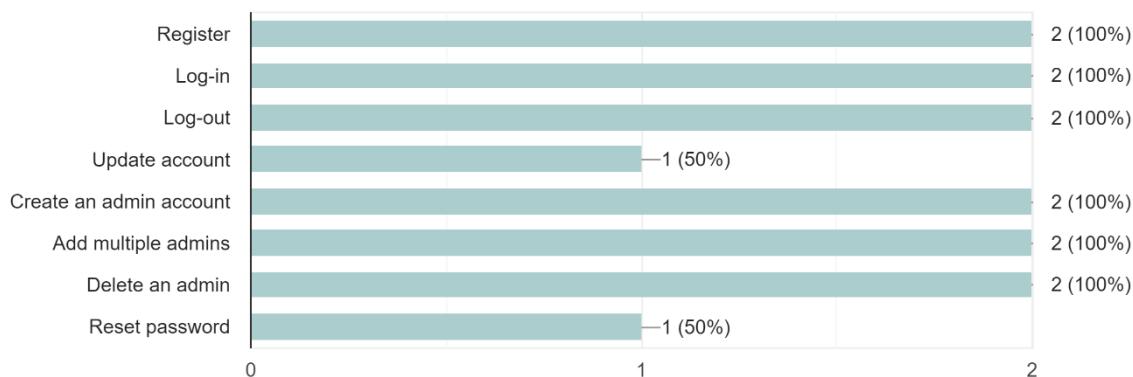


Figure 95: Tasks completion rate for the principal role

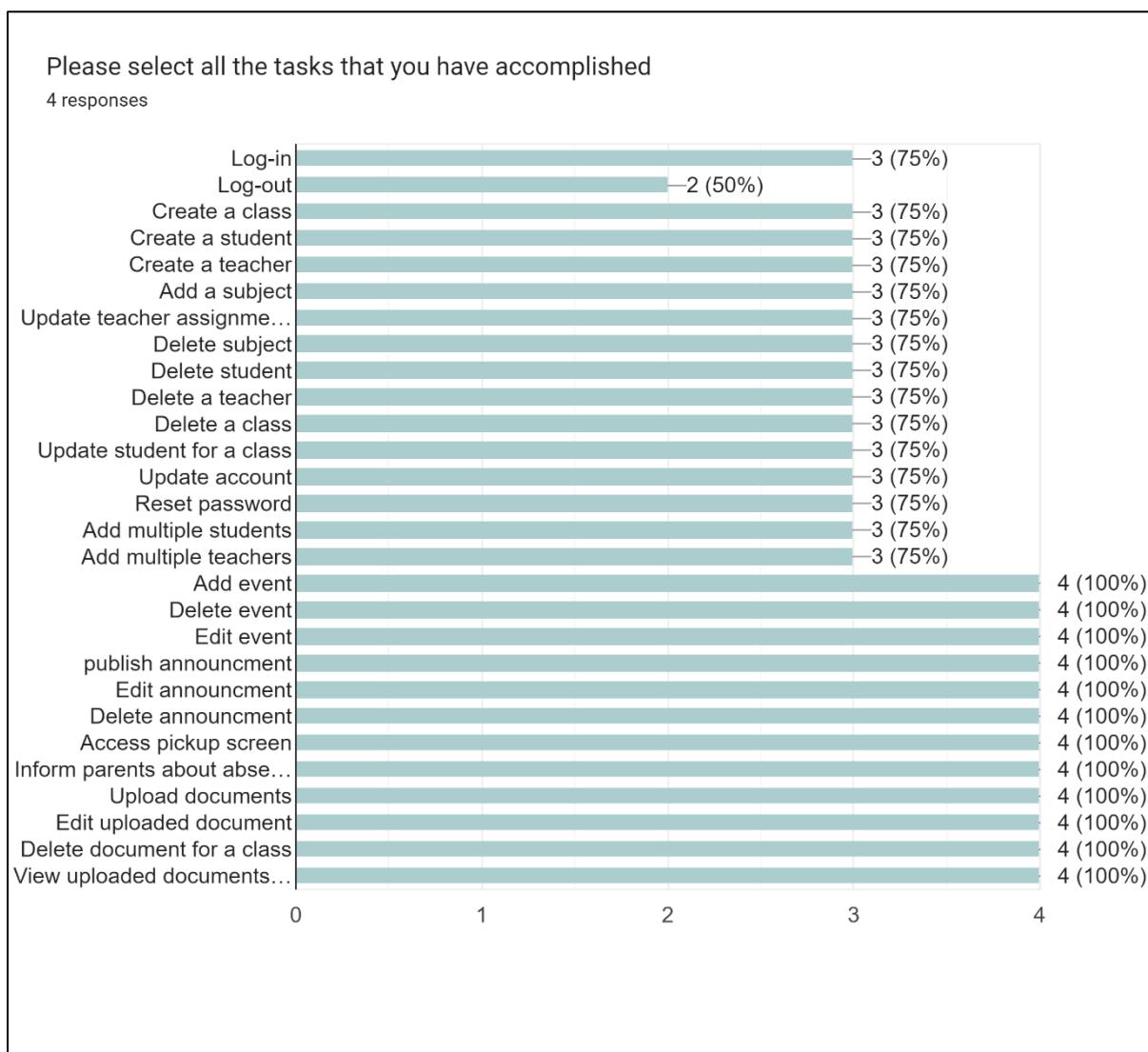


Figure 96: Tasks completion rate for the admin role

Since Halaqa provides a mobile application for the teachers, parents, and commissioners, the tasks of the mobile application that the participants performed during the user testing are the following:

**For the teacher:**

- 1- Log-in
- 2- Log-out
- 3- Reset password.
- 4- Update account.
- 5- Update office hours.



- 6- Upload grades for a student.
- 7- Upload unified grades for students in a class.
- 8- Send a private message to a student parent.
- 9- Broadcast a message to student parents.
- 10- Receive private messages from parents.
- 11- View students.
- 12- Customize the grade distribution for a subject.

**For the Parent:**

- 1- Log-in
- 2- Log-out
- 3- Reset password.
- 4- Update account.
- 5- View child grades.
- 6- Send a private message to a teacher.
- 7- Receive message from a teacher.
- 8- View events.
- 9- View announcements.
- 10- View uploaded documents for a child.
- 11- Upload a document for a child.
- 12- View absence of a child.
- 13- Upload an absence excuse for a child.
- 14- Notify about arrival for a child.
- 15- Create a commissioner account.
- 16- Update a commissioner account.
- 17- Delete a commissioner account.
- 18- Authorize someone else to pick up a child for a one time.

**For the authorized commissioner:**

- 1- Log-in
- 2- Log-out
- 3- Notify about arrival for specific students to the school.

In Figure 97, Figure 98, and Figure 99, the tasks that the teacher, parent, and authorized commissioners' participants have completed without any problems can be seen. The results are fascinating; all participants were able to complete the test without showing any problems as the task completion rate for all functionalities is 100%.

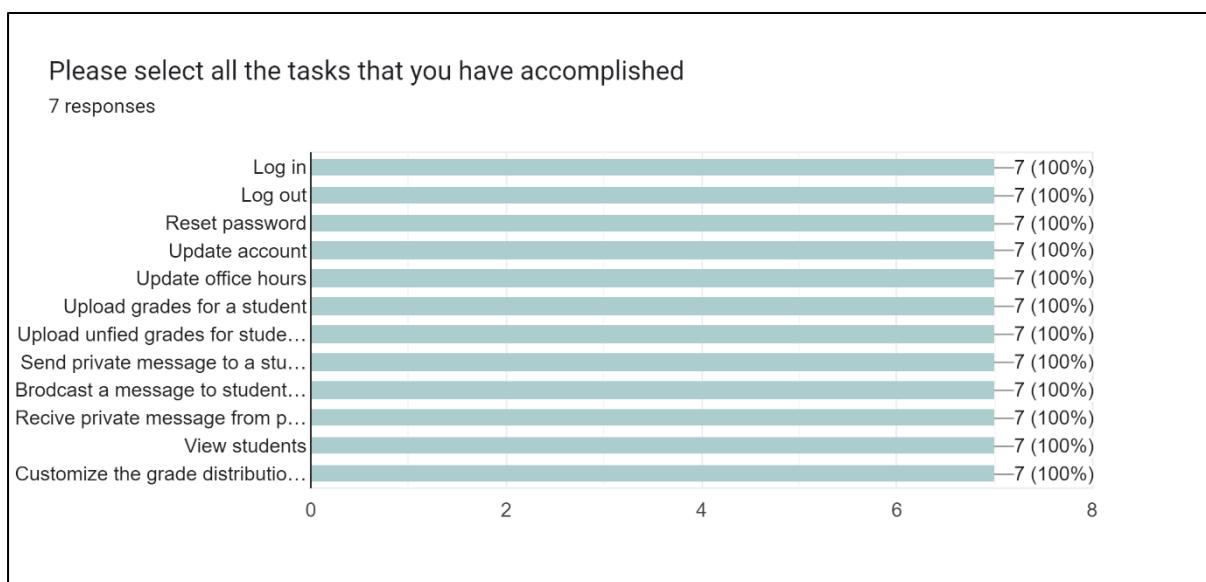


Figure 97: Tasks completion rate for the teacher role

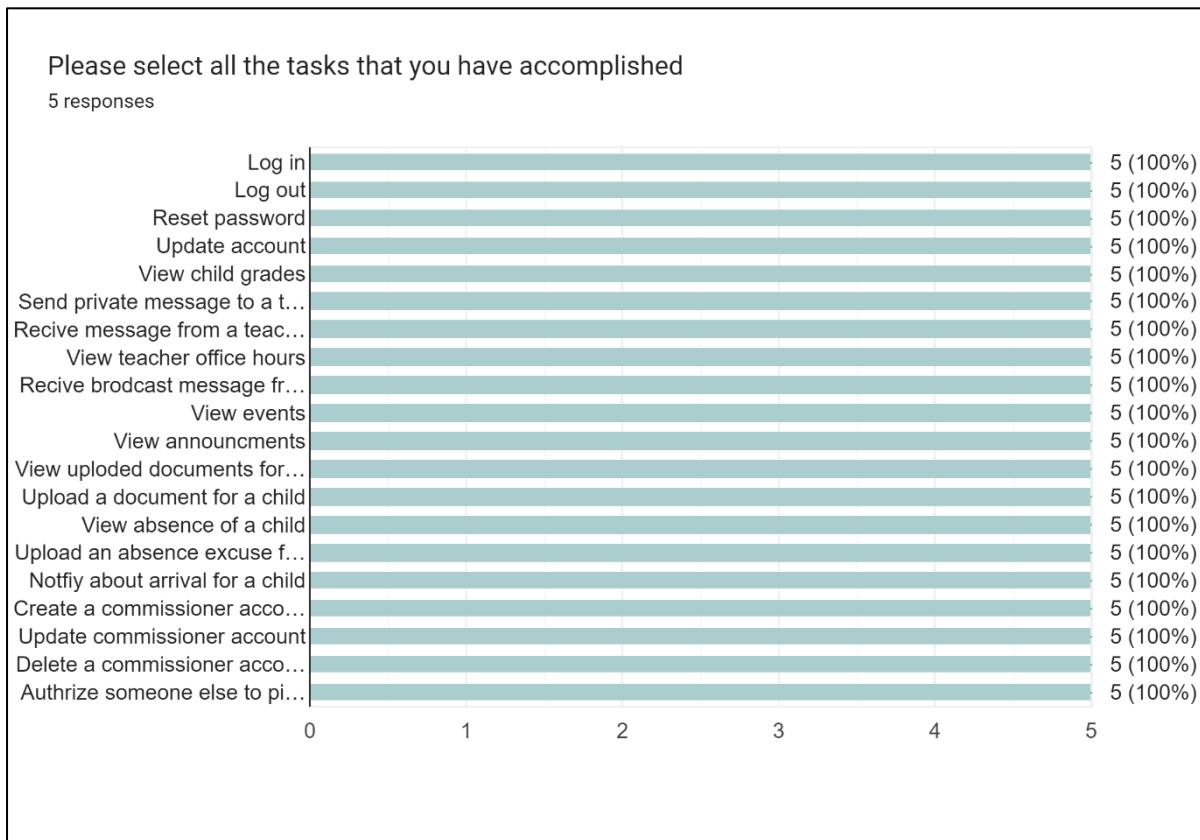


Figure 98: Tasks completion rate for the parent role

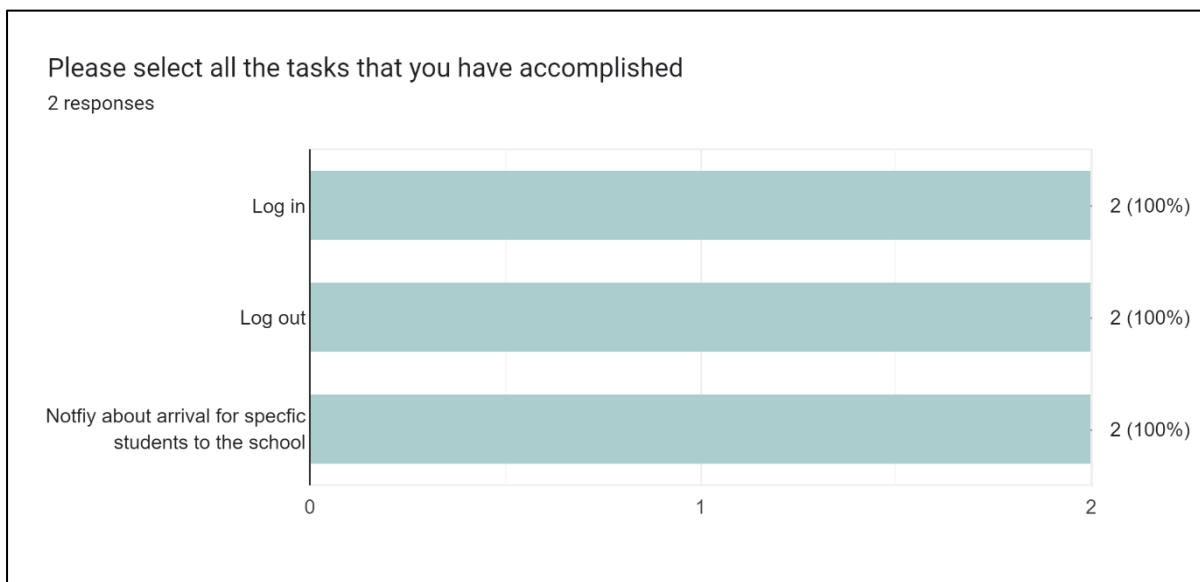


Figure 99: Tasks completion rate for the authorized commissioner role



In the interview questions that are related to the system usability, we used system usability scale (SUS) to evaluate the usability of the application because it is a standard test for usability. According to [24], the System Usability Scale is similar to Likert scale, which includes 10 questions related to usability that users of a website/application answer. Participants rank each question from 1 to 5 based on how much they agree with the question statement. Ranking it 5 means the participant strongly agrees with the statement, while 1 means they strongly disagree.

The questions are the following:

- 1- I think that I would like to use this system frequently.
- 2- I found the system unnecessarily complex.
- 3- I thought the system was easy to use.
- 4- I think that I would need the support of a technical person to be able to use this system.
- 5- I found the various functions in this system were well integrated.
- 6- I thought there was too much inconsistency in this system.
- 7- I would imagine that most people would learn to use this system very quickly.
- 8- I found the system very cumbersome to use.
- 9- I felt very confident using the system.
- 10- I needed to learn a lot of things before I could get going with this system.

Table 4 lists the participants' response to the questions, the average response for each question and the Satisfaction Score. Questions with an odd number are positive statements about the system, that are aimed at knowing the user satisfaction on the website/application. The questions are the first, third, fifth, seventh and the ninth question. On the contrary, the questions with the even number are negative statements that indicate the extent of the user's dissatisfaction with the website/application. The columns illustrate the score numbers, while the blue cells in the table indicate how many users have ranked the statements with the score. To obtain the satisfaction score, each odd numbered question average response is subtracted by one, while the even numbered average response are subtracted from five. The final score of satisfaction is calculated by summing all the satisfaction scores, and then multiplying the result by 2.5. These calculations are done to get the final result out of 100.



As it can be seen in the Table 4, the final score of satisfaction for Halaqa is 95.625 out of 100, which indicates that the users are very satisfied with the application. This percentage is higher than the average system usability scale score, which is 68, just as mentioned in [24]. Graphic representation of the users' responses to the questions can be seen in Appendix B.

**Table 4: SUS results**

Question	Response					Average Response	Satisfaction Score
	5	4	3	2	1		
Question#1	16	3	1			4.75	3.75
Question#2			1	3	16	1.25	3.75
Question#3	16	4				4.8	3.8
Question#4		1			19	1.15	3.85
Question#5	20					5	4
Question#6				2	18	1.1	3.9
Question#7	17	3				4.85	3.85
Question#8	1		1	3	15	1.45	3.55
Question#9	20					5	4
Question#10	1				19	1.2	3.8
<b>Final Satisfaction Score:</b>							<b>95.625</b>

Other than the System Usability Satisfaction questions, additional questions were asked to get extra feedback about the product. The questions were asked with the purpose of collecting the participants' desires on the system and their main opinions on it. The questions are as follows:

1. Do you think that the product currently will make parent and school communication easier? Why?
2. Are there any changes you would like the product to adapt?
3. Would you use the system when it is launched?
4. What is your overall opinion about the interface (ex. Font size, colors)?
5. Any extra feedback and suggestions?

The results for these questions can be seen in Appendix B. For the first question, all of the participants agreed that the product will make parent and school communication easier. Their reasons have varied on why they agree but some of the answers included reasons such as, "Yes, the parent will be informed about everything in the school and will be able to observe his/her



child progress without effort. For the school yes also because available school systems are complicated” or “I think it provided the main functionalities to keep up with the students and the staff that are working/studying in the school”. Some participants have even showed their love for a unique feature of us which is the authorized commissioner account as they stated that “yes, the application functions are very needed and very easy to use, I loved the commissioner part so much and that paper will not be needed after using the app”.

For the second question, the answers have varied. A participant has suggested clarifying the process of uploading the data sheets on the website, and the other has suggested allowing the student to have an account in the platform so that they can also communicate with the teachers. Some of the participants suggested adding new features such as, the ability to set reminders for important school-related tasks like deadlines for assignments, exams, and parent-teacher meetings, or the ability to schedule and manage parent-teacher conferences within the app. These functionalities were not part of the product scope in this release, but they can be considered as future work.

Regarding the third question, all the participants agreed on using the system when it is launched, which is a positive indicator of the neediness of the product. As for the fourth question, all the participants praised the interface as they found the colors comfortable for the eyes and the design being consistent and accessible to navigate and understand. Some stated that “The overall design is intuitive and easy to navigate, has clear icons that makes what I am looking for easy.”, and “I find the interface of Halaqa to be very appealing. The use of blue, light blue, white, and black colors is a great choice, as they create a professional and calming atmosphere that is appropriate for educational settings.”. One of the participants has noted that the text font is a little bit big, but they have praised it by saying “Yes, it is very user friendly and formal the font is a little bit big, and I think it considerate for many types of people for example elders and so on”. Which is considered as an acknowledgement that Halaqas interface design is suitable for every age.

In the end some of the testers have given us extra feedback and suggestions, as a participant has suggested adding a notification to the parent when the authorized commissioner has notified his/her arrival to the school, which can be considered as a future work for Halaqa in the next release. A participant vented to add a multi-language support to the application, while others have suggested the ability for the teacher to upload assignments and tests as it would enhance the education process.



## 5.2 Quality Attributes (NFR testing)

In this section, we documented the non-functional requirements (NFR) for our application. Halaqa contains 5 NFR: learnability, availability, compatibility, performance, and the language of the application. They are listed in the following table, along with their testing results. All of them have passed the test.

Table 5: Quality attributes

User story	Quality Attribute	Measure	Results
As a user, I want the application to be available 99% of the time I try to access it, so that I don't get frustrated and find another application to use.	Availability:  How much the availability of the system can be in a month?	As stated in the legal information of the service level agreement of firebase hosting in [26].	According to [26], the server availability is 99.95% of the Monthly Uptime Percentage
As a user, I want to be able to learn how to use the application in less than an hour, so that I won't get frustrated and confused.	Learnability:  How fast is it for users to complete the main actions once they see the interface?	Compute the time it takes all types of users to complete their actions.  Every user should take maximum 1-5 minutes to complete each function.	While testing the application on 20 users (principals, admins, parents, teachers, and commissioners), we recorded the time they took completing the main functions. The time the users took to complete all main functionalities was between 10 to 15 minutes.



As a user, I want the application to support the Arabic language so that I can understand the terminologies.	Language: the availability of the Arabic language in the application	The number of pages in the application that are in Arabic.	All pages and interfaces in Halaqa support the Arabic language only.
As a user, I want the mobile application to be provided on IOS and Android platform so that I can use it freely on different types of gadgets.	Compatibility: Which operating system does the mobile application support and run on?	Run the application in both IOS and Android and test the compatibility of all functions.	All functions in the Halaqa mobile app are compatible with IOS and Android.
As a user, I want the application to show and return the results within 5-10 seconds of performing an action, so that I don't get impatient and frustrated.	Performance: How fast does the system return results?	Compute the response time for all functionalities provided by Halaqa.	After testing all the functionalities, the response time for each function ranges from 1 to 8 seconds.



### 5.3 Discussion

In this section, we documented the discussion of the results of the user acceptance testing. Based on the results of the test, we have concluded that all users find the application easy to use and that most people will be able to learn how to use it with ease. Some have suggested adding more features, which we are considering them as a future works for Halaqa. Regarding some feedback from the participants, a participant has faced some difficulty using the features that required uploading sheet files as they were not familiar with using websites to upload and submit files. This process can be improved by first educating the users on how to upload files from their computers to the web. While another user has suggested adding a back button to the pages, as we haven't provided it in some of our interface since users don't navigate to another page deeply within a single page. All of the pages can be reached from the home page and no further navigation to another page through them is possible other than going back to the home page by clicking its link in the navigation bar. Others suggested the ability for the teacher to upload assignments and tests, but since Halaqa does not provide the student the ability of having an account in the platform these functionalities were not considered compatible with parent and school communication. In future releases of Halaqa we are planning on adding the student to the platform where these features will come in handy. In the end, we have concluded that the overall results have satisfied our goal of making the system usable and easy for the users and it has satisfied all its non-functional requirements as it has good performance and availability.



# Chapter 6

## Conclusion & Future Work



## 6 Conclusions And Future Work

As the educational field seeks for a technological solution that will link school and student parents together, the main objective of Halaqa is to act as a bridge between the two parties as it is crucial that parents participate in their children's learning journey at an early stage, improving their study outcomes as a consequence. This project provides several features that focus on enhancing the communication and the pickup methods between the school faculty and the students' parents.

In this document, we started by introducing and clarifying the idea of Halaqa and giving a general introduction to the project. Followed by the introduction chapter, the background chapter is presented and plays a major role to prepare the reader for a summary of Halaqa's domain by explaining the impact of the education in the society, the obstacles of the communication between parties and some of the scenarios that affect the schooling process. To deliver an application that fills the gap in market applications, and to specify Halaqa's features, we reviewed and discussed mobile applications in the same field of Halaqa, represented in the literature review chapter. To summarize the work done in that chapter, we have compared the features that our application provides with eight of the most similar and popular education related applications on the market. We seek in our application to achieve convenience and ease for all parties involved in the education institution. As opposed to the other applications we have analyzed, our application provides a single platform that combines the important and basic features for easier and effective communication. To facilitate the implementation of our application and to give more understanding of Halaqa's functionalities and components and how they interact with each other, the system description and design chapters are presented. After we analyzed our system, we started developing our application using HTML, JavaScript, CSS, Node.js, and Dart. Testing was done against different testing scenarios to ensure it's free from bugs and that the system satisfies all the goals and the objectives. User Testing was performed on the system, and it achieved a usability score of 95.625 out of 100, which is a very high usability score. So, our application has passed all testing with good results.

Our target is to make Halaqa act as a connection bridge between the school and the student's parents. Improving the school-home communication improves their relationship and strengthens their collaboration for the student's benefit. The application makes it easy and stress-free, which is also beneficial for the parents and school staff. As a result, the student and



parent experience with the school and learning process is enhanced. Every school should strive for that, and this developed application is a tool that they can use to achieve that.

## 6.1 Global And Local Impact.

### 6.1.1 Global Impact

Education is an important part of life, regardless of a person's nationality, gender, race or age. Globally, the education process requires effective communication between the school's parties and the students' families to facilitate education and raise the educational level of students while avoiding problems that may arise during the education process. In addition, life is unpredictable as we may face problems, such as epidemics, wars, natural and climatic conditions that may hinder the continuation of education. Halaqa is a communication circle that enhances communication and facilitates the process of managing a school environment in one system under any circumstances. Any school can use the application globally, if they speak Arabic, which is one of the most common languages in the world.

### 6.1.2 Local Impact

The Kingdom of Saudi Arabia (KSA) attaches great importance to education to build a promising generation with diverse capabilities, skills and cultures based on a strong and solid education. Continuity of communication during the school period with the students' families is extremely important to reach the required educational results. Therefore, we have developed Halaqa in Arabic, since it is the official language of KSA as it is in the Middle East, to reach the largest possible number of Arab users and give them an effective and comfortable experience while communicating to complete the educational process with satisfactory results for all parties. Communication and pick-up scenarios used in this project are based on Saudi schools and their needs, which makes the application have a high local impact in Saudi Arabia. Thus, it improves school-home communications and education levels.



## 6.2 Problems And Challenges Encountered During The Software Development

During the development of Halaqa, the challenges that occurred were different and in a wide range of areas. One of the challenging functions that our project faced was adding multiple students using an excel sheet. Since the user was the one who will upload the excel sheet, it was very challenging to cover all the possible cases that the user might misinput such as the format of the uploaded file, column names, data that is included in the excel sheet, etc. The code first must check the type of the uploaded file from the user if it is an excel sheet with extension .xls or .xlsx, after that, the code will check the columns if it has the required field compared with the accepted format. Then validation is performed row by row to check if the data of the students has one of the following cases: new student, student of existing parent, a redundant student, the availability of a class, and whether the email address is new or used before. Covering and checking the validity of all those cases was challenging and required a lot of effort.

The second challenging problem that we had faced was that if a user, which is in our case an admin or a principal, creates an account for another user (teacher- parent- admin), Firebase Authentication will switch the logged in user credentials and session with the new added user credentials and creates a new session. We used an API post request to a Cloud function with the new account to be created information and processed and created it through an admin SDK using node.js with node modules to avoid this problem and provide security.

## 6.3 Limitations Of The System

Since the project time is limited, Halaqa at this stage has the following limitations which can be overcome in future work:

- It does not support the English language.
- It is limited to students of levels 1 to 12, and it does not include children in preschoolers.
- Chatting is limited between parents and teachers only.



In regards to the student pickup at the end of the school day, Halaqa allows parents and commissioners to inform the school about their arrival so that the student can be ready for pickup. However, it's up to the school to fully benefit from it by taking the extra step and organizing the pickup cars in a line behind each other. This way makes the pickup process more organized, prevents car jams and accidents, and makes it safer for students to board their cars. Since the parent or the commissioner have informed the school about their arrival in the line, they know that the student will be ready for them at the school gate, making the pickup process much faster and the line moves more smoothly.

## 6.4 The Main Contribution Of The Project

The main contribution of Halaqa is to help the education industry to have the best communication channel between the school and students' parent, to facilitate the exchange of important documents and to manage the process of picking up students at the end of the school day, all in one platform. It is one of the very few applications that provide complete management of the school environment.

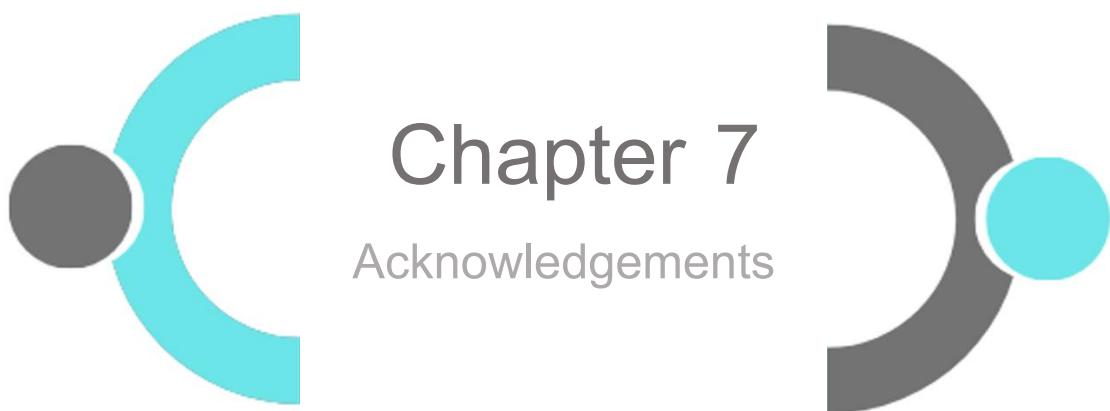
## 6.5 Future Work

Due to the limited time in which we have to develop the system, we have focused only on implementing the main and important features. However, adding more features and functions that can help users are in our consideration in the future, and some of them are:

- Supporting the English language.
- Allowing the student to have an account on the platform.
- The possibility of conversation between the student and the teacher.
- Group chatting between all the students' parents of a class and a teacher for that class.
- The possibility of having online learning through virtual sessions and online quizzes.
- Search bar to search for a certain student.
- The possibility of conversation between the admin and the parent.
- The possibility of uploading past events with videos and multiple pictures.



- Use location in the functionality of informing the school of arrival for pickup to verify that the parent or the commissioner have actually arrived.
- Providing a link that will stand for 24 hours for the one-time authorized commissioner.
- The possibility of one account for a parent who has children in different schools.
- Providing notification to the parent when the authorized commissioner has notified his/her arrival to the school.



# Chapter 7

## Acknowledgements



## 7 Acknowledgements

We would like to extend our gratitude to Allah for the assistance received in completing this project. Additionally, we would like to thank Dr. Hessah Alsaaran, our project supervisor, for her valuable guidance and hard work. We also extend our appreciation to Dr. Maha Alyahya, our scrum master, for her feedback throughout the project. Lastly, we cannot overlook the support of our parents, who played a crucial role in the success of this project.



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## 9 Appendix

### 9.1 Appendix A

User testing form: [https://docs.google.com/forms/d/e/1FAIpQLSdx0r0V9VQC6WA7wtONq-WSN79IIDphgLONelbW9l83N0yCZA/viewform?usp=sf\\_link](https://docs.google.com/forms/d/e/1FAIpQLSdx0r0V9VQC6WA7wtONq-WSN79IIDphgLONelbW9l83N0yCZA/viewform?usp=sf_link)

**حلقة**

السلام عليكم ورحمة الله وبركاته  
نحن طالبات من جامعة الملك سعود من تخصص تقنية المعلومات التابع لكلية علوم الحاسوب والمعلومات.  
نضع بين أيديكم إستبانة لإكمال عرض مشروع تخرجاً و هو تطبيق إلكتروني يدعى (حلقة).  
يهدف التطبيق إلى تحسين و تسهيل عملية التواصل بين المدرسة وأولياء الأمور لما يشتمل من مميزات كتوفير محادثات خاصة بين  
المعلم وولي الأمر، وإبلاغولي الأمر مباشرة عن حالة الحضور والغياب للطلاب، وإعلان مباشر عن الأنشطة والفعاليات المقامة  
في المدرسة وخارجها، والمساهم لأولياء الأمور بارفاق أذعار الغياب ، ومتابعة درجات الطلاب والتقارير المرفقة من قبل  
المدرسة.  
كما يمكن إدارة وتنظيم حملة الإنصراف والخروج للطلاب بطريقة فعالة بحيث يتم تبلغ المدرسة عند وصولولي الأمر  
لإصطحاب الطالب.  
وبالإضافة للعديد من المزايا الأخرى.

شكراً لكم لتعاونكم،

هذه الإستبانة ستستخدم لأغراض علمية فقط

ree4ma.ee@gmail.com Switch accounts

Not shared

\* Indicates required question

Figure 100: Survey introduction



What is the gender of the test participant? \*

- Male  
 Female

What is the age demographic of the test participant? \*

- 20-30  
 31-40  
 41-50  
 51 or above

How experienced is the website/application tester with using websites/applications? \*





How reliant is the test participants on using websites/applications that facilitate \* the educational field work?

1      2      3      4      5

very low                              very high

What is the role of the product tester? \*

Principal  
 Admin  
 Teacher  
 Parent  
 Commisenior

[Next](#)      [Clear form](#)

Figure 101: Survey unified questions



Tasks accomplished (Principal)

Principal

Please select all the tasks that you have accomplished \*

- Register
- Log-in
- Log-out
- Update account
- Create an admin account
- Add multiple admins
- Delete an admin
- Reset password

[Back](#) [Next](#) [Clear form](#)

Figure 102: Principal testing tasks



Tasks accomplished (Admin)

Admin

Please select all the tasks that you have accomplished \*

Log-in  
 Log-out  
 Create a class  
 Create a student  
 Create a teacher  
 Add a subject  
 Update teacher assignment for a subject  
 Delete subject  
 Delete student  
 Delete a teacher  
 Delete a class  
 Update student for a class  
 Update account

Reset password  
 Add multiple students  
 Add multiple teachers  
 Add event  
 Delete event  
 Edit event  
 publish announcement  
 Edit announcement  
 Delete announcement  
 Access pickup screen  
 Inform parents about absence  
 Upload documents  
 Edit uploaded document  
 Delete document for a class  
 View uploaded documents/excuses by parents for a student

[Back](#) [Next](#) [Clear form](#)

Figure 103: Admin testing tasks



Tasks accomplished (Teacher)	
Teacher	
<p>Please select all the tasks that you have accomplished *</p> <ul style="list-style-type: none"><li><input type="checkbox"/> Log in</li><li><input type="checkbox"/> Log out</li><li><input type="checkbox"/> Reset password</li><li><input type="checkbox"/> Update account</li><li><input type="checkbox"/> Update office hours</li><li><input type="checkbox"/> Upload grades for a student</li><li><input type="checkbox"/> Upload unified grades for students in a class</li><li><input type="checkbox"/> Send private message to a student parent</li><li><input type="checkbox"/> Broadcast a message to student parents</li><li><input type="checkbox"/> Receive private message from parents</li><li><input type="checkbox"/> View students</li><li><input type="checkbox"/> Customize the grade distribution in a subject</li></ul>	
<a href="#">Back</a>	<a href="#">Next</a>
<a href="#">Clear form</a>	

Figure 104: Teacher testing tasks



Tasks accomplished (Parent)

Parent

Please select all the tasks that you have accomplished \*

<input type="checkbox"/> Log in
<input type="checkbox"/> Log out
<input type="checkbox"/> Reset password
<input type="checkbox"/> Update account
<input type="checkbox"/> View child grades
<input type="checkbox"/> Send private message to a teacher
<input type="checkbox"/> Receive message from a teacher
<input type="checkbox"/> View teacher office hours
<input type="checkbox"/> Receive broadcast message from teacher
<input type="checkbox"/> View events
<input type="checkbox"/> View announcements
<input type="checkbox"/> View uploaded documents for a child
<input type="checkbox"/> Upload a document for a child
<input type="checkbox"/> View absence of a child
<input type="checkbox"/> Upload an absence excuse for a child
<input type="checkbox"/> Notify about arrival for a child
<input type="checkbox"/> Create a commissioner account
<input type="checkbox"/> Update commissioner account
<input type="checkbox"/> Delete a commissioner account
<input type="checkbox"/> Authorize someone else to pickup a child for a one time

Back      Next      Clear form

Figure 105: Parent testing tasks



**Tasks accomplished ( Authorized commissioner )**

Authorized  
commissioner

Please select all the tasks that you have accomplished \*

Log in  
 Log out  
 Notify about arrival for specific students to the school

[Back](#) [Next](#) [Clear form](#)

Figure 106: Authorized commissioner testing tasks

**The System Usability Scale (SUS)**

I think that I would like to use this system frequently. \*

1      2      3      4      5

Strongly disagree                        Strongly agree

I found the system unnecessarily complex. \*

1      2      3      4      5

Strongly disagree                        Strongly agree

I thought the system was easy to use. \*

1      2      3      4      5

Strongly disagree                        Strongly agree



I think that I would need the support of a technical person to be able to use this system. \*

1      2      3      4      5

Strongly disagree                        Strongly agree

I found the various functions in this system were well integrated. \*

1      2      3      4      5

Strongly disagree                        Strongly agree

I thought there was too much inconsistency in this system. \*

1      2      3      4      5

Strongly disagree                        Strongly agree

I would imagine that most people would learn to use this system very quickly. \*

1      2      3      4      5

Strongly disagree                        Strongly agree

I found the system very cumbersome to use. \*

1      2      3      4      5

Strongly disagree                        Strongly agree

I felt very confident using the system. \*

1      2      3      4      5

Strongly disagree                        Strongly agree



I needed to learn a lot of things before I could get going with this system.\*

1      2      3      4      5

Strongly disagree                             

[Back](#)    [Next](#)    [Clear form](#)

Figure 107: Unified SUS testing questions

**Open questions**

Do you think that the product will make parent and school communication easier? \*  
Why?  
Your answer \_\_\_\_\_

Are there any changes you would like the product to adapt? \*  
Your answer \_\_\_\_\_

Would you use the system when it is launched? \*  
Your answer \_\_\_\_\_

What is your overall opinion about the interface (ex. font size, colors) \*  
Your answer \_\_\_\_\_

Any extra feedback and suggestions?  
Your answer \_\_\_\_\_

[Back](#)    [Submit](#)    [Clear form](#)

Figure 108: Unified testing open questions



## 9.2 Appendix B

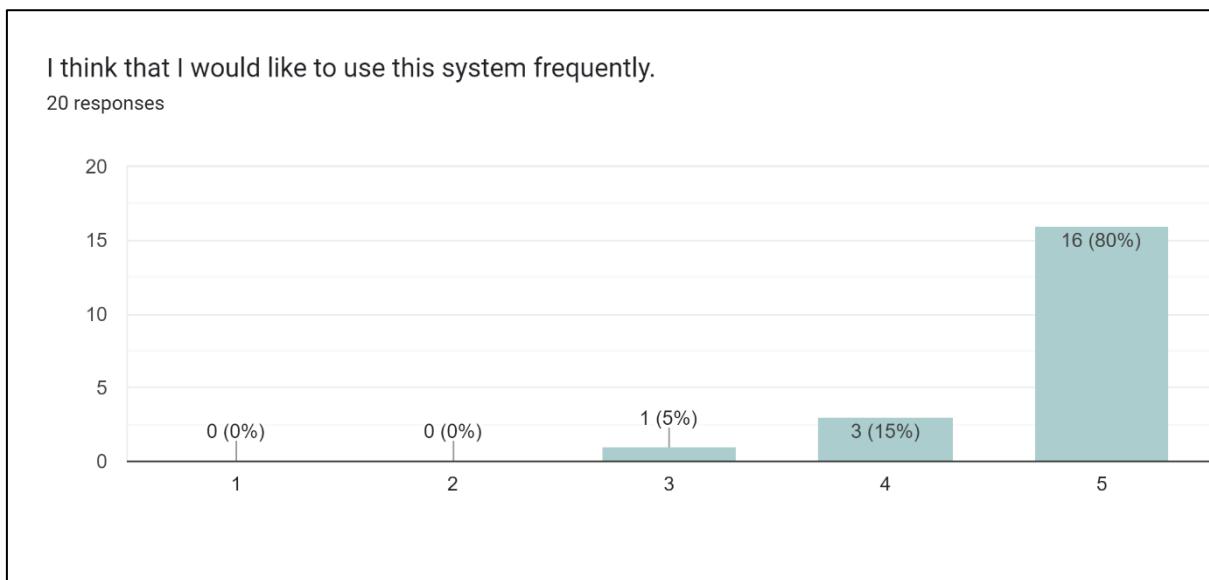


Figure 109: SUS question 1

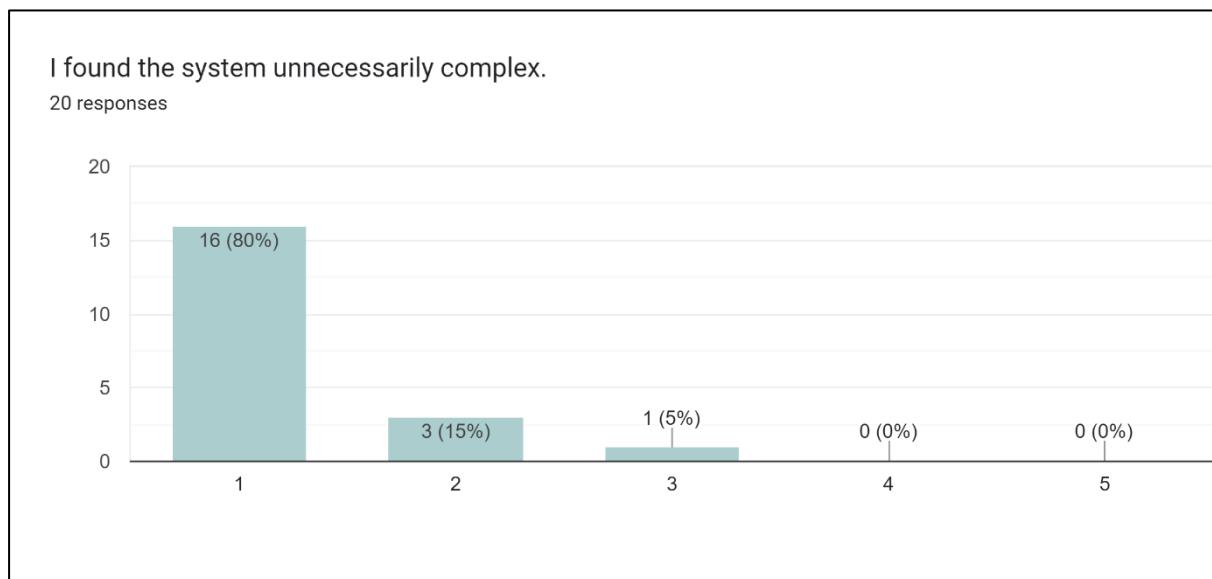


Figure 110: SUS question 2

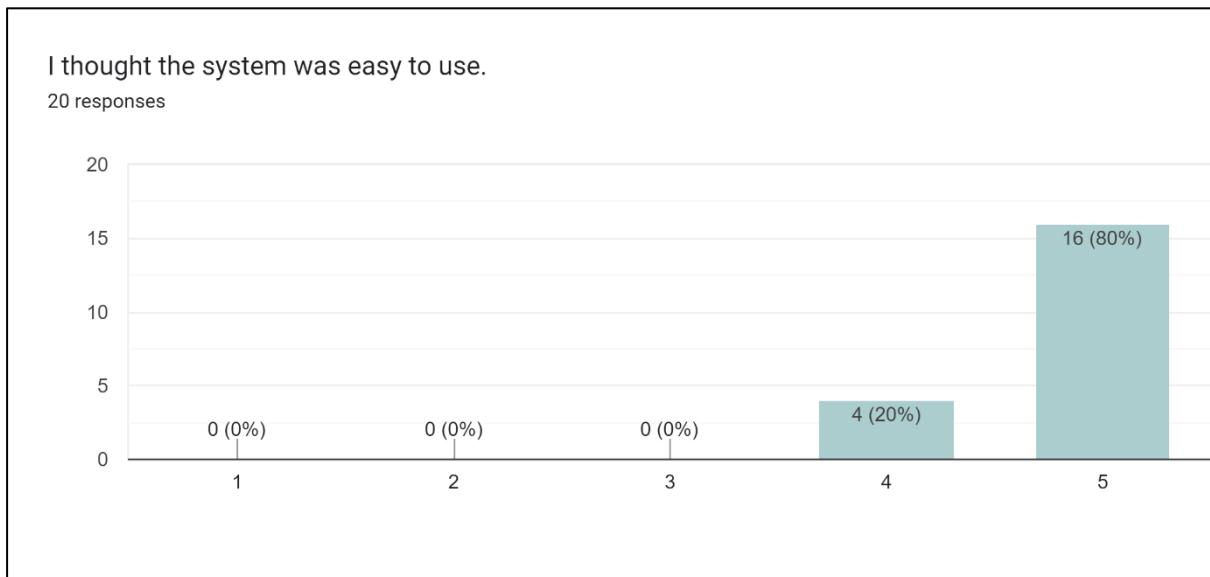


Figure 111: SUS question 3

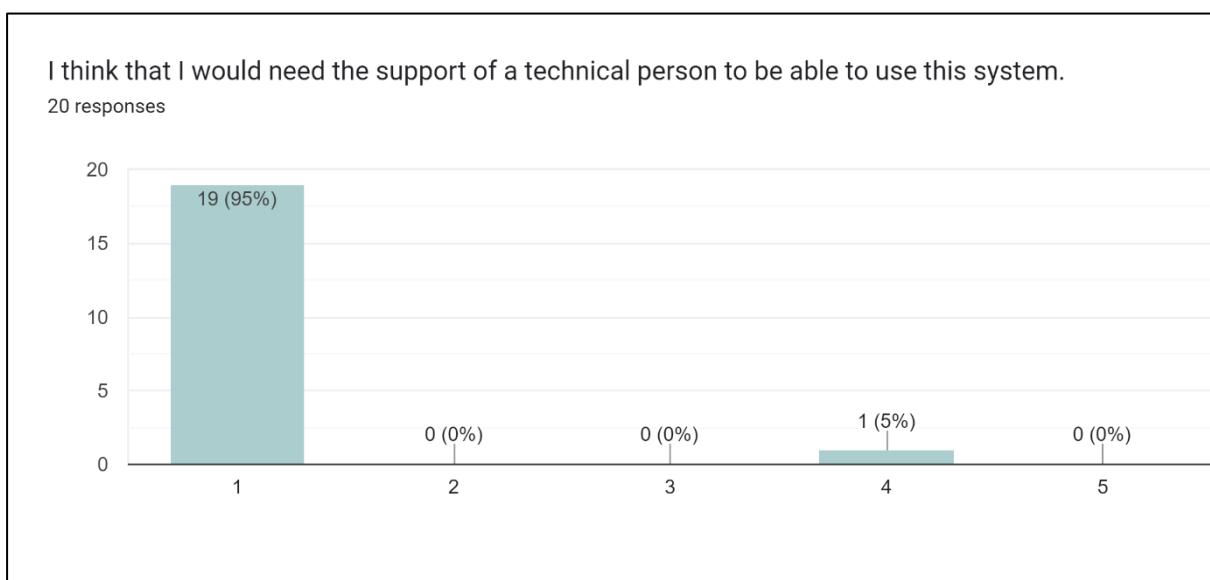


Figure 112: SUS question 4



I found the various functions in this system were well integrated.

20 responses

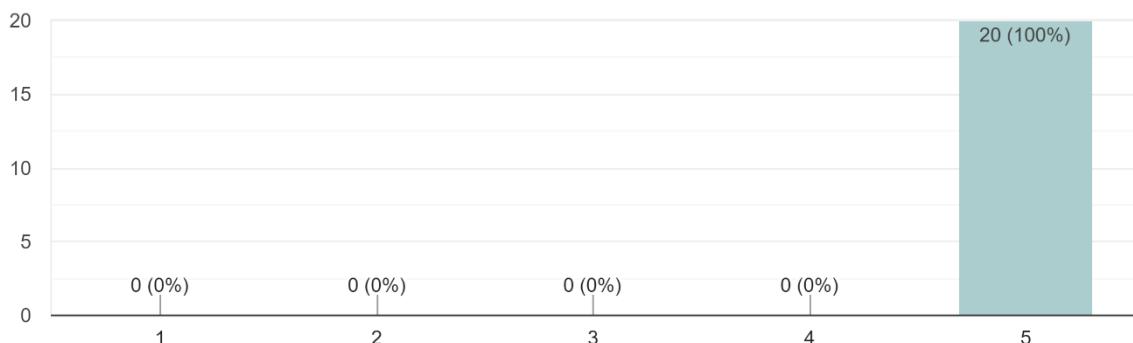


Figure 113: SUS question 5

I thought there was too much inconsistency in this system.

20 responses

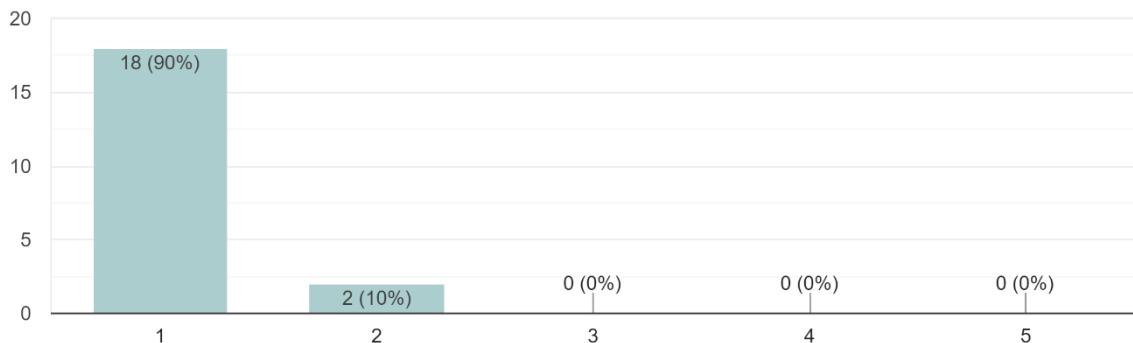


Figure 114: SUS question 6



I would imagine that most people would learn to use this system very quickly.

20 responses

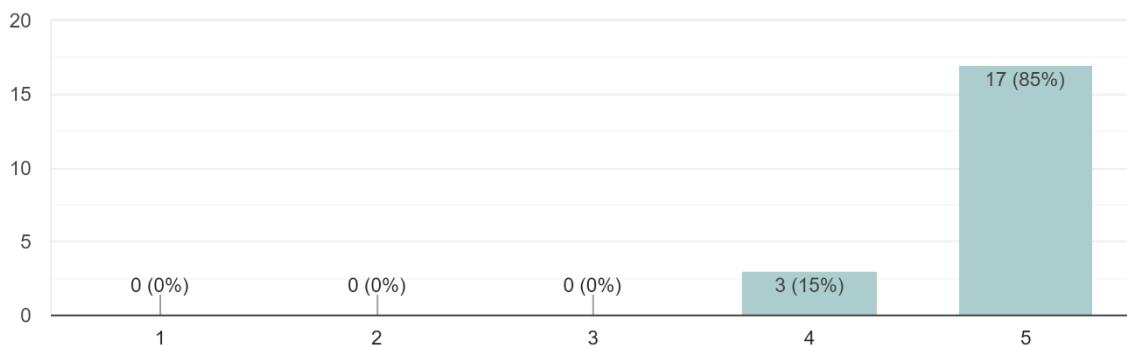


Figure 115: SUS question 7

I found the system very cumbersome to use.

20 responses

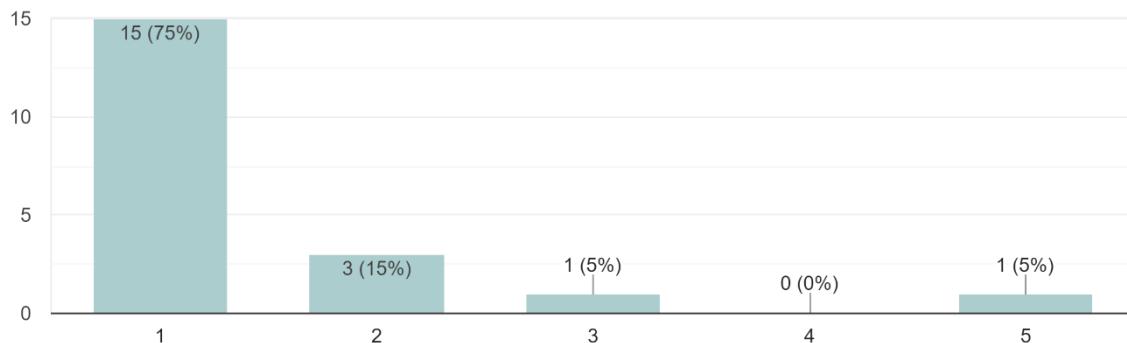


Figure 116: SUS question 8

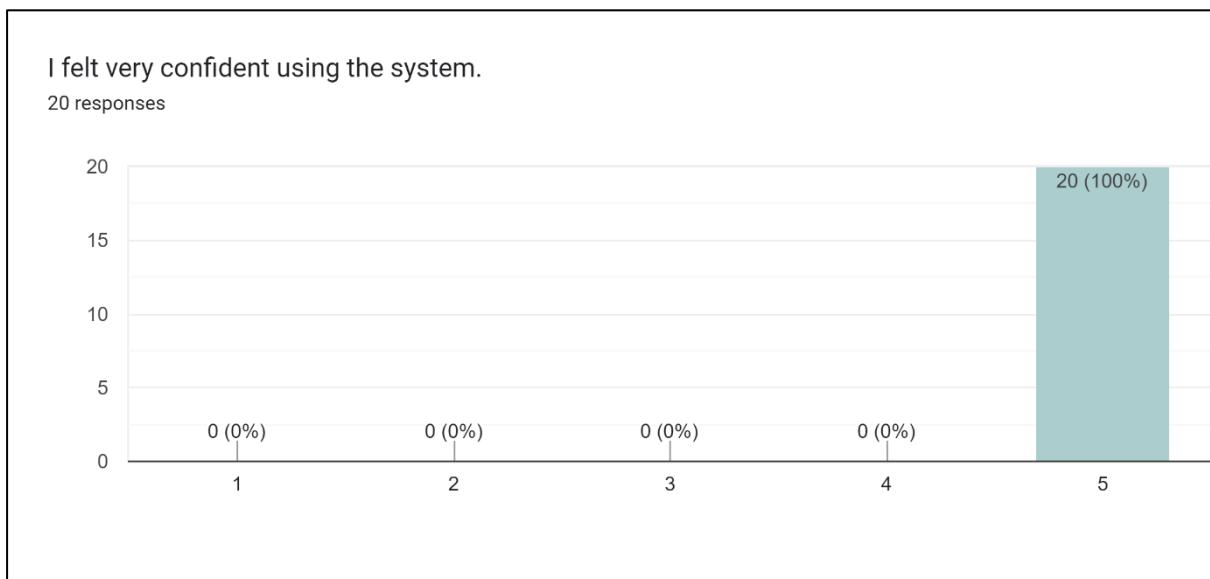


Figure 117: SUS question 9

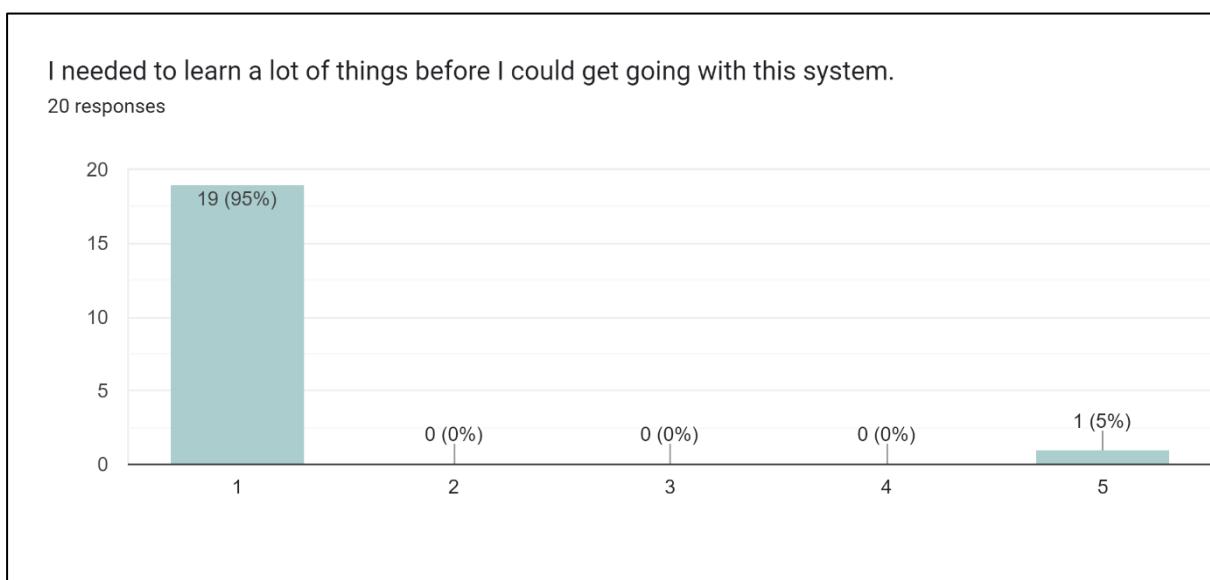


Figure 118: SUS question 10



Do you think that the product will make parent and school communication easier? Why?

20 responses

I think it provided the main functionalities to keep up with the students and the staff that are working/studying in the school

yes, the system organizes the school-staff and students

طبعا، سيكون اسهل بختصر الوقت ودخول المدرسه صعب في بعض الاحيان.

Yes, it provides all the necessary functions that ease the communication between parent and school

Yes, the parent will be informed about everything in the school and will be able to observe his/her child progress without effort. For the school yes also because available school systems are complicated

نعم لأنه سهل عملية التواصل دون تكبد عناء الذهاب الى المدرسة

نعم

نعم فهو وسيلة تسهل علينا كأولياء أمور التواصل مع المدرسة

Figure 119: User testing open question 1

Do you think that the product will make parent and school communication easier? Why?

20 responses

Yes, easy to use the various functions are comprehensive and fixes a lot of problems in the field I think it is easier than noor system

yes, the application functions are very needed and very easy to use , I loved the commissioner part so much and that paper will not be needed after using the app

yes, because it connects both parties easily

yes, because it is synchronized with the school and available for phones

Yes, it provides all the necessities for a successful collaboration between the parents and school

Yes, I think that the features covered every type of communication that happens between schools and parents.

I think it will make the pick up process more organised

Yes, This can be especially helpful for busy parents who may not have time to attend in-person meetings or

Figure 120: User testing open question 1 (part 2)



Do you think that the product will make parent and school communication easier? Why?

20 responses

Yes, I think that the features covered every type of communication that happens between schools and parents.

I think it will make the pick up process more organised

Yes, This can be especially helpful for busy parents who may not have time to attend in-person meetings or make phone calls during school hours. The app allows parents to stay connected with their child's education and school activities in a convenient and accessible way.

Yes, It can help to keep them informed about their child's progress and any important updates or announcements from the school.

Yes, I believe that Halalqa will make communication between parents and schools easier by providing teachers with a range of tools to communicate important information in a timely and effective manner.

Yes, because it provides everything that a parent should know about their child

بالتأكيد، النظام واضح ويدمج اغلب احتياجات أولياء الامور من المدرسة

Figure 121: User testing open question 1 (part 3)

Are there any changes you would like the product to adapt?

20 responses

لا

No

No, but maybe if it contained more functionalities in the future that would be better

Clarify the process of adding excel sheet

Maybe the back button should be added in some pages

لا متكامل

The menu bar should be fixed

no, it is wonderful the way it is

no, no need

Figure 122: User testing open question 2



Are there any changes you would like the product to adapt?

20 responses

no, no need

the save button does not show if the changes are saved or not

Maybe allow the student to have an account so that they can communicate with the teacher also

If I had to suggest some changes to make the app even better, I would recommend adding the ability to set reminders for important school-related tasks such as deadlines for assignments, exams, and parent-teacher meetings.

The ability to schedule and manage parent-teacher conferences within the app. This would allow parents to easily book a time to meet with the teacher.

No, I think Halalqa is a very useful application for teachers.

Maybe allow attaching files in the chat

لا، لكن نظام و حلقات التعليم والتواصل مع المدرسة واسعة ومن الممكن زيادة الكثير من الامور للتسهيل مثل متابعة الواجبات ورفع الاختبارات

Figure 123: User testing open question 2 (part 2)

Would you use the system when it is launched?

20 responses

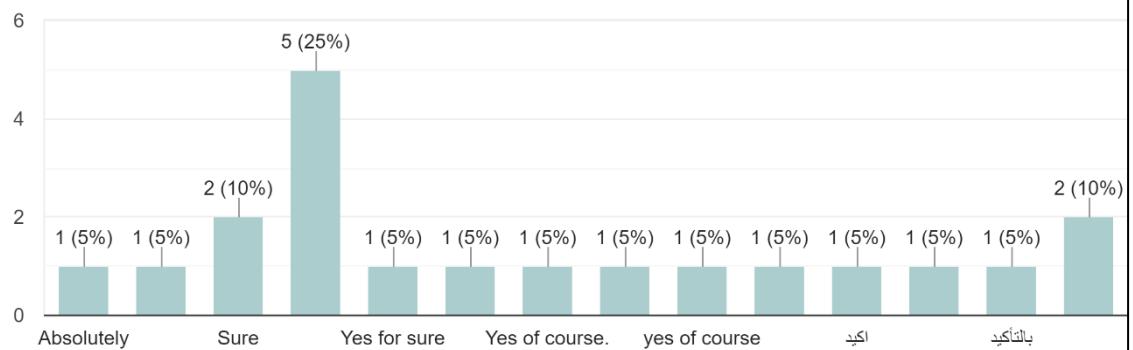


Figure 124: User testing open question 3



What is your overall opinion about the interface (ex. font size, colors)

18 responses

مرح لليعن والوان مبهجه

I wish the front size was bigger.

Yes it is very user friendly and formal the font is a little bit big and I think it considerate for many types of people for example elders and so on

محبته للعن ومرحه

واضح ومنسق

مدمجه بشكل مناسب مع المطلوب

Everything is beautiful and looks great

beautiful I liked it everything is great

I loved it

Figure 125: User testing open question 4

What is your overall opinion about the interface (ex. font size, colors)

18 responses

clear and I feel comfortable reading and using it

I think it is perfect, as the text is readable and the colours are clear and consistent

I thought they were great and suitable

The interface is very good as it is very clear

The overall design is intuitive and easy to navigate, has a clear icons that makes what I am looking for easy.

I find the interface of Halalqa to be very appealing. The use of blue, light blue, white, and black colors is a great choice, as they create a professional and calming atmosphere that is appropriate for educational settings. Additionally, the meaningful icons used in the application make it easy to navigate and use.

I think the interface of Halalqa is well-designed and user-friendly, which enhances the overall user experience of the application.

Figure 126: User testing open question 4 (part 2)



Any extra feedback and suggestions?

17 responses

No

يُفضل اشعارولي الامر بأن المفروض طلب باخراج الطالب

This website was very clear to use and has great useful functions

I think it's perfect the way it is

نشكر الفائزين على اعداده ونتمنى مزيد من النجاحات

لا

اتمنى إنجازها باسرع وقت ممكن وتطبيقها

No everything is magnificent

no, I liked the application very much

Figure 127: User testing open question 5

Any extra feedback and suggestions?

17 responses

No everything is magnificent

no, I liked the application very much

no

no

Maybe allow the teacher to upload assignments

Maybe allow the student to have an account to communicate with the teacher also.

Consider adding multi-language support to the app.

My suggestion is to add a calendar feature that allows teachers to schedule upcoming assignments, tests, and other important events.

كمعلم اضافه الواجبات والاختبارات بتساعد في عملية التعليم بشكل فعال اكتر

Figure 128: User testing open question 5 (part 2)



### 9.3 Appendix C

Name	Role	Email
Lolo Almohammed	Admin / Parent	Lloolloo989@gmail.com
Aljazy Alqahtani	Principal / Parent	Jazy.ms92@gmail.com
Mona Alyusif	Teacher / Parent	Mony171393@gmail.com