An-Najah National University
Faculty of Engineering & Information Technology
Computer Engineering Department

Software Graduation Project:
Kiddy

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Acknowledgment

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Finally, we would like to extend our sincere thanks to our colleagues. Having the opportunity to work with such passionate and great minds was inspiring, and we appreciate every contribution they made.

Disclaimer Statement

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Abstract

All families have children, and everyone seeks to have their children in the best places, and kindergarten is one of the most important phases in the children's lives. Our website provides the parents the necessary information and for everyone who visits our site to pick up the most suitable kindergarten for their children, there will be a smart system that filters the kindergartens for the users/parents depending on their preferences. Our system will be mocking real-life scenarios for registration and other important details necessary for the whole process to be completed. There will also be some management features provided for the managers of the kindergarten themselves. The website is covering important features:

- Registering to the system either as a parent looking for kindergartens or registering as a kindergarten owner and providing him a complete management system
- The ability to register a child to a kindergarten after choosing a suitable kindergarten by the parent.
- Support feature, like parents contacting the kindergarten.
- A powerful matching feature to find the most similar kindergartens to parent's preferences.
- HR management system feature provided for the kindergartens themselves to manage their employees.

The website is developed to meet the main features a real website must provide, this work has been done incrementally by adding features one by one and testing it right along.

Kiddy is not an available website for both parents to look for a suitable kindergarten for their children and for any kindergarten owner would like to register their kindergarten to our system and benefit our services.

1. Introduction

1.1 Statement of the problem

People are always eager to have their own family members in the best places and that's what always people are trying to do; in the context of childhood and education, every family is getting to a point where they should have their children registered to a kindergarten, but it's not easy to find a kindergarten that best matches every person's preference. In addition, kindergarten owners are always having problems to manage and organize their kindergarten's details like employment and semesters, so our website is offering solutions for those kinds of problems,

1.2 Objectives

The main goal of this building such a website is to offer solutions for the problems mentioned in the previous section, there will be the ability to offer a complete management system for each kindergarten individually, and other details like semester and HR management systems.
There will be also a focus on solving the parents' problem of finding the best kindergartens that suit their children.

1.3 Scope of the Work

This application is meant to provide services for both parents and kindergartens owners.
A user can experience the following services.

- Registering as a normal parent and having regular parent services
    - Managing children, addition, editing, deletion.
    - Applying register applications to different kindergartens.
    - Searching for most suitable kindergartens according to a matching feature
- Registering as a kindergarten owner and getting owner's services.
    - Managing one or more kindergarten independently
    - Reviewing register applications for applied children.
    - Communicating with parents as needed
    - Optional subscription for HR Management system
    - Visualization charts
- An Admin that can review, perform actions to every single user and provide powerful charts.

1.4 Significance

Having an international platform to host all kindergartens in the globe and offering users such an experience to try different services at a large scale is a significant challenge. Our application is built on purpose to solve those challenges and offer users the best experience and solve common scenarios happen to people and make their life easier.

2. Constraints and Earlier Coursework

2.1 Constraints

Due to the lack of time, it's almost impossible to build a full comprehensive management system for kindergartens that provides features for both owners and parents. In addition to the reality that such an international platform indeed requires comprehensive experience to get it scalable and maintainable. And the lack of data was an important factor that limited our creativity in applying and implementing some smart features like matching feature. Nevertheless, we have applied our code best practices on the high and low level of implementation, we also could manage to generate and mock some real data according to our context and we got a great correctly functional application.

2.2 Earlier Coursework

- **Database Design Course:** In this course we have learnt the basis of designing a database from scratch and other main topics, that helped us to utilize that knowledge to design relatively a complex database in our website and build correct relationships between entities.
- **Web development Course:** This course provided us the basis for building web applications, we have learnt HTML, CSS, and JS during the course, and it was the first step to start learning some advanced libraries like react which was fully used in our website, also we used NodeJS as a backend language to build the server side.
- **Software Engineering Course:** In this course, we have learnt some important topics in the software engineering context, we were able to utilize the knowledge we acquired from this course to apply it in our application.
- **Advanced Software Engineering Course:** This course was one of the best courses that helped us to get better and deep knowledge about software engineering, we learnt advanced topics like architectural styles, architectural patterns, design patterns, and best practices so we could apply that to our application, we have chosen a layered architecture as an architectural style for the application.
- **Distributed Operating Systems Course:** This course has provided us a significant knowledge about distributed systems and have required us to build a distributed system from scratch, also we learnt different techniques and technologies like RPC and RESTful architectural pattern, which was used as a standard pattern in our application.
- **Critical Thinking:** We were able to read professional publications and acquired research skills which helped us to finish the current graduation project course.

3. Literature Review

We all know that technology affects almost every aspect of our lives, especially education, and with the attempt to make education smarter, whether in terms of management or teaching, it has been found that there are a series of problems in the process of converting to a smart kindergarten, such as lack of coordination and the insufficient use of intelligent teaching resources. Over time, it has become a hot topic that needs special attention. Now there are many management systems for kindergartens and preschools that compete in terms of ease of use, and the variety of services that are offered to users.

One of the widespread and easy-to-use applications is **HiMama**, it provides an easy way to record and share children's activities to involve parents and improve outcomes for children. **Procare** helps enrich classroom and parent interactions as well as automates the payment process. Also, **Brightwheel** aims to simplify the tasks that kindergarten teachers and administrators deal with.

So, most of the kindergarten management systems, considering the applications that we mentioned above, eliminate paperwork, and improve the communication process between the teacher and the parents. But there are still a lot of services that can be provided by this type of application.

Kiddy is an international platform and one of many kindergarten management systems that mainly focuses on hosting kindergartens in one place so that users can have comprehensive and up to date information and data about kindergartens. It offers management systems for kindergarten owners to easily manage their semesters and other details related to kindergartens, and has a powerful matching feature enables the user to choose and review the best kindergartens for user’s preference.

4. Methodology

4.1 Technologies

4.1.1 ReactJS

React is a declarative, efficient, and flexible JavaScript library for building user interfaces. It makes it easy to compose complex UIs from small and isolated pieces of code called components.

In our project we used ReactJS as the front-end technology due to the easiness of learning, rich set of user-interface, community support, and the fast development of software. In addition, it offers the capability to reuse already built components.

4.1.2 NodeJS

NodeJS is an open-source, cross-platform runtime environment for executing JavaScript code. It was chosen as the back-end language to write the server implementation for our project. We chose it because of the ease and fast development of software using it, large community support, large set of libraries and modules that makes it easy to perform tasks, and because it supports a lot of web framework servers like ExpressJS which was also chosen to be our framework web server.

4.1.3 MySQL Database

For the database, our choice was a Relational Database Management System; MySQL DB. It was used as a primary database because it’s an open-source, free to use, powerful RDMS that serves the context of our business domain. Kiddy is a Management system that has a lot of relations so choosing a RDBMS is the safe choice for such a context.

4.1.4 Sequelize

Sequelize (Object Relational Mapper) ORM was chosen to be used as the gate for communicating with MySQL database in terms of objects. It was chosen because of the ease of using and learning of this technology and due to the large community for it.

4.1.5 Ionic

It was used to build the mobile app for Kiddy since it's a powerful, cross-platform application that offers responsive functionalities and capabilities.

4.1.6 Machine Learning Libraries

Since we built a matching featuring according to the similarity between kindergartens and the user's preferences, different machine learning libraries where used; Numpy, Sklearn, Pandas are the libraries used for this feature to get completed.

4.1.7 FastAPI

FastAPI is a modern, fast high performance, web framework for building APIs with python. It was used to deploy the matching (similarity) model we previously calculated to be used by our nodejs backend server.

4.1.8 Other Technologies

- **Firebase**: was used to build a chat system.
- **Visual Studio Code**: was considered as the main and primary code editor for developing our source code.
- **Git**: was used as a distributed version control system for managing our base code
- **GitHub**: the hosting service was used to host our servers' repositories.
- **Postman**: an open-source tool used for testing our APIs.

4.2 Security

4.2.1 Roles

Kiddy management system has 3 layers of roles:

- **Parent**: Can manage their children, apply for kindergartens, communicate with owners, and find the best matching for their own preferences.
- **Kindergarten Owner**: Can manage one or more kindergartens independently.
- **Admin**: Has full access and authority to the whole system.

4.2.2 Authentication

All Kiddy's APIs require authentication which ensures a high level of security and a block to any network attack.

4.2.3 Authorization

All APIs ensure a high level of authorization so there is no access to a non-privileged user to a protected resource and there will be checks on each resource if it belongs to the right user before performing any action.

4.3 Architecture

4.3.1 Architectural Style

RESTful architectural style was the chosen architectural style for our application. It's an architectural style that defines a set of rules our application has implemented most of them:

- Uniform Interface
- Client-Server
- Layered
- Stateless
- Cacheable
- HTTP protocol

4.3.2 Architectural Pattern

Model-View-Controller (MVC) architectural pattern was used as a pattern to implement our source code. It was used due to the advantages of separation of concerns between layers and the high maintainability it provides.

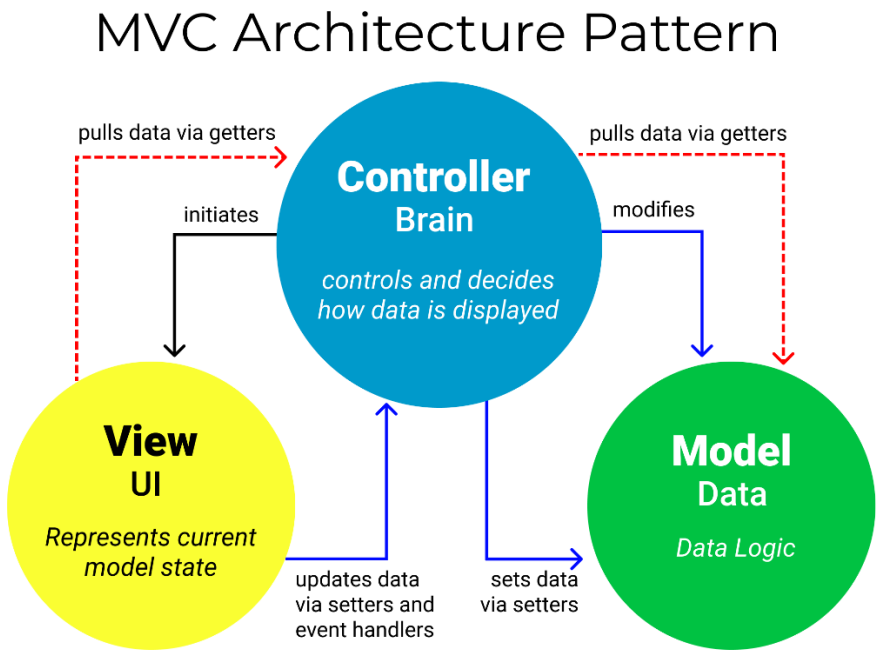

Figure 1: MVC Pattern

4.4 User Interface

4.4.1 Home Page

In this page, users can register to the system as a parent (regular users) or as kindergarten owners.

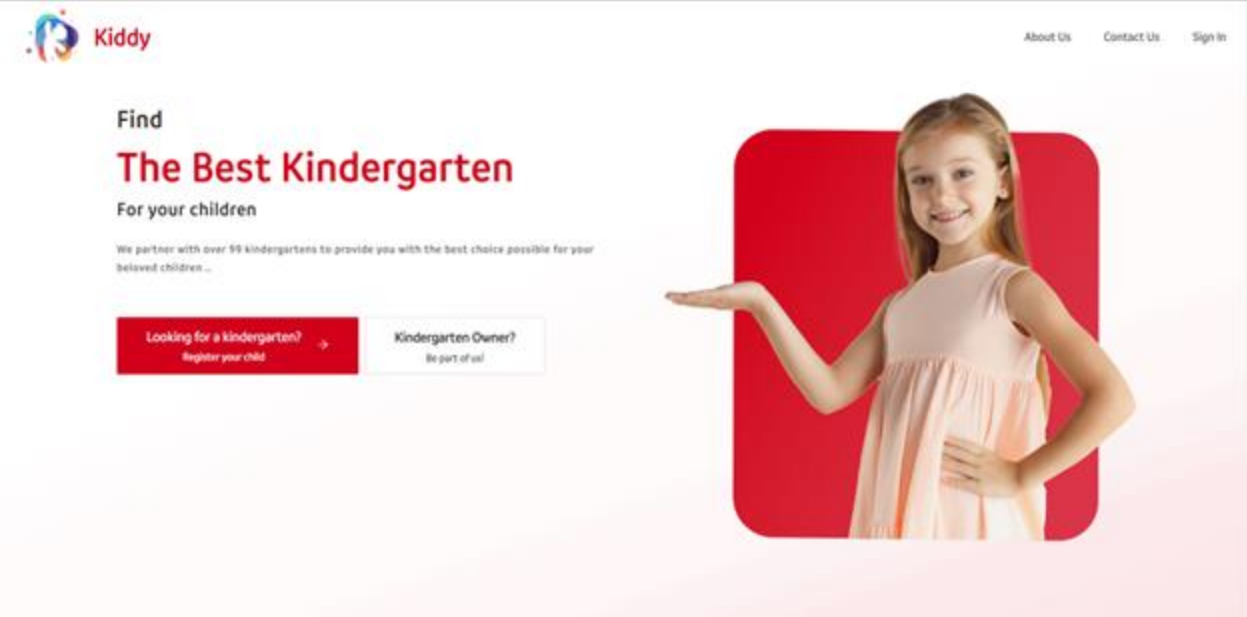

Figure 2: Kiddy Home Page.

Registering as a parent requires adding the needed information of the parent itself at the first step, then as the second step, they will be asked to fill their first child's information.

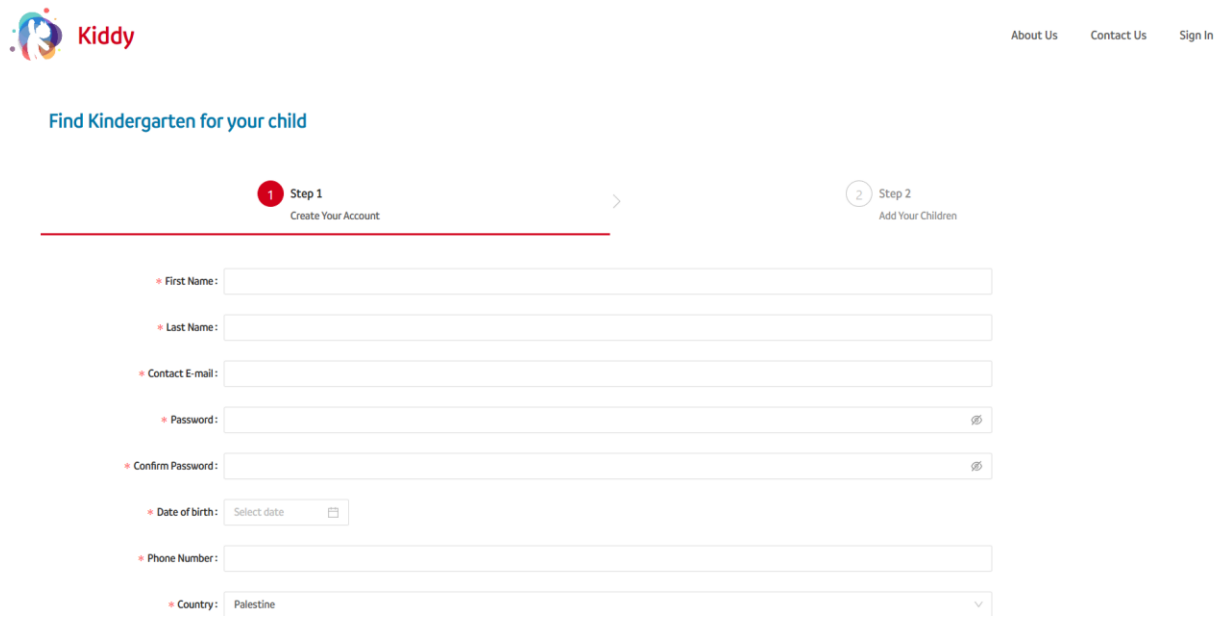

Figure 3: Register as parent.

Registering to the system as kindergarten owner requires the user to fill personal information as the first step, then as a second step, kindergarten information will be filled also.

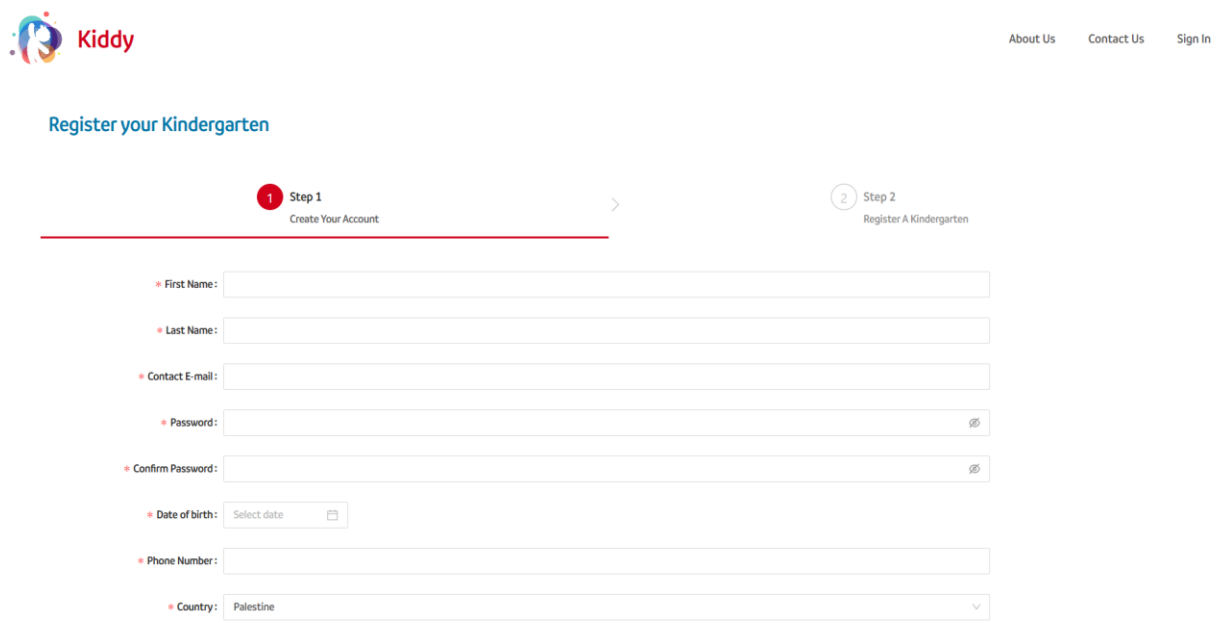

Figure 4: Register as Kindergarten Owner.

4.4.2 Parent Account

4.4.2.1 Dashboard

Here, the parent is free to manage his own children and each of them has an independent profile.

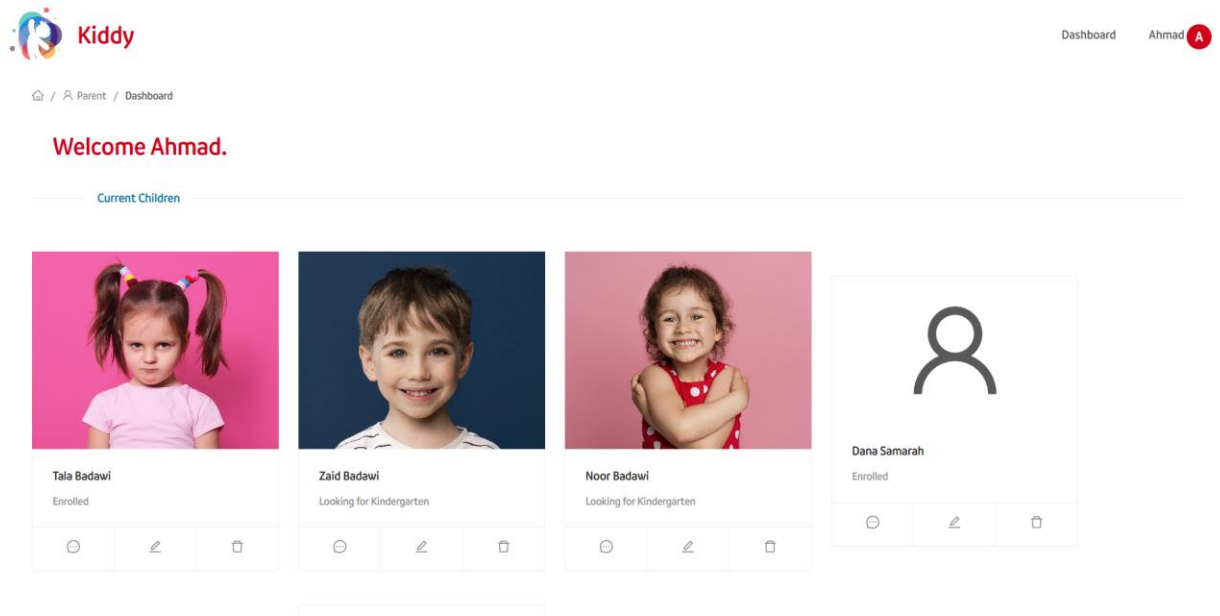

Figure 5: Parent Dashboard.

4.4.2.1 Child Profile

Each child has its own independent profile which contains 3 main parts:

- Profile Data which displays child's data.
- Searching for kindergarten for that specific child.
- Chat Center as a support for parents to contact kindergartens.

Child Profile:

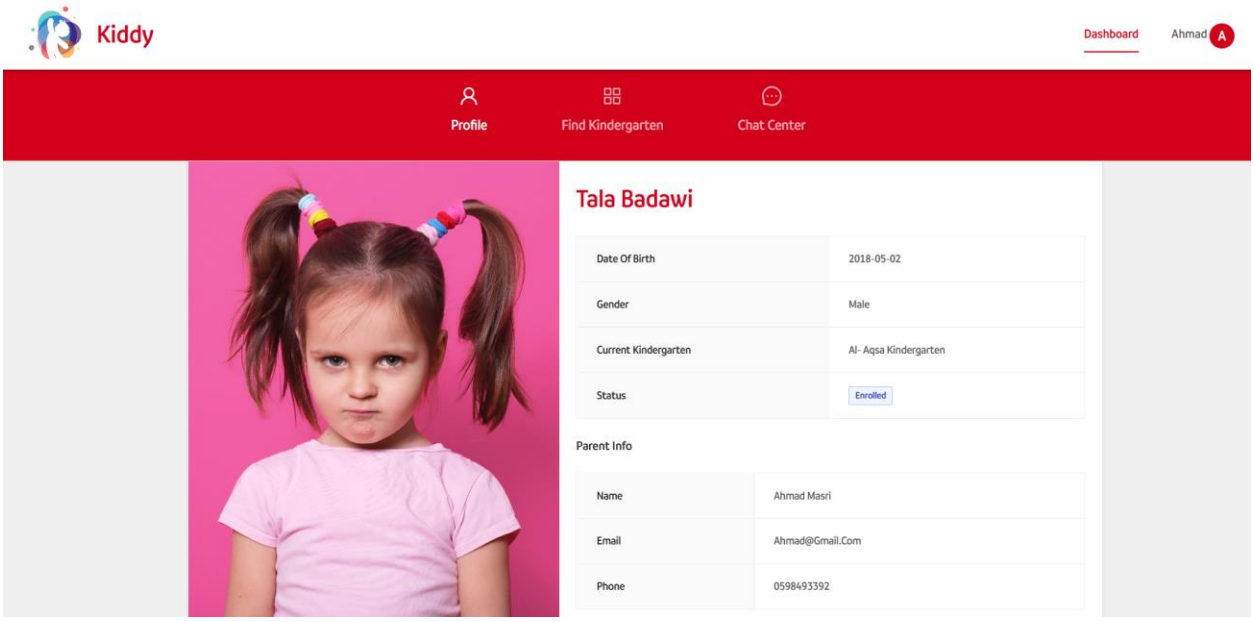

Figure 6: Child Profile.

Chat Center:

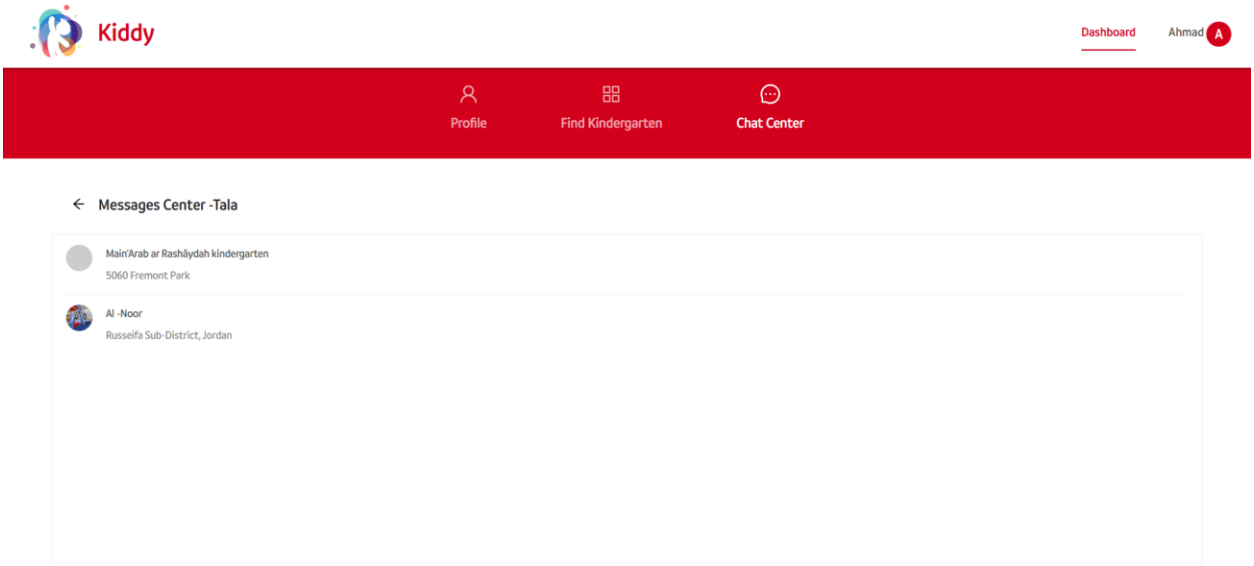

Figure 7: Chat Center.

Searching For Kindergarten:

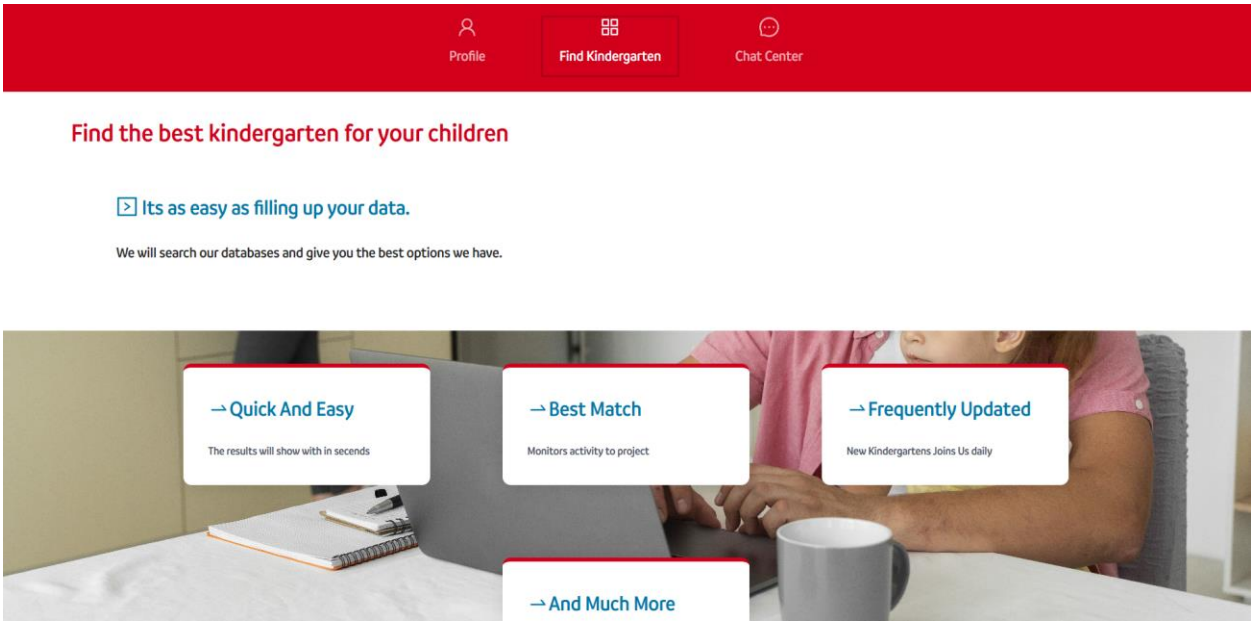

Figure 8: Searching For Kindergarten.

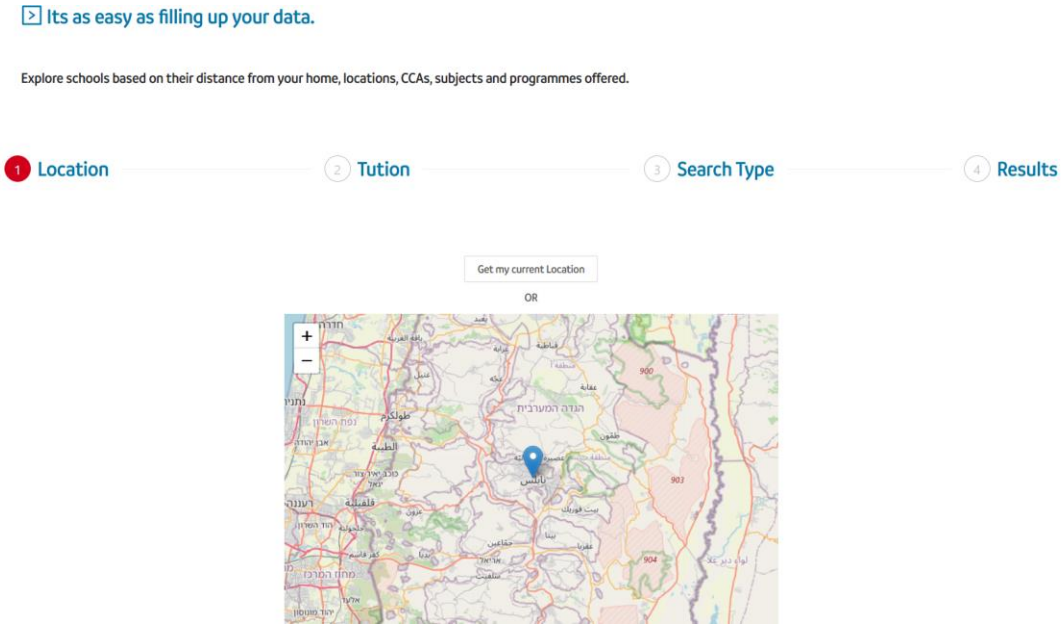

Figure 9: Search Steps.

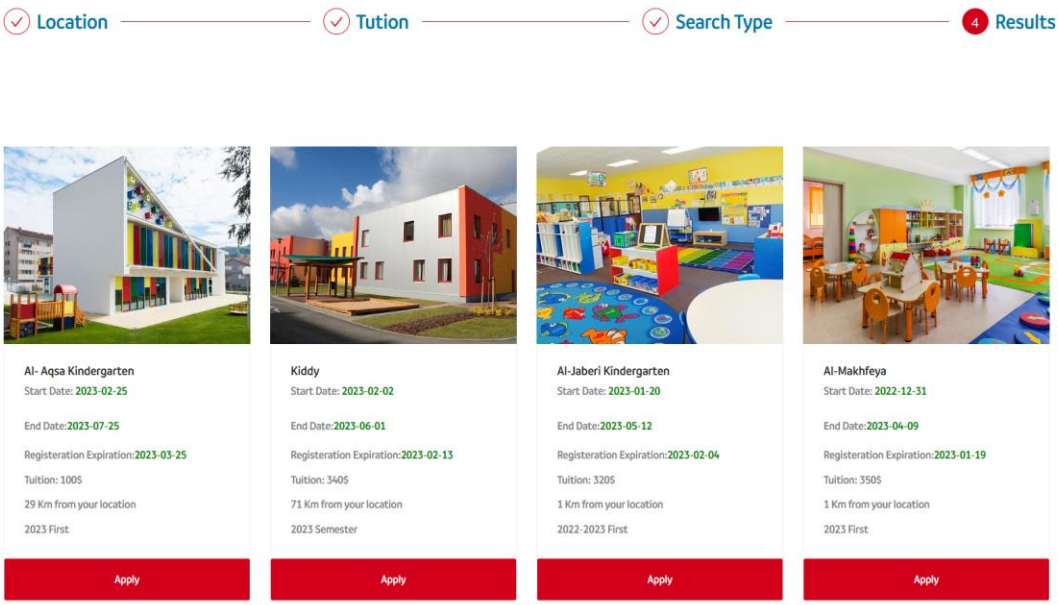

Figure 10: Search Results.

4.4.3 Kindergarten Owner Account

4.4.3.1 Dashboard

Here the kindergarten owner can manage and see the kindergartens he owns and perform actions independently.

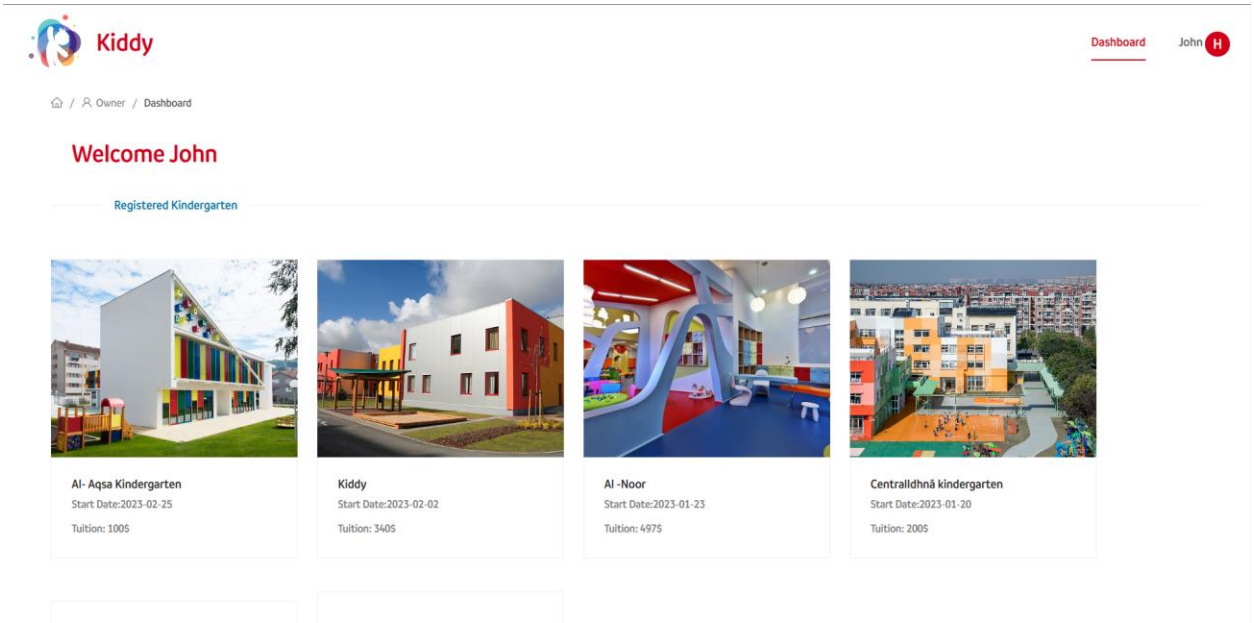

Figure 11: Kindergarten Owner Dashboard.

4.3.1.2 Kindergarten Management system

This page represents the whole management system Kiddy offers for each kindergarten. Kindergarten owners can review register applications coming from parents, manage their semesters, benefit the services Kiddy offers for kindergarten owners like HR management system, those services are subscribed after the owner chooses the plan suits them, and indeed there are child support tab for communicating with parents and a tab for displaying charts and statistics.

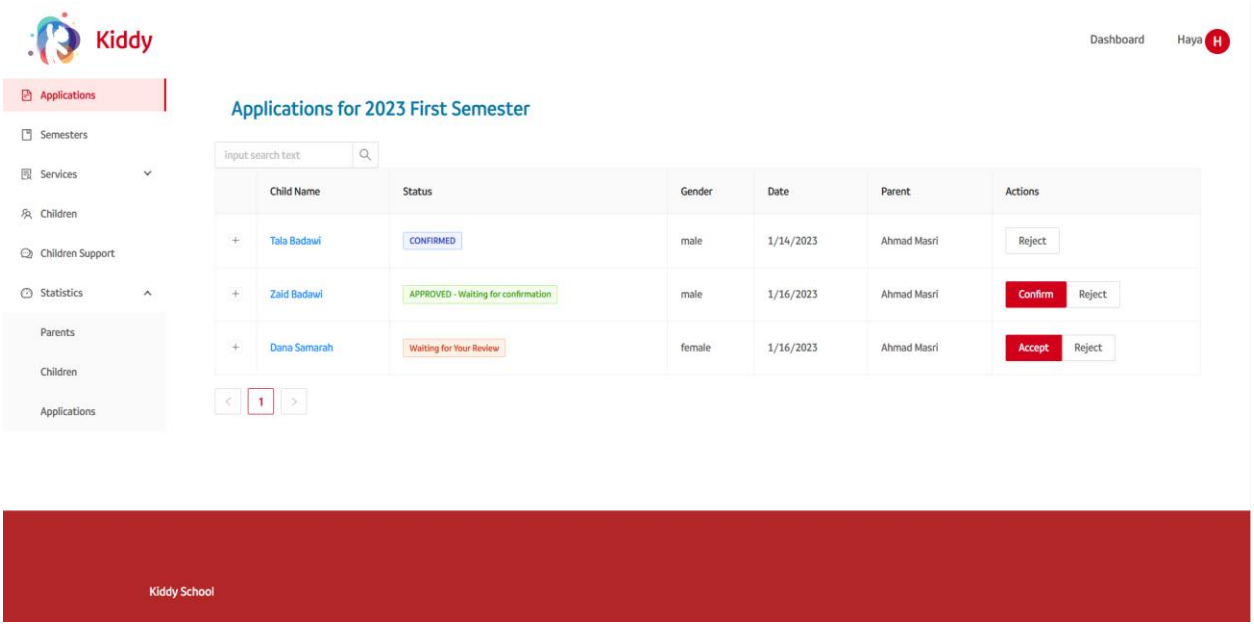

Figure 12: Register Applications.

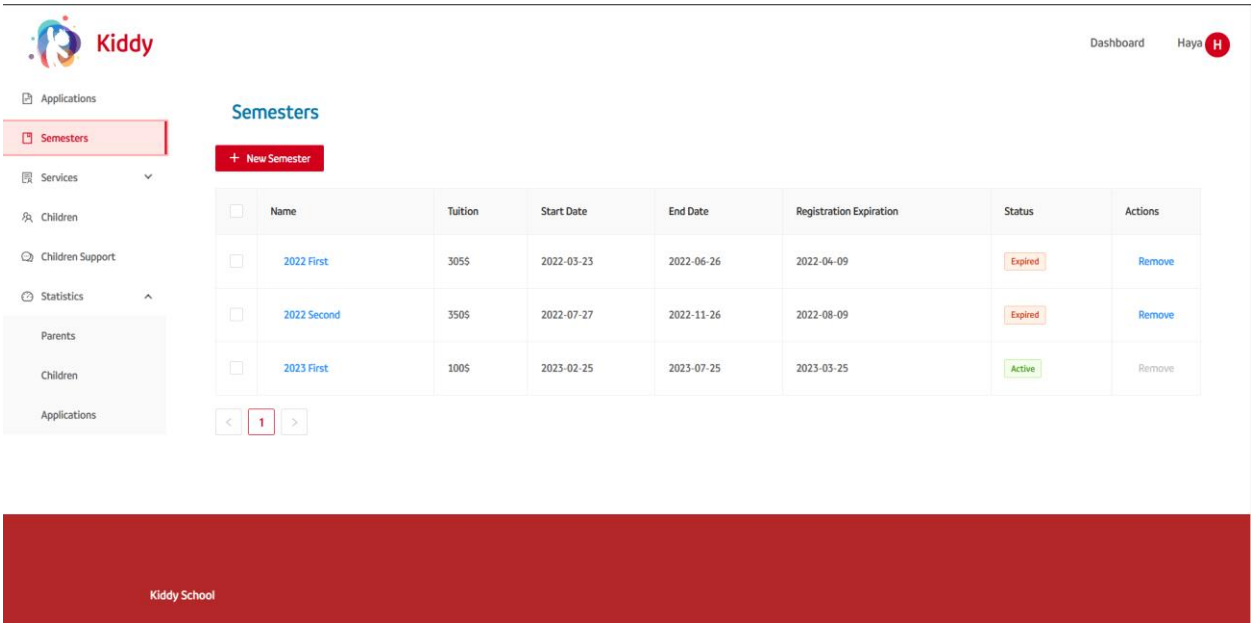

Figure 13: Managing Semesters.

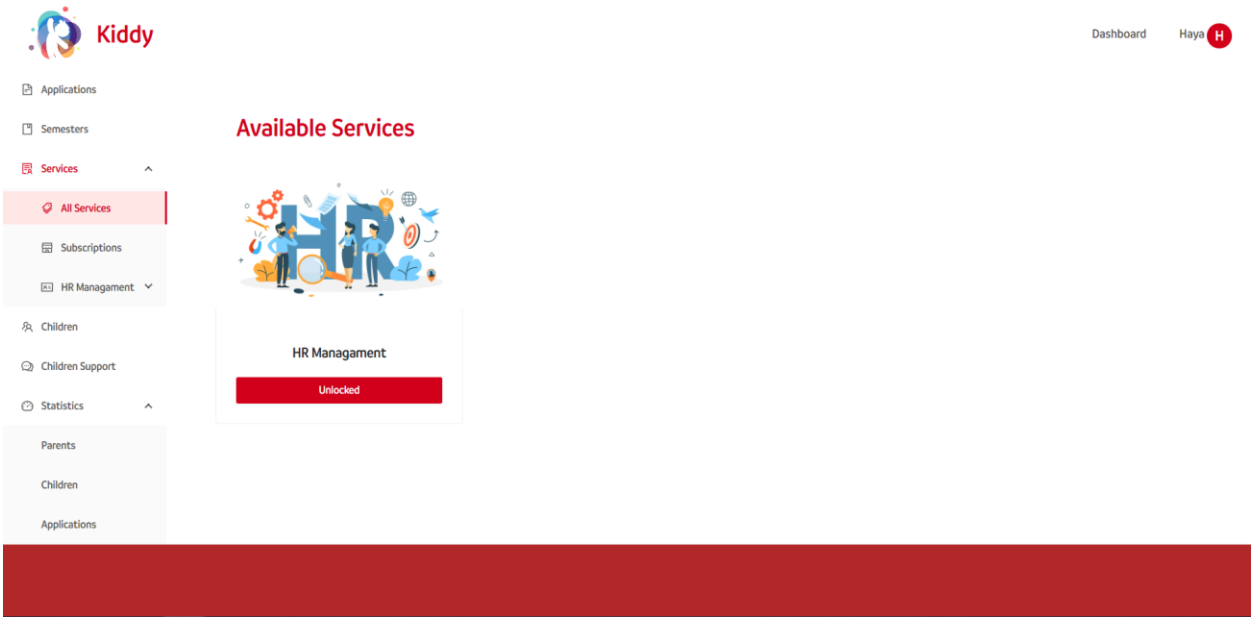

Figure 14: Kiddy Services.

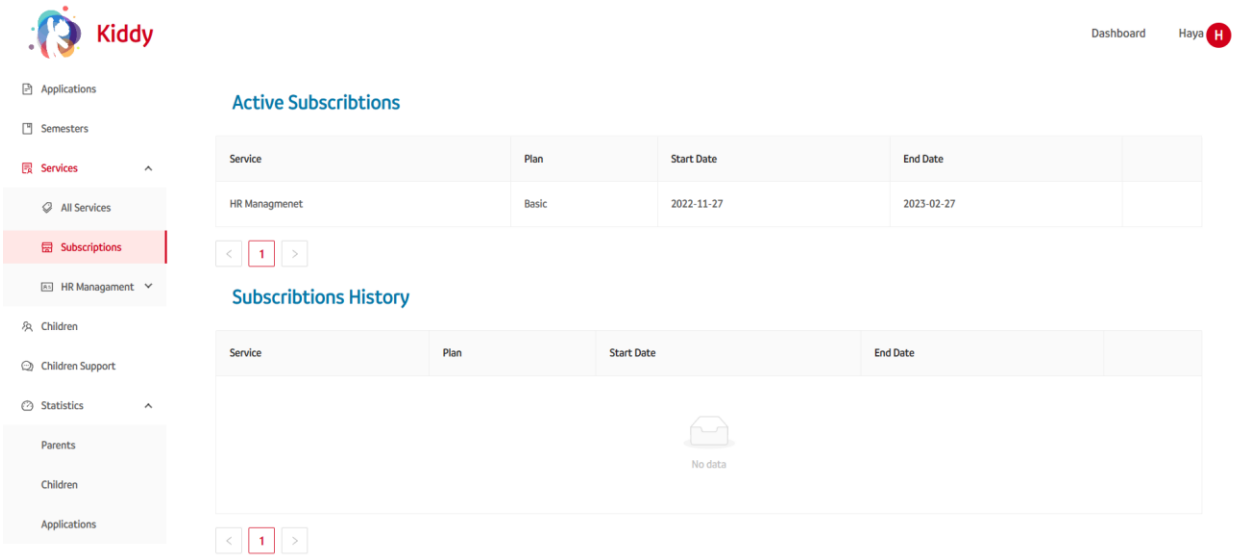

Figure 15: Subscription History.

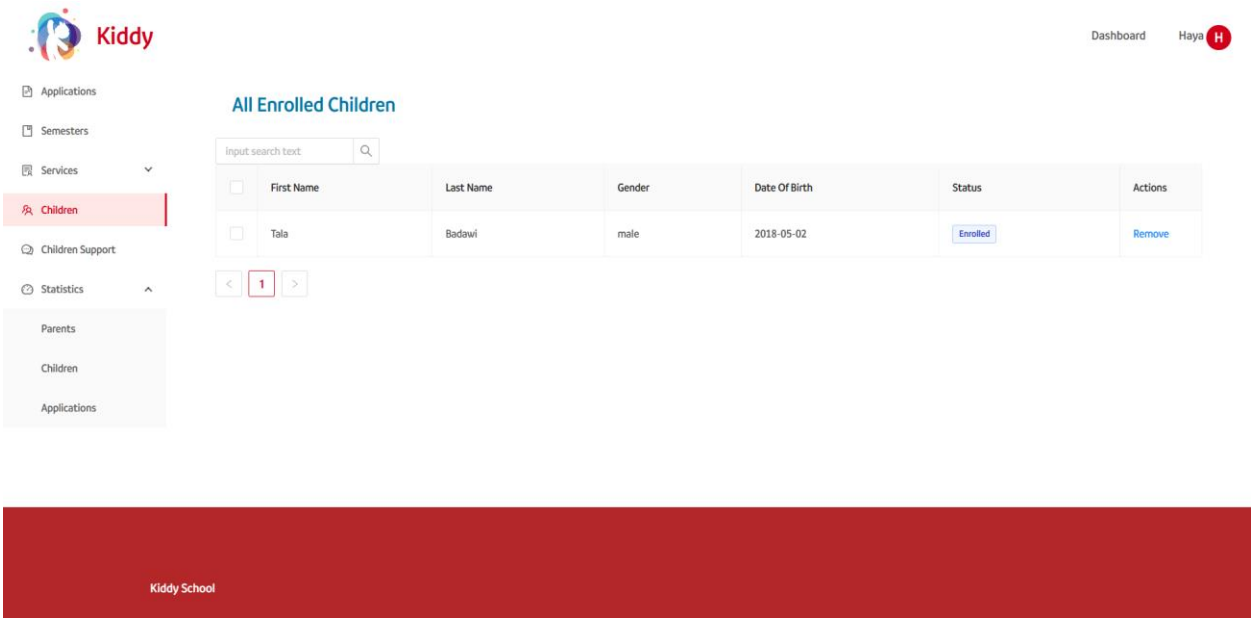

Figure 16: Enrolled Children.

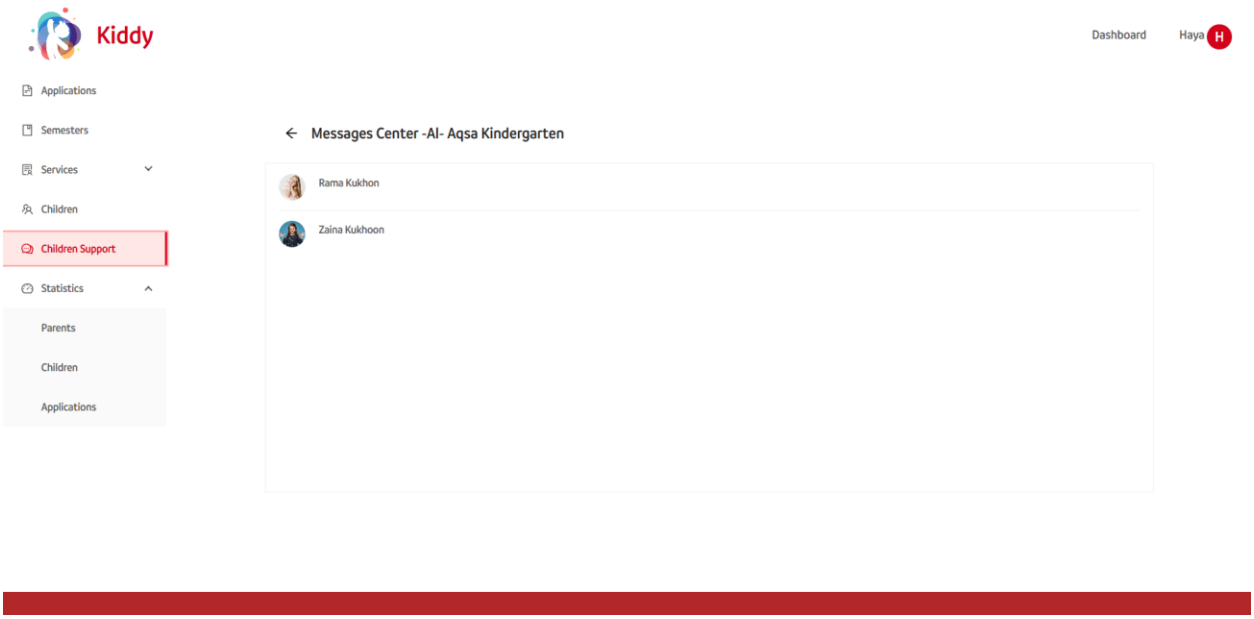

Figure 17: Chat Center.

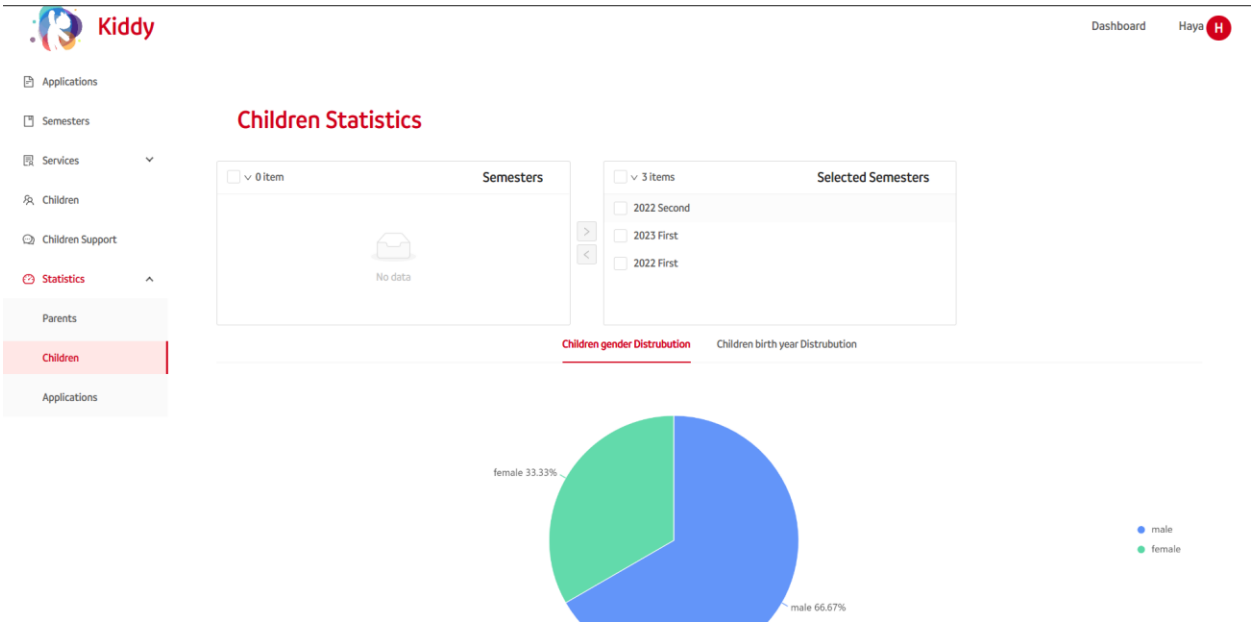

Figure 18: Gender Pie Chart.

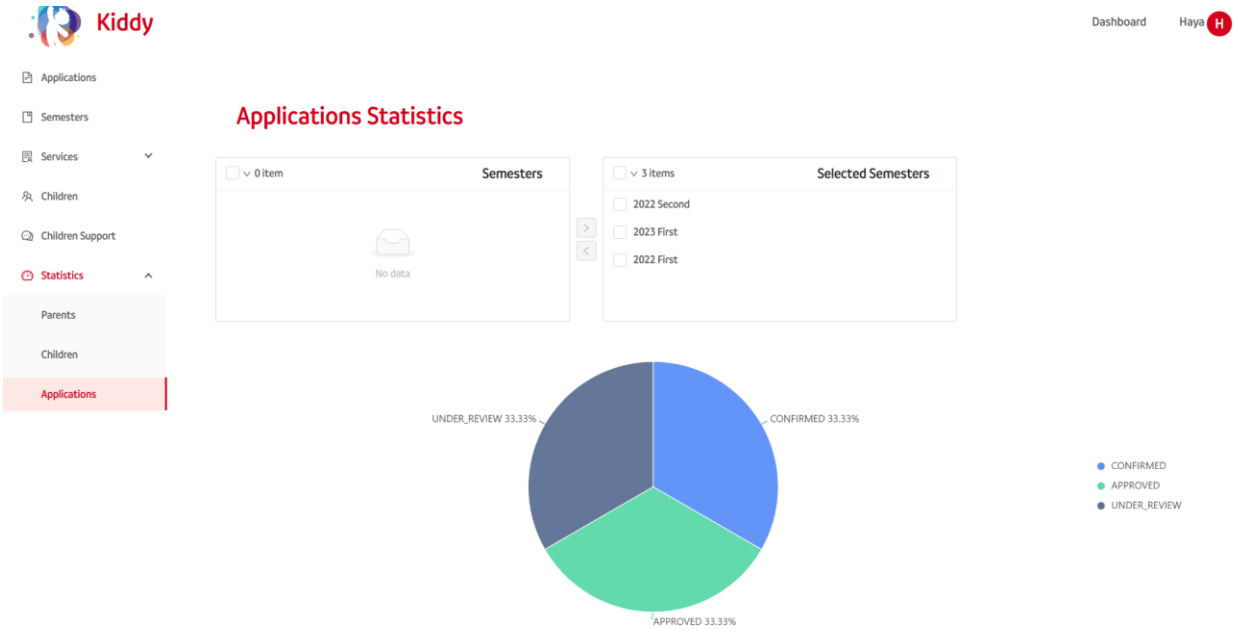

Figure 19: Applications' statuses Pie Chart.

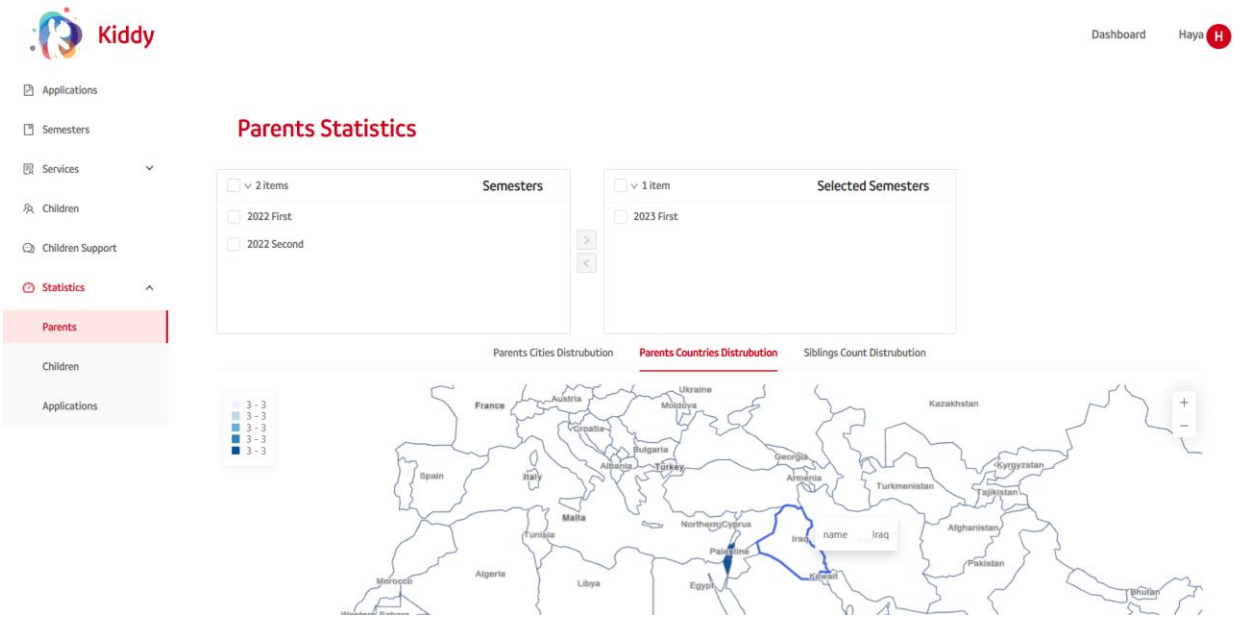

Figure 20: Geographical Heatmap.

4.4.4 Admin Account

This is the main page for admin, from here admin can manage and see all interactions and events occurring in the system. Admin can navigate users, kindergartens, and children. Also, can manage plans for different services like HR management system offered for kindergarten owners to benefit from. Never forget to mention also the statistics available for the admin to see and draw insights. Different charts are available like pie charts, bar chart, geographical heat maps.

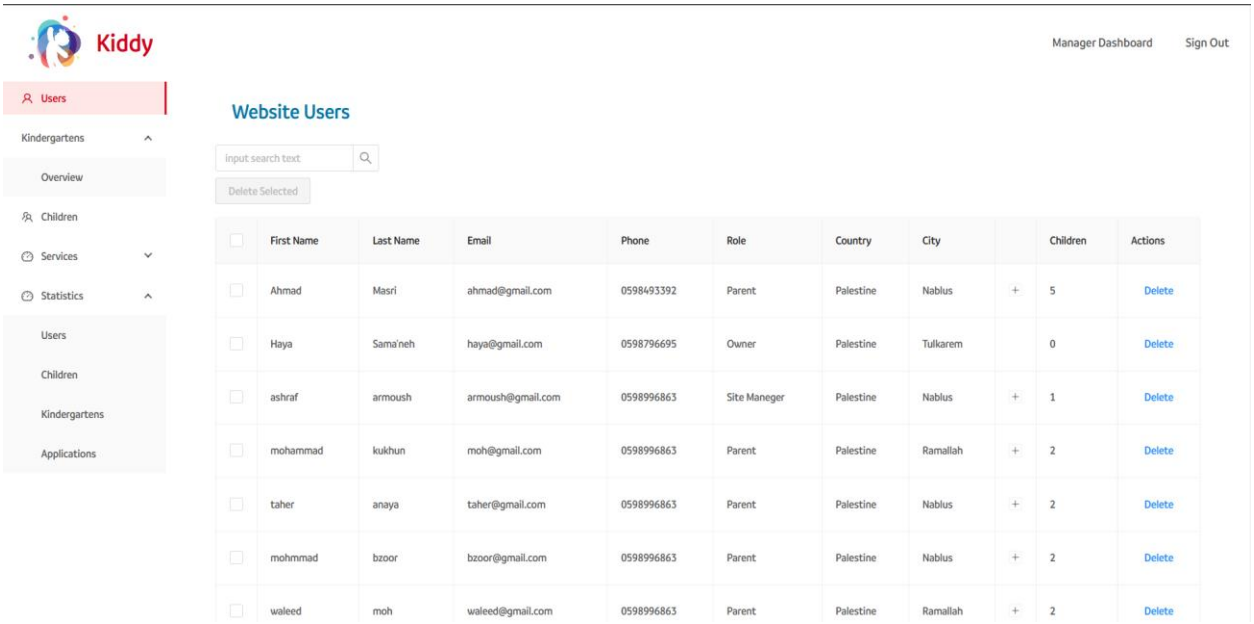

Figure 21: All users managed by admin.

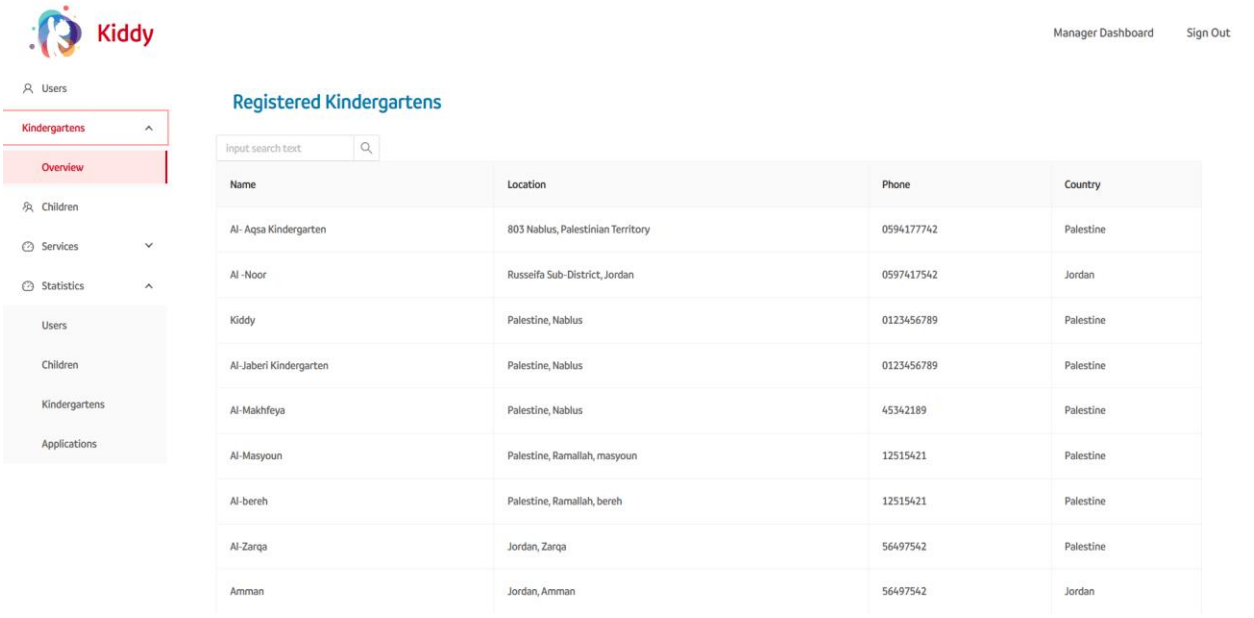

Figure 22: All Kindergartens Managed by Admin.

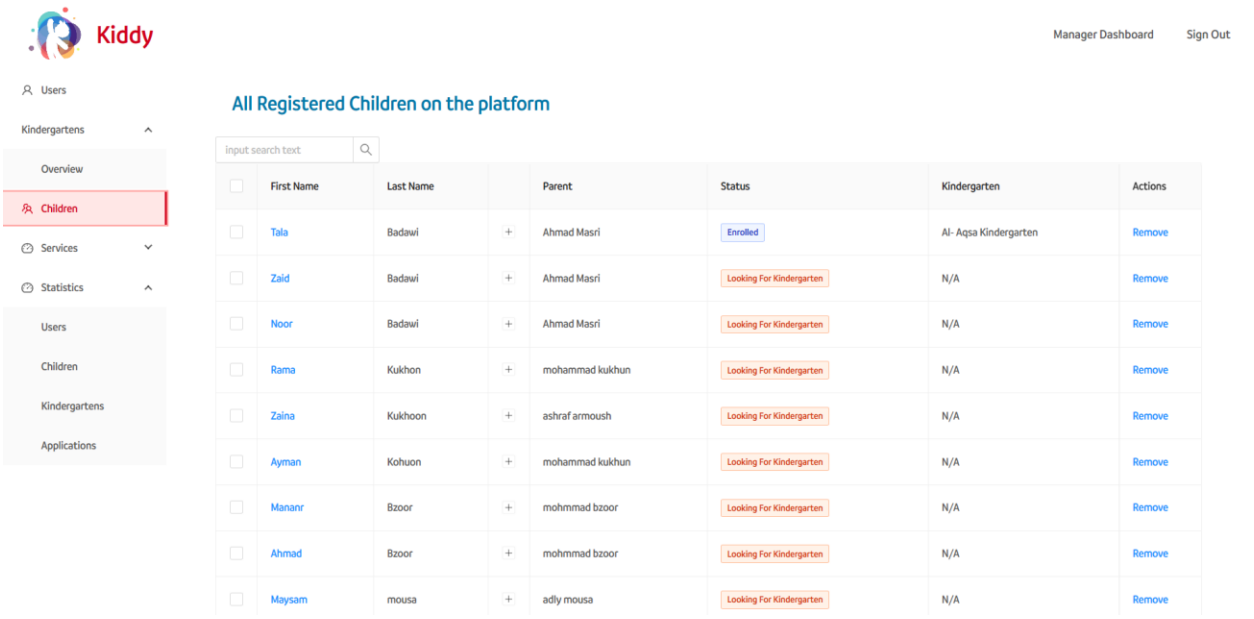

Figure 23: All Children Managed by Admin.

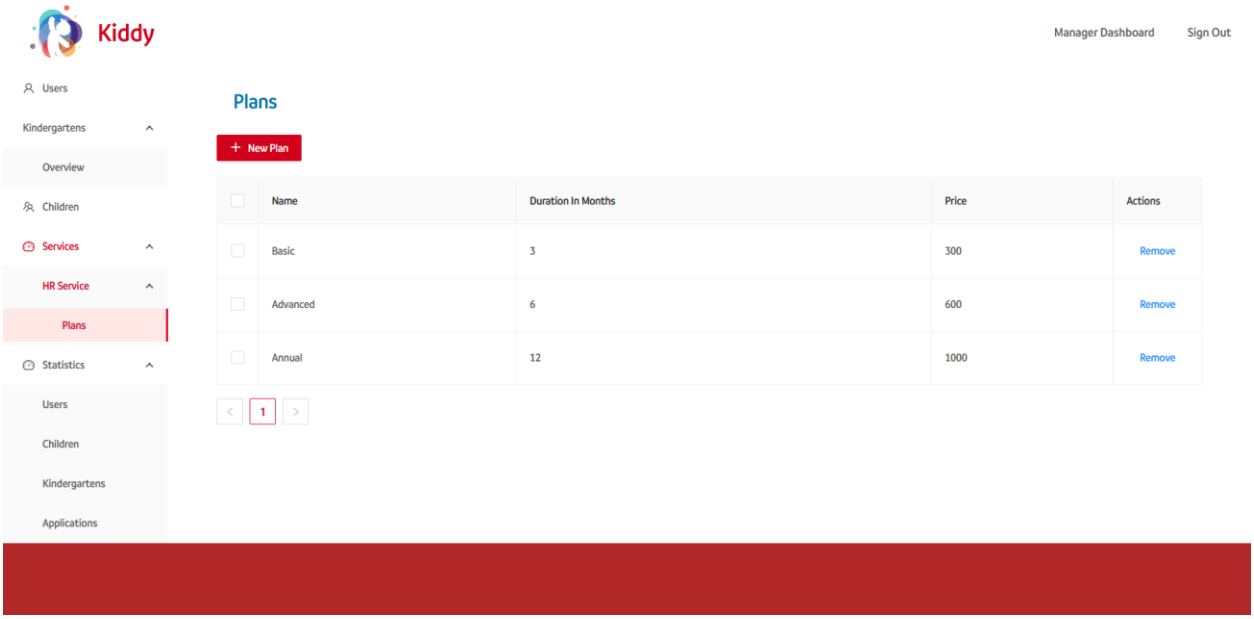

Figure 24: Services' Plans Management.

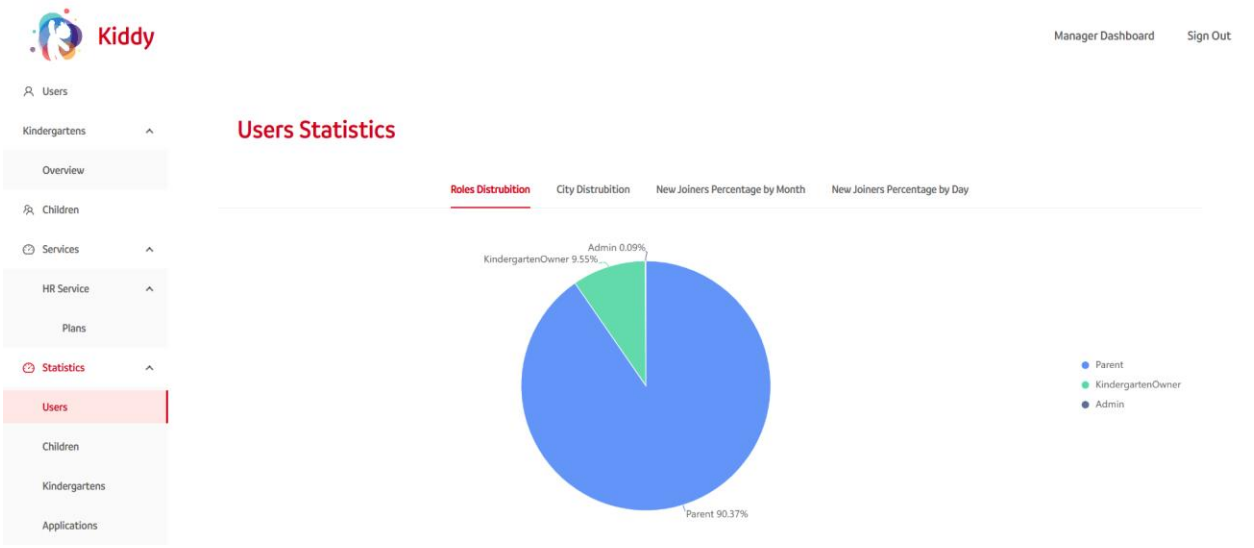

Figure 25: User Roles Pie Chart.

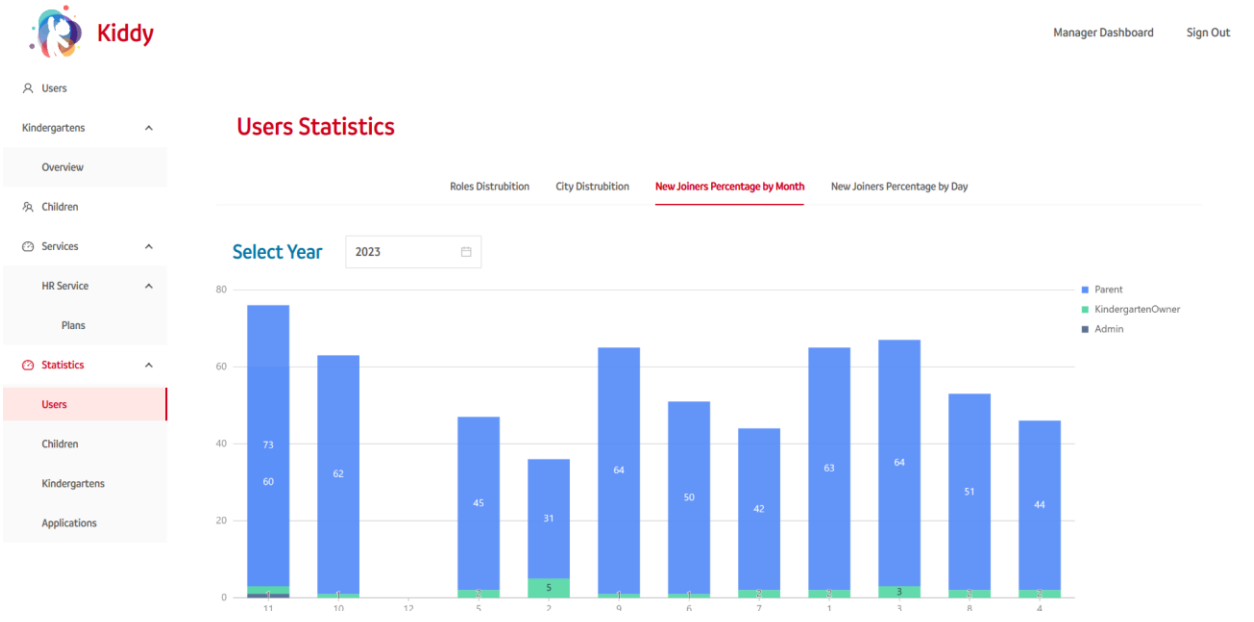

Figure 26: Joined User Statistics by Year.

Figure 27: Users Joins by Day.

Figure 28: Children Date Of Birth Distribution.

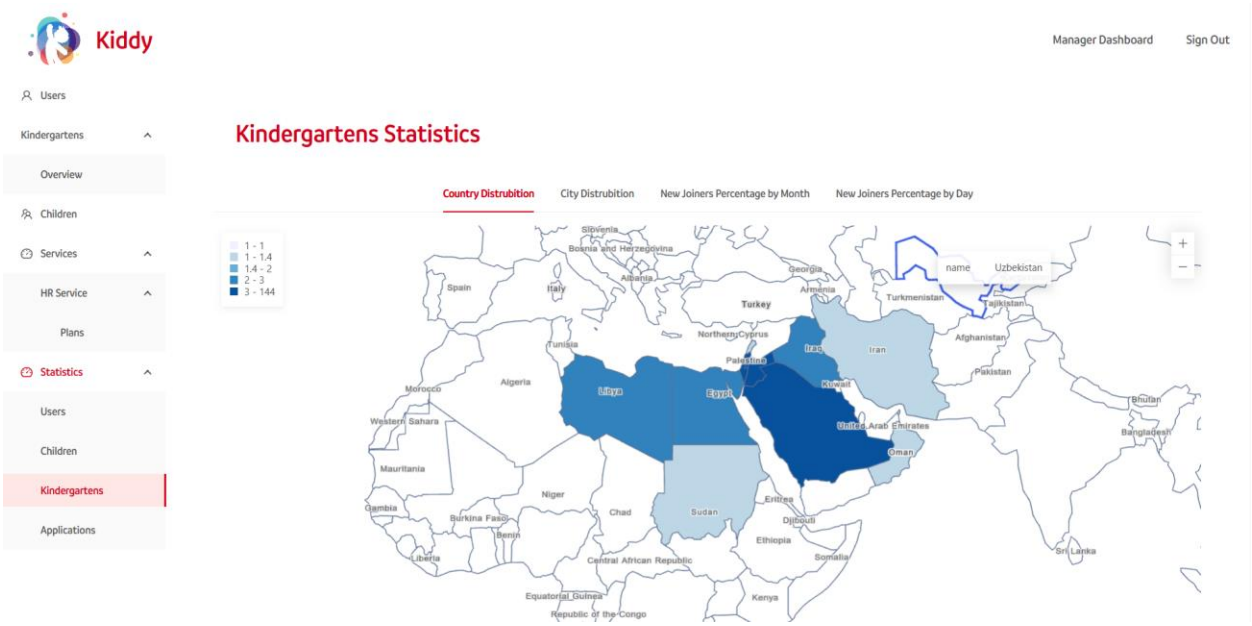

Figure 29: Geographical Heatmap for users' Distribution.

4.4.5 Mobile Application

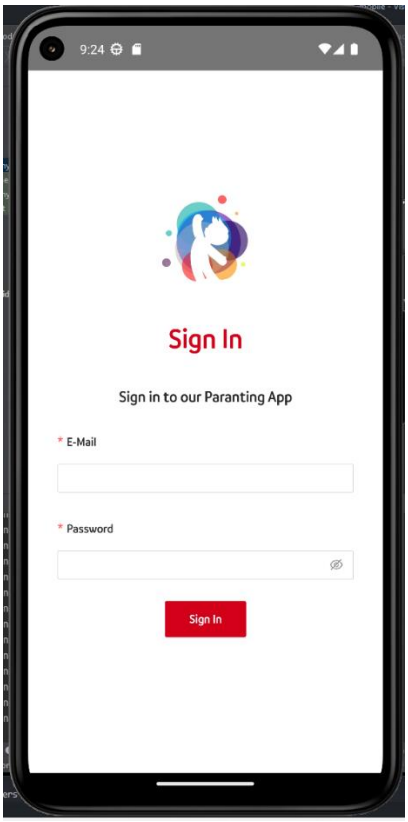

Figure 30: Sign In - Mobile.

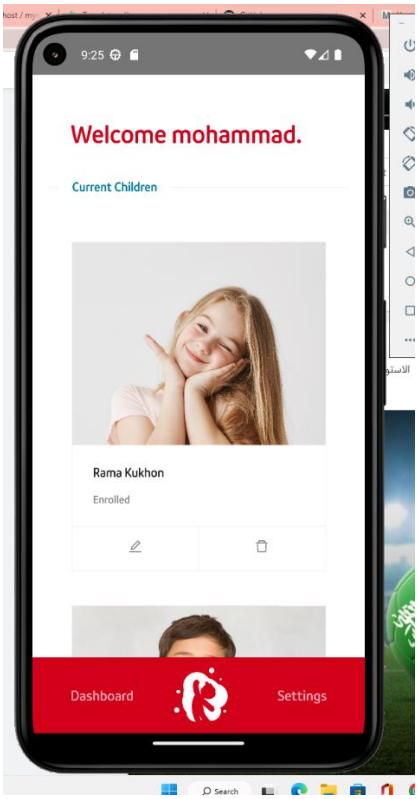

Figure 31: Dashboard – Mobile

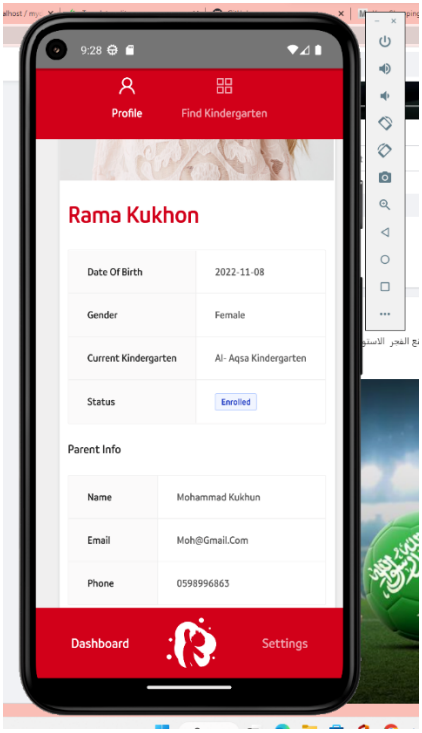

Figure 32: child Profile: Mobile

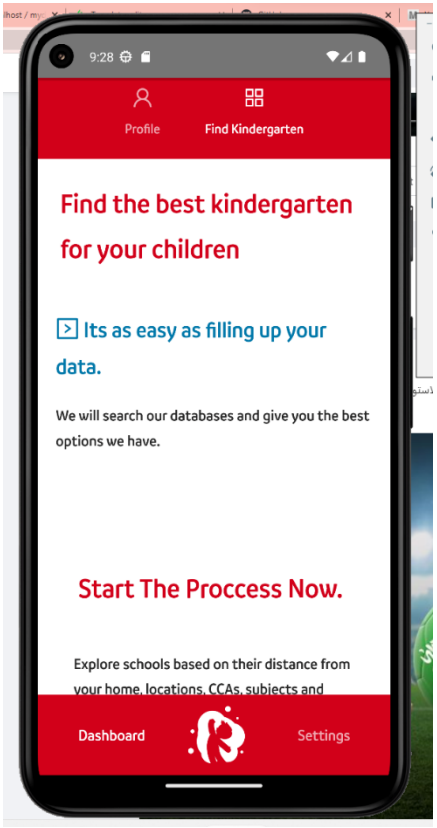

Figure 33: Matching Feature - Mobile

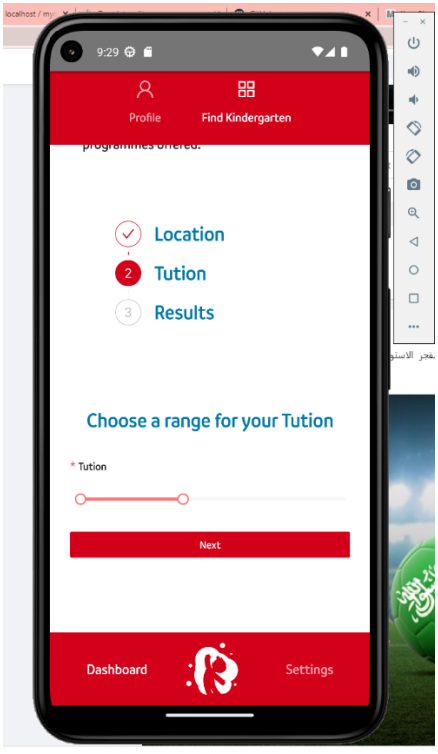

Figure 34: Matching Feature Steps.

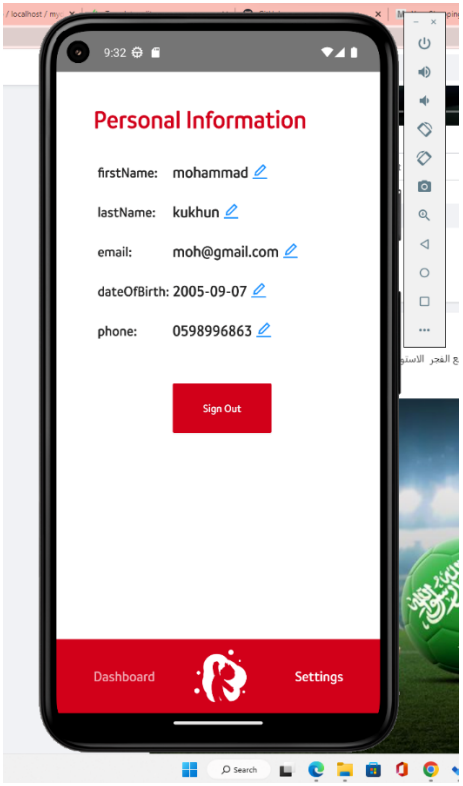

Figure 35: User Profile - Mobile.

5. Results and Discussion

5.1 Results

The application was successfully developed and deployed, and it does have the expected and necessary features it needs to fully operate and serve users.
As a result, users can:

- Register either as a regulate user (parent) and experience all parents' services or register as kindergarten owner and have a full management system.
- Parents can manage their children and follow their statuses.
- Parents can apply for register applications for different kindergartens.
- Parents can communicate with kindergartens.
- Kindergartens can manage their own semesters.
- Kindergartens have their own independent HR management system.
- Kindergartens can review statistics and charts for different periods of time.
- Admin can see, manage, and perform actions to all levels of entities.

5.2 Discussion

Our application Kiddy has provided the minimum number of features needed to make an international platform operate sufficiently without any missing critical features. Kiddy succeeded in hosting large numbers of kindergartens and providing the owners the ability to manage their kindergartens easily, and that was implicitly reflected to a great user experience. But still, there are a lot of details to handle such an international platform, there are some features that are fully dependable on data, so at the beginning of this international platform it will be hard to provide an excellent performance for different and data-dependent features like the matching feature, also an international platform requires a strong knowledge in distributed systems and robust implementation which was carefully considered but still needs to handle details about this context.

6. Conclusion and Recommendations

6.1 Summary

Kiddy is an international platform that succeeded to acquire the sights and interests of people whether they are seeking to benefit from the management features kiddy provides for each kindergarten owner independently or parents who are seeking to find the most suitable kindergartens for their children according to their preferences.

6.2 Improvements

Having real-life, meaningful data would help much to generate a lot of smart features and enhance the main matching feature, the more parents and kindergarten owners join to Kiddy platform, the more effective, greater results offered to the user.

6.3 Future work:

- Real time Timeline feature: this will help to exchange different users' experiences between users.
- Roles for employees: there will be other roles implemented for employees belonging to kindergartens.
- More AI smart features: like recommender system after gathering good amount of data.

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