A QR CODE BASED INFORMATION SYSTEM FOR MANAGEMENT OF THE DISTRIBUTION OF SANITARY PADS IN RURAL NAROK

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An Information Systems Proposal submitted to the Faculty of Information Technology in partial fulfilment of the requirements for the award of the bachelor's degree in Business Information Technology
Date of submission: January 22nd, 2021

Declaration

I declare that this work has not been previously submitted and approved for the award of a Bachelor's degree by this or any other University. To the best of my knowledge and belief, the proposal contains no material previously published or written by another person except where due reference is made in the proposal itself.

Student's signature:

……[*Signature*]……[*Date*]

Supervisor's signature:

…….[*Signature*]…… [*Date*]

Abstract

Period Poverty refers to the lack of accessibility of menstrual health materials caused by poor standards of living and high poverty rates in rural parts of the country which leads to school dropouts, early pregnancy and poor performance due to high stigmatization. This problem was identified before and was sort out by the distribution of pads using a manual process, The manual process involved government lorries distributing free towels to schools under the supervision of the head teacher guidance counsellor and the rural chief who facilitated distribution without reporting, this uncovered hitches of unaccountability and monitoring hence the implementation of the proposed system Pad IT which improves accessibility of sanitary towels at a subsidized rate in an automated manner through the scanning of QR codes printed on cards to verify access of the pads. The proposed technology implemented allows parents to top up a percentage of ksh 15 to provide eligibility which represents a lower retail market price after which the code scanned provides the details of the student history and wallet top up. The methodology used is Spiral method which allows an integration of prototyping and waterfall method to measure risks in each phase of the project. This project will approach an Object-Oriented Analysis and design that is represented by a mobile based android system to allow the generation of QR codes which will be printed on cards to represent a profile for each girl in a given school in rural Narok. The system will use a firebase database that will store up data and generates reports to ensure accountability of data. Therefore, providing visibility in the distribution of sanitary towels.

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List of Abbreviations

CSS Cascading Style Sheets

IDE Integrated development Environment

MHH Menstrual Health Hygiene

MHM Menstrual Health Management

NFC Near Field Communication

OOAD Object Oriented Analysis and Design

QR Quick Response

RFID Radio Frequency Identification

Chapter 1: Introduction

1.1 Background

Menstrual hygiene management (MHM) refers to the use of clean menstrual management materials to absorb or collect blood that can be changed in privacy as often for the duration of a menstrual period and having access to convenient facilities to dispose of the materials. This material includes cloth, pads, tampons or cups. While Menstrual Health Hygiene (MHH) is the broader link between menstrual health well-being, gender equality, education empowerment and rights.

Globally there's a shift of focus directed by UNICEF to improve girls menstrual hygiene in four areas which are: social support, knowledge and skills, facilities and services and access to absorbent materials and supportive supplies. (Roeckel, Guide to Menstrual Hygiene Materials, 2019).Commonly low and middle-income countries shows that many girls are not able to manage their menses and associated hygiene with ease and dignity due to a combination of discriminatory social environments inaccurate information, poor facilities and limited choice of absorbent materials and to top it , an additional myth and taboos that has been created in the rural parts of the countries that facilitate menstruation being very private hence leading to the exclusion of the girls. During a current study by the Menstrual health Kenya, statics have been gathered to show that ¼ of girls do not associate menstruation with pregnancy and 45 percent of them are able to discuss the issue openly with their parents while that 65 percent of girls and women cannot afford pads and out of that it also shows that 2/3 of girls in rural areas receive sanitary towels from their sexual partners. (Njanja, 2018)

This highlights the levels of period poverty caused by lack of access of sanitary towels due to poor standards of living that leads to some of the girls around not being able to afford pads. Although the government has put in measures to have free and subsidized pads distributed to schools (News,2016), there are gaps that arises such as mischievous corruption and reselling of the pads which causes a defect to solve the problem.

Current distribution gave been done across rural areas which involves using of lorries to deliver pads to chief offices or school storage facilities which are supervised by the headteachers .Although the process seeks out to deliver some of the schools do not have secure storage facilities and monitoring how the girls get the pads has been proven to be a challenge as there are no reports given.

The integration of the QR codes will facilitate the improvement of monitoring and accessing the Sanitary materials at a subsidized rate in the rural areas hence have an accountability of all girls facing period poverty to be able to access the pads and drive an improvement of school attendance which facilitate better performance for the girls.

1.2 Problem Statement

The current existing method of the pads distribution in rural areas and schools have been found to be inadequate as some of the girls are not aware the pads are being given to them due to theft and reselling of the materials at a higher rate and the lack of innovation as the biggest issue as to why women cannot afford the product. (Muriithi, 2018)

Hence this system will safeguard the need of girls and provide an environment that will allow her to appreciate the changes in her body without experiencing stress, and limitations of information or supplies during menstruation reducing period poverty.

1.3 Aim

The aim is developing an Information System that manages pad distribution in rural Narok to solve the problem identified in section 1.2 which is period poverty.It will assist in the tracking and allocation of the sanitary towels at an affordable price to the girls in the rural areas.

1.4 Specific Objectives

I. To review techniques that have been in place for the distribution of sanitary towels.
II. To identify methods possible to distribute sanitary towels in an efficient and accessible way at an affordable rate.
III. To develop a QR Code and Mobile Application system that will facilitate the distribution of sanitary towels at a subsidized rate.
IV. To test the system created using the data gathered.

1.5 Justification

This project will use QR code technology to cover the bases of having accountability of the pad distribution. It is an affordable solution that will allow a lot of data integration and Mobile money to facilitate receiving pads at a lower retail rate, allowing access of the pads in the schools while keeping track on the school attendance of the student.

The system will allow girls to have access to affordable pads on a monthly basis increasing their levels of confidence and reducing the number of dropping out due to stigmatization and period poverty driven by poor standards of living.

1.6 Scope and Limitations

This project will focus on alleviating period poverty with the goal of improving the quality of education which eliminates discrimination of gender disparities and to ensure equal access of education in all situations that will enable good health and well-being. Under the Menstrual Health materials, it will only cover and is limited to the distribution of Sanitary towels as opposed to other materials such as Tampons, Menstrual caps and cloths.

The project will be launched in Narok county as the pilot phase to enable real time results and data collection of the capabilities and measures of the solution being put in place.

The limitation of using QR code technology in this project is having the codes printed out on papers for the girls, which pose as a security threat of either losing the codes or identity theft during pad distribution hence causing a breach within the system.

Chapter 2: Literature Review

2.1 Introduction

This chapter sets out to review existing systems used in the pad distribution and the techniques adopted in alleviating period poverty. It will highlight the trends in QR technology and explore challenges that are faced in the current system by creating a relation between school dropout rates and the period poverty caused in rural Narok.

2.2 A description of current pad distribution process

Pad distribution to rural schools in Kenya are done manually through a paper based manual process. This system is employed to all schools as the government sort out to have a duty-free pad policy scaling up the management of menstrual health hygiene for those in need across the counties to all the women and girl

Although the approach to have tax free pads in Kenya has been deployed many girls still miss out of the pad distributions as patches arise that the same pads are being resold to them by their teachers because there is no structure in place to track what happens (Mukuria, 2016). Poor storage facilities in schools supplement some of the problems such as the pads getting stolen from schools and some of the teachers using the pads for their own convenience causing the girls not to have access unless paying or sexual exchange transaction leading to stigmatization and school dropout cases.

Period poverty drives the rate of classes being missed in the name of solving the dilemma at the moment. In Rural Narok and across rural areas It precedes notions and myths about having Menstruation to reflect an act of woman hood hence some of the girls who are not able to afford the pads end up receiving the pads from their husbands they have been married off to therefore the problem is not solved at hand because they didn’t receive the pads being distributed by the government .This system is inefficient as a lot of free handouts aimed to help the girls are not accounted for causing a recurrence and the cycle of the pad distribution without structure (Kariuki, 2018).

2.2.1 Challenges experienced with the presently used pad distribution.

The major problem facing the manual distribution of the pads in rural Narok is the lack of accountability and tracing structure to ensure that all the girls within a given school are able to receive the duty-free pads being distributed by the government and local NGO such as Zana Africa. Due to lack of structure and monitoring ,it the drives the notion to provide false reports back to the supplier of the data collected from the pads distributed to the girls hence not solving the main problem that all the girls are not able to access them at a given date on a monthly basis.

2.2.2 Correlation between Period Poverty and School attendance.

A number of policy makers have argued the importance of menstruation in limiting school attendance and attaining performance is important for a variety of development outcomes. Many of the female students prefer missing school during their menses if they lack the materials, a quick survey done by the state of period in the Us across the World shows that 84% (more than 4 in 5 teens) have either missed class time or know someone who missed class time because they did not have access to period products. 25% (1 in 4 teens) have missed class because of lack of access to period products. 83% (more than 4 in 5 teens) think lack of access to period products is an issue that is not talked about enough (Stubbs, 2018). In rural Kenya Ten percent findings related shows that girls will stay at home and use other materials such clothes, ripped mattress, or feathers and very few girls receive education about their period and end up being misinformed. Only 32 percent of rural schools have facilities where girls can change which drives a topic of a conducive environment to accommodate menstrual hygiene to be addressed.

The solution provisions education experts increasingly believe that a cost-effective way to keep high school girls from dropping out in poor countries is to help provide them with sanitary products (Kristof, 2009). Which drives the technology basis of automating the pad distribution of pads to rural areas. Therefore, the conclusion basis that period poverty plays an important role in education and attendance hence should be addressed as a subject in itself and raise awareness and equality in education by teaching Menstrual Health Hygiene in schools to all students both male and Female.

2.3 Works cited in reference to managed distribution systems

Some of the works referred are not in the same line with pad distribution process but borrow the technology suited to execute the proposed system

2.3.1 Radio Frequency Identification and Near Field Communication food distribution technology.

Tap2eat is a digital mobile platform solution created on the basis of having food distributed at a subsidized rate to children in public schools around Kiambu and Nairobi county. The technology implemented in solving the problem is the use of a virtual wallet linked to an NFC (Near Field Communication) smart wrist band which students Tap to receive food. Parents pay and track an amount of Ksh 15 top up the 70 percentage to receive a subsidized lunch using mobile money and later notifies the parents when the child has eaten

The use of cash and manual transfers become cumbersome as the food providers found it a problem that kids were losing money on their way to school, theft from their peers and therefore turned to the use of technology which made work fast and reliable to track and get food at an affordable rate. (Njiru, 2019).

2.3.2 Barcode and RFID on paper currency, checks and luggage's personal identification.

Barcode technology is almost similar to the use of QR code, but the main difference arises in the ability to accommodate large amounts of data the barcodes and RFID are implemented to the method of tracking items and reducing counterfeit transactions and a way of safeguarding travel and account for stolen baggage. The use of RFID technology is considered to be accurate to scan multiple barcodes than a barcode scanner. The advantages of using this system

a) The use of barcodes and RFID tags on paper currency will significantly reduce the time taken to count and provide accurate information.
b) It reduces the amount of time taken to sort and trace counterfeit paper as all the currency is assigned unique numbers that cannot be duplicated.

This system is sufficient but not reliable as it results in being expensive in tracking and is limited in the keeping of certain types and amounts of data.

2.3.3 Manual distribution of Sanitary towels

The government delivers sanitary towels through lorries allocated to counties, the pads are delivered to the chief offices or the school storage facilities whereby the headteacher or the guidance counsellor are put in charge to give the girls who need them. The problem that arises is that oftentimes the pads are not accounted for in terms of numbers and report visibility back or follow up to ensure that all the girls have received the pads upon arrival. Hence patches of theft within the school property and illegal claim of the pads happen leaving no evidence to show pads were brought meant to give access and manage menstrual hygiene and boost school attendance.

2.4 Gaps in the existing system

The main challenge of the barcode technology is that it is one dimensional only able to read limited amounts of data as compared to using QR codes which is a two-dimensional combination of vertical and horizontal rows and columns enabling it to store a large amount of data. The amount of time taken to create each tag specified in the use of RFID&NFC for an item is time consuming as compared to generating an existing code. The use of RFID&NFC technology is expensive as the extra cost of using the wrist watches to keep the data for scanning can lead to loses, for example a student might lose the wrist watch or it can get spoiled and the cost taken to repair the watches are an extra notch to solving the main problem hence the data collected on that given day for distribution of food can be inaccurate from the system.

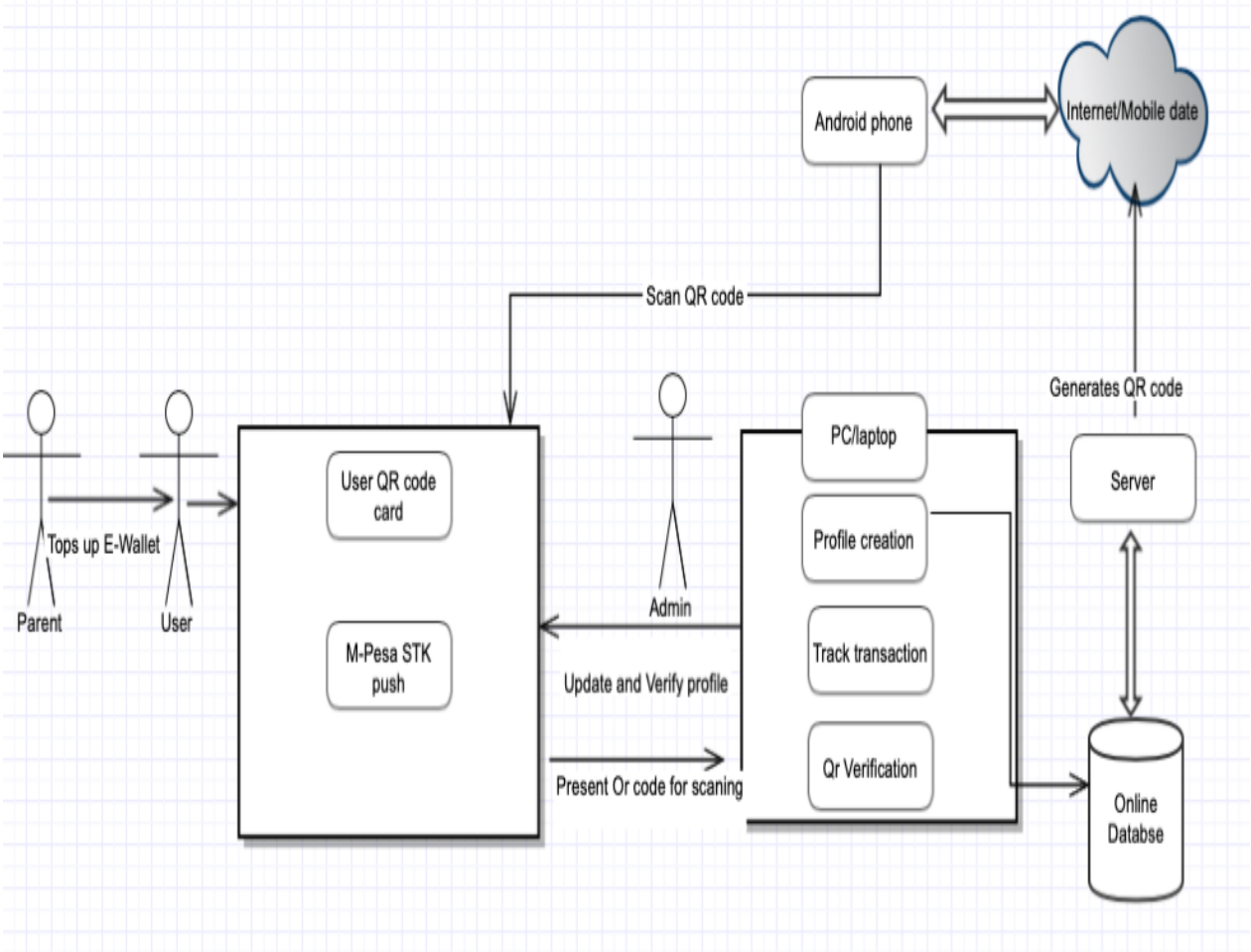
The challenge in using the manual process is mainly falsification of data collected during distribution.

2.5 Conceptual Framework

The proposed Pad IT is a mobile based QR code system used to facilitate the distribution of pads. The Administrator manages the profile for all the girls in the school. Each girl is given a unique profile on the generated on the QR code from the databases which contains and status and details that makes her eligible for receiving a pad all imprinted into a card containing all their details. The girls account facilitates two users: The parent/guardian and the girl. The parent uses the girl's unique identification to top up a certain amount from M-Pesa mobile money every month to be able to receive the pads from the school centres allocated for storage whereby the

mobile devises owned by the administrator will be used to scan their cards containing the QR codes and this will allow the system is to keep an account of every girl, the number of pads received in a year each month and is limited to providing the pads if the E-wallet has not been toped up by the parent. Below is a conceptual diagram representing the working of the system.

Figure 1 Conceptual Diagram



Chapter 3: System Development Methodology

3.1 Introduction

System Development Methodology is the engineering technique that is used in projects to ensure that a solution is reached which fulfils the requirements of the users. The methodology to be used in this system development is spiral method which combines the features of prototyping and waterfall method, the processes are represented by a spiral rather than a sequence of activities with backtracking that allows visibility, cost and risk evaluation. The system will use Object Oriented Analysis and Design (OOAD) to group the models as an interacting object to be able to achieve its functional and non-functional requirements

3.2 Spiral Method

This is a risk driven model that is represented by loops which represents phases in each process that are explicitly assessed in each outcome hence the reflection that combines features found in the steps in prototyping and waterfall method.

Some of the advantages incorporated in this method is that it allows

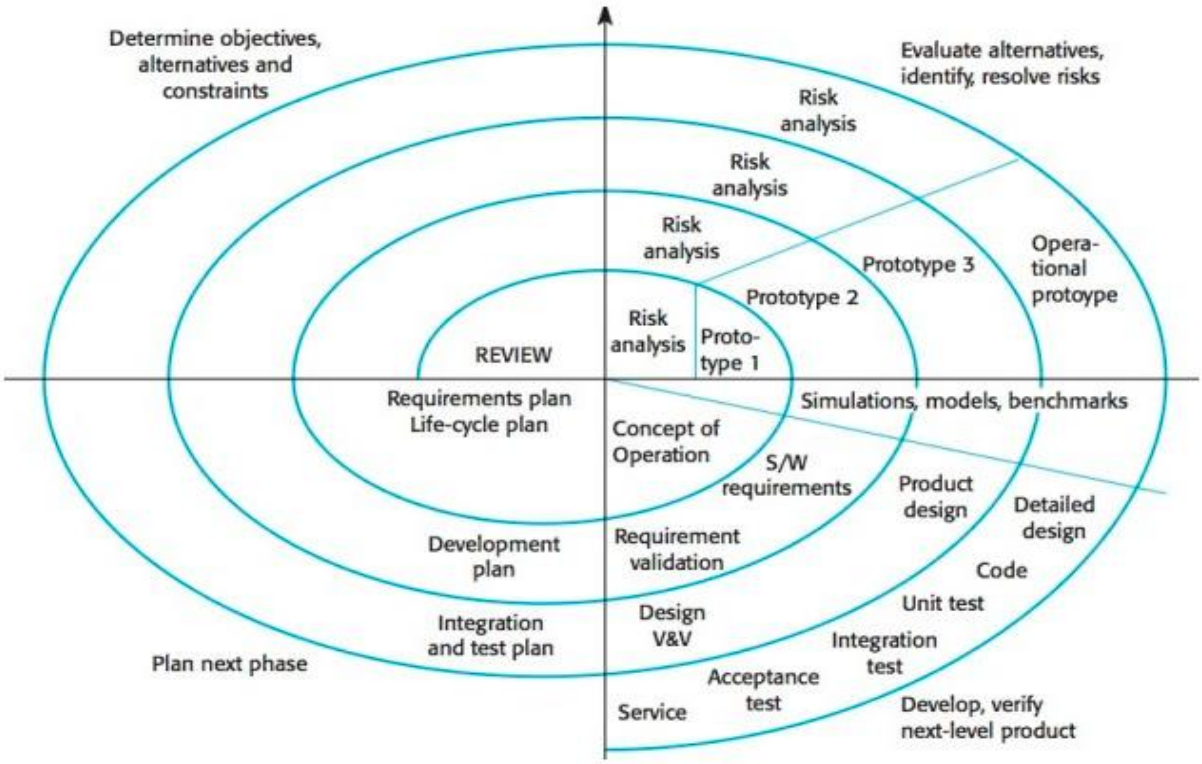
a) Realism: The model accurately reflects the iterative nature of software development on projects with unclear requirements.
b) Flexibility: It incorporates the advantages of the waterfall and rapid prototyping methods such as improved system usability and a closer match to user's real needs.
c) Provides comprehensive model risks and good project visibility.
d) Allows frequent feedback from the users as it closely ties them to each lifecycle phase.

Some the disadvantages of using the spiral method are:

a) Needs technical expertise in risk analysis to really work.
b) Model is poorly understood by non-technical management hence not so widely used and requires high administrative overhead.

c) Spiral may continue indefinitely, and developers must be reassigned during non-development phases. This may lead to a hard task to verify milestones and indicate readiness to proceed to the next iteration
d) Time spent for evaluating risks too large for small or low-risk projects.

Below is a representation of the spiral diagram that combines the rapid prototyping method that analyses each step to produce the given outcome analysing risks and



iteration.

Figure 2 Spiral Design Method

3.2.1 Spiral Model Phases: Objective setting and Planning phase.

In this phase requirements are gathered, reviewed and necessary resources and work environment identified, the requirements reviewed are like business requirement specification (BRS) and system requirement specification (SRS).

3.2.2 Risk assessment and analysis

This phase is undertaken to identify risks and alternate solutions. The prototype is produced at the end of the phase as alternate solutions are suggested and implemented to reduce key risks.

3.2.3 Development and validation

In this phase the actual product is made, and it entails development and testing that involves coding, design documents, test cases and data reports that is gotten from the generic models.

3.2.4 Planning and Evaluation Phase

The customers get involved in this phase whereby they evaluate the product and ensure that all the requirements are met, and feedback is given back to enable the next phase of spiral implementation in solving the problem outcomes.

3.3 Software Requirement Analysis

Software requirements analysis refers to the descriptions of the system services and constraints that are generated which might range from a high-level abstract that drives the requirements engineering process and are detailed.

This project will apply the process of Object-Oriented Analysis and Design(OOAD) that will allow grouping of objects to perform a given task for example the user will require the QR code detail to be able to receive the pads after toping up the E-wallet .The main reason being that it allows the re-use of the objects and reduces the time and cost of development and improves the quality of delivery as each step is accounted for. The system contains functional and non-functional requirements that allows operation deliverables.

3.3.1 Functional Requirements

Functional Requirements refers to complete and consistent high-level statements of what the system is able to do and the services it delivers.

The requirements delivered by this system is as follows:

Administrator

i) Generates reports of the distribution of pads on a monthly basis.

ii) Facilitates the generation of QR profile for the students.

iii) Scans the QR code profile.

User

i) Updates the payment status to facilitate the approval of receiving pads.

3.3.2 Non-Functional Requirements

These defines system properties and constraints e.g. reliability, response time and storage requirements. Constraints are I/O device capability, system representations, and may also specify a particular IDE, programming language or development method. Non-functional requirements are classified as Product, Organisational and external requirements.

a) Product requirement

The Pad IT system will be available to students in a given school on normal school hour 8:00am-5:00pm and it is limited to scanning a student's QR code only once in a month.

b) Organisational requirement

Users of the system will authenticate themselves using their generated QR code.

c) External requirement

The system shall implement student privacy provision.

3.4 System Design

This is the process of defining the architecture, modules, interfaces and data for a system to satisfy specified requirements. The design used in defining the project is Sequence and Data flow diagrams, (DFD's). DFD shows how inputs and outputs flow in the system. A representation shows elements that is contained such as the

Process: A user is able to receive pads by scanning a QR code printed on paper.

Data Flow: This represents the movement of data from one the input to the outcome for example the QR generator creates a code for a girl that contains details such as updated pay to receive the pads.

Data stores: This represents the data of the students such as the Name, Age, detail and class.

External Tactics. This represents users that are not associated with the system but still use it to get certain data.In this situation the external parties are the local Ngo's who

supply pads and assist in topping of the retail price in order for the girls to receive pads at a given price and also review the reports generated from the system.

The Sequence diagrams are part of the UML and are used to model the interactions between the actors and the objects within a system based on a time sequence. A sequence diagram shows the sequence of interactions that take place during a particular use case or use case instance. For example, the administrator adds a new student on the system to enable eligibility to receive pads and provides reports at the end of each month.

3.5 System Development tools and Techniques

The tools used in the development specification includes:

1) Android Studio-This is the (IDE)Integrated Development Environment used in developing the system. This platform is suitable in creating a mobile application that will facilitate the generation and scanning of QR code
2) Firebase-This is the database used to manage the data in the system.
3) Flutter-This is the programming language that will be used in creating the product.

3.6 Method to be used in testing the system

The system will be tested using the black box method, this method of testing considers the project as a black box that allows users to insert data and expect a given outcome. The test will be able to allow the user to scan a QR code on the girls card to view the details filled by the administrator which make it eligible to have access over the pads hence if the card is scanned right it will be verified by the users, The advantage of using this method is that it allows anyone who doesn't have technical knowledge to test and test cases are designed immediately when the functional specification is completed.

Below is a diagrammatic representation of the method.

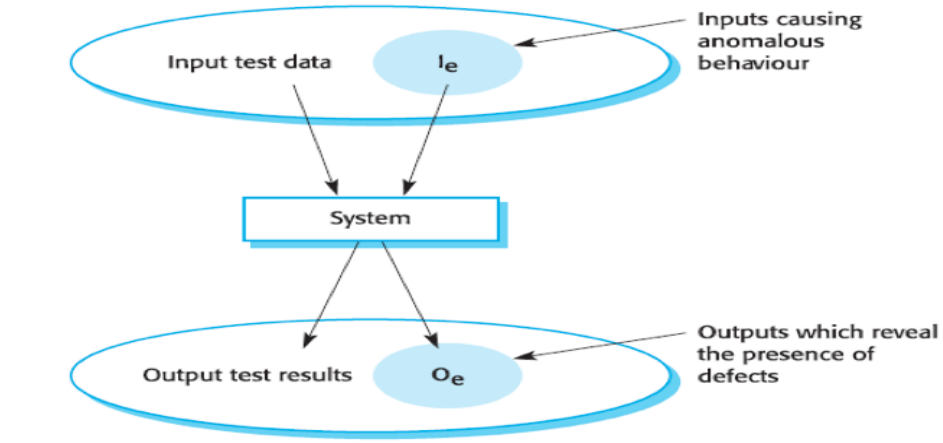


Figure 3 Black Box Testing

3.7 Domain of execution

The execution of the project will be mobile based. It is cost effective as it allows automatic generation of QR codes that will be scanned. This will also facilitate the mobility as the users can be able to move from one place to another with the access of mobile data.

3.8 Proposed Modules and System Architecture

Administrator Module-He/she will facilitate the creation of the user profiles, monitor and facilitate reports generated from the system.

Student module-This module allows the student to review the system student also submits the QR code to be scanned to be eligible to receive a pad

Donors module-This module donates sanitary towels to the different schools

Parent module-This ensures the students fee amount has been paid.

These modules play an important role that allows execution of the system to be able to deliver its functionalities.

Chapter 4: System Analysis and Design Description

4.1 Introduction

The aim of this chapter is to provide a list of identified system requirements and highlight the approaches that were employed in gathering the functional and non-functional requirements during the system analysis stage. In addition to that the system architecture that entails the android mobile based application accessed by the registered administrators for each school has been illustrated.

4.2 Requirement gathering

There are different methods used by researchers to gather and understand the system requirement and some of these methods include use of questionnaires, observation, documentation review, interviews, brainstorming, personal experience and among others. Some of these methods proved effective to our requirements identification. The first method used to gather the system requirement is quantitative in nature.

The use of an Open-ended questionnaires was presented to a targeted population of schoolteachers in Narok and the results were analysed to understand the user requirements in relation to the pad distribution application that has been automated and monitored as compared to the manual distribution.

The second method that was used was qualitative in nature whereby the teachers were interviewed on a face-to-face basis to analyse the efficiency and impact that the system will have in the community including the risks involved in issuing of the cards to the students where their profiles will be printed on to have the administrators scan their eligibility to receive a pad.

The last method used was Observation which was significantly effective as we got first-hand detailed information of the pad distribution facilitated by the chief and head-teacher. This highlighted the gaps within the method such as record keeping and monthly accounting for the pads issued.

The requirements gathered facilitated: The ease in identifying distribution points for the administrators. The number of girls registered in the school this allows the records of pads issued to be accounted for. Potential donors and community well-wishers to donate the pads to the school going girls.

4.3 System Requirements.

The system's functional requirements, which are the requirements that are related to the functional aspects of the pad distribution system. (Siedle, 2016) comprise of functional and non-functional requirements as shown respectively in sections 4.3.1 and 4.3.2 below.

4.3.1 Functional requirements

The system's functional requirements, which are the requirements that are related to the functional aspects of the pad distribution system (Siedle, System Requirments, 2016) are as listed below in Table 1.

Table 1:Functional Requirements

FR1	The system should allow the different admins to login to a specified school	
FR 2	The system should allow an admin to update his/her profile for the specified school	
FR 3	The system should allow an admin to add a donor	
FR 4	The system should allow an admin to add a student	
FR 5	The system should allow an admin to add a parent	
FR 6	The system should allow an admin to view registered student	
FR 7	The system should allow an admin to view registered donors	
FR 8	The system should allow an admin to view registered parents	
FR 9	The system should allow an admin to delete or update a student's profile	
FR 10	The system should allow an admin to delete or update a donor's profile	
FR 11	The system should allow an admin to contact parents when status reads unpaid	
FR 12	The system should allow an admin to generate monthly reports	
FR 13	The system should allow an admin to generate QR codes profiles for the students	
FR 14	The system should allow an admin to view the live dashboard	
FR 15	The system should allow an admin to update the number of pads	
FR 16	The system should be able to notify the admin about unpaid student profiles	

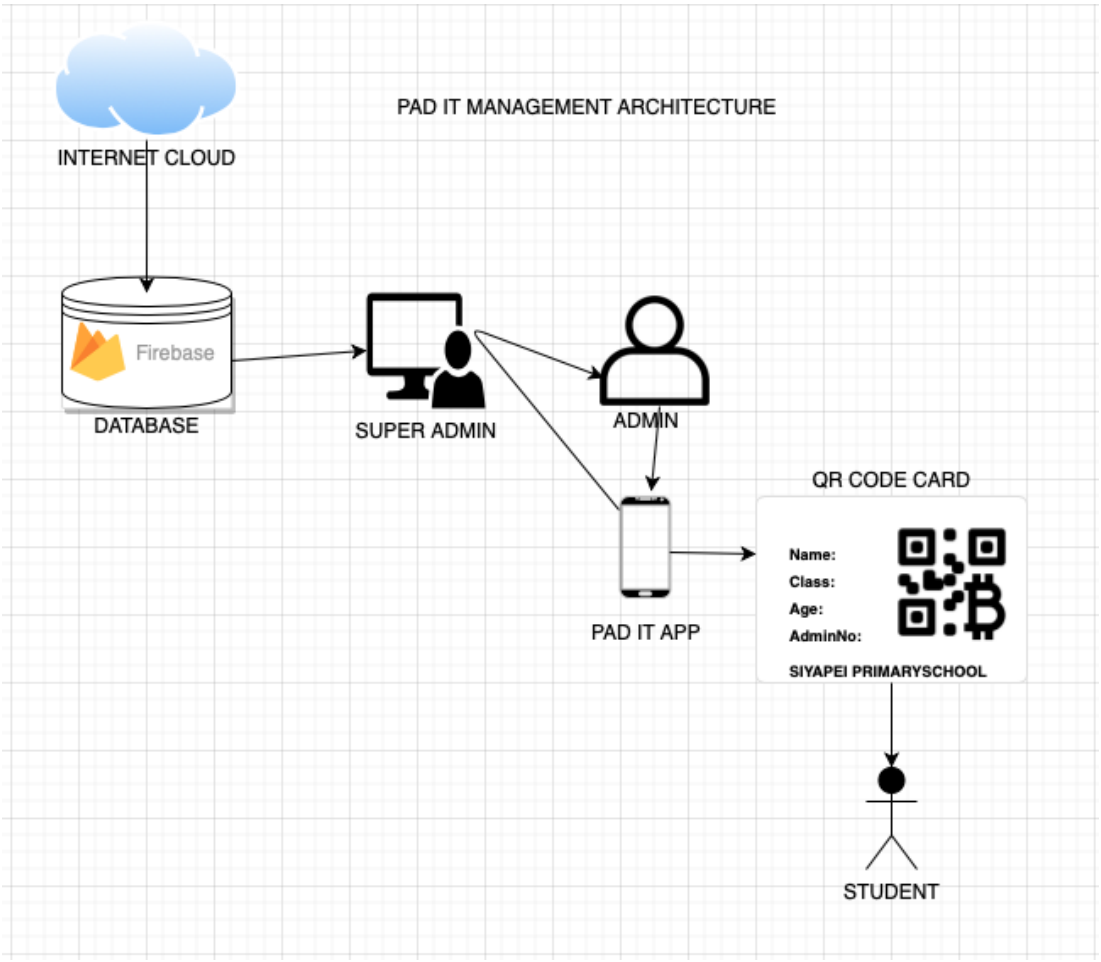
4.3.2 Non-Functional requirements

The system's non-functional requirements are the requirements that do not relate to the functional aspect of the pad distribution system. They include performance, reliability, maintainability, scalability and usability for the efficiency of the QR system. They are as listed below in Table 2

Table 2: Non-Functional Requirements

NFR 1	The system should allow users to navigate on all the interfaces.
NFR 2	The system should grant access to authorized users.
NFR 3	The system should allow the administrator to generate QR codes with ease
NFR 4	The system should allow the admin to manage different schools profile
NFR 5	The system should only grant privileges to modify data within the system to authorized users.

4.4 System Architecture



The system architecture comprises of two components the Android Application and the firebase database. There is a super admin who manages all the administrators and updates details on the firebase. The other admins facilitate the updates and manages the schools registered by the Super Admin.

The system relies on the interaction and connectivity between the database in order to manage the data being collected containing the number of pads donors and students

and the mobile application for the user interaction and QR generation. The QR code is then printed into a card and issued to the students

4.5 System Analysis

This is the process of defining modules, interfaces and data for a system to satisfy specified requirements using diagrams to illustrate the flow of data from each component module and interactions (System Analysis and Design, 2020). They include and not limited to a use-case diagram which will help to derive the goal of the Pad IT distribution system.

4.5.1 Use Case Diagram

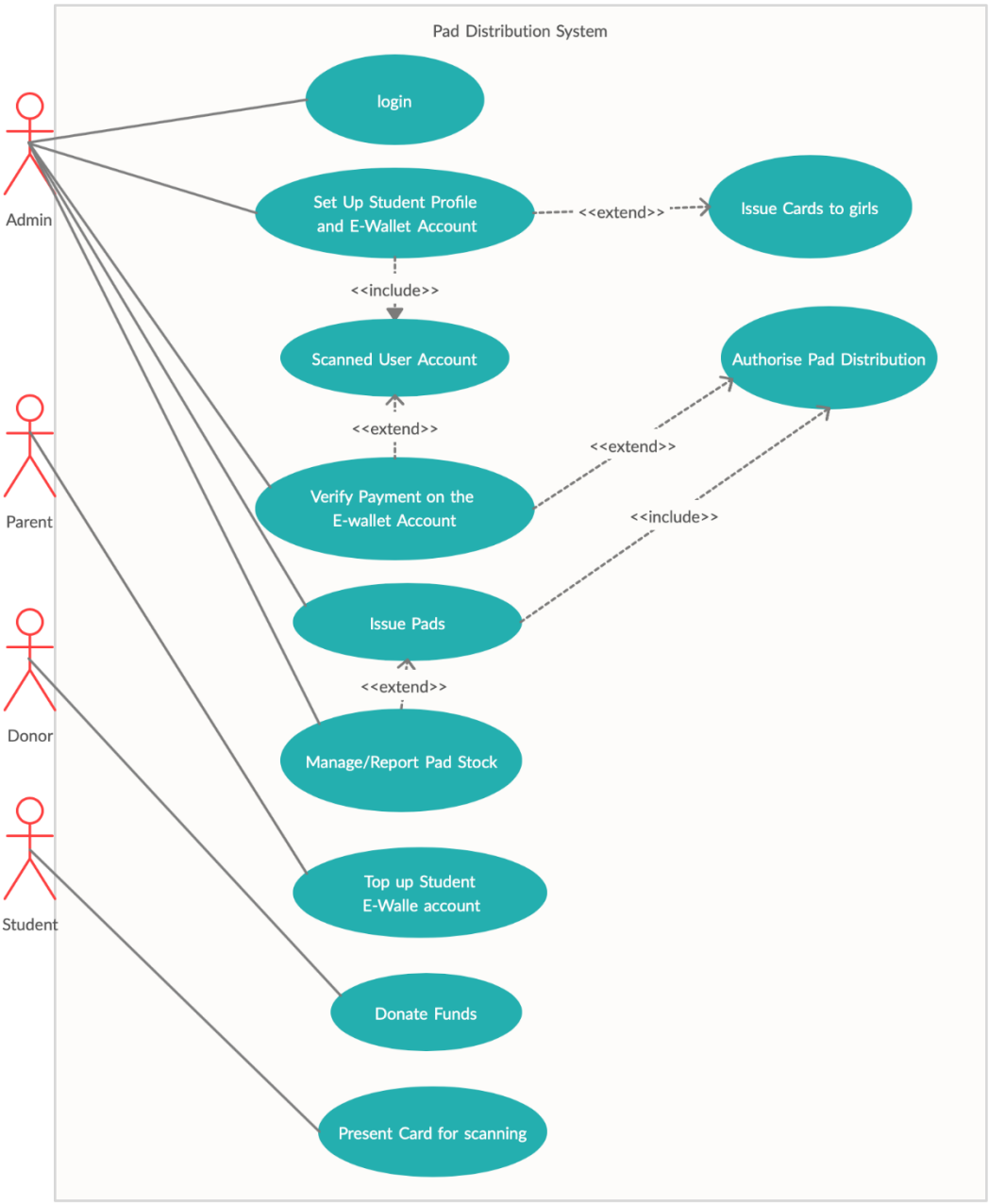


Figure 4 Use Case Diagram

The use case diagram illustrates the interactions between the users and the system by representing the processes each module performs in order to achieve the management of pad distributions. The modules include the Admin, Student, Parent and Donors.

4.6 System Designs

This is the process of defining the architecture, modules, interfaces and data for a system to satisfy specified requirements. The design used in defining the project is Sequence and Data flow diagrams, (DFD's). DFD shows how inputs and outputs flow in the system. They include and not limited to, a class diagram, an entity relational diagram (ERD), a sequence diagram and a database schema.

4.6.1 Class Diagram

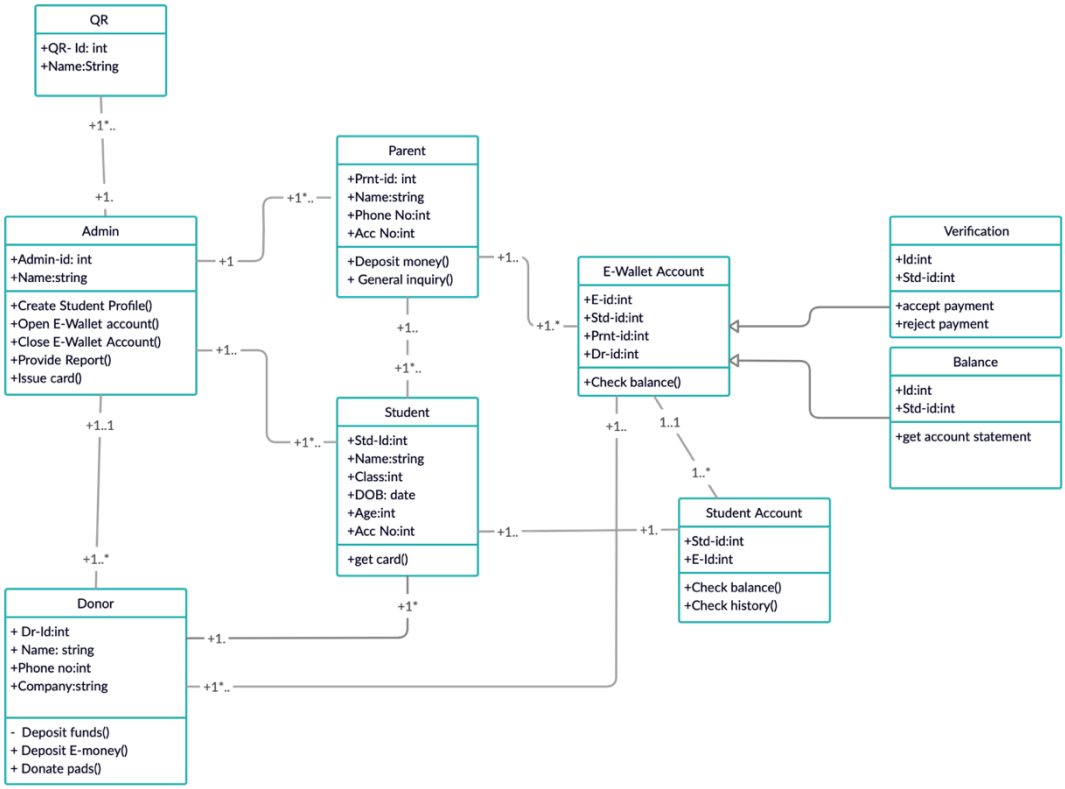


Figure 5 Class Diagram

The class diagram above depicts the classes of controllers and models of the mobile application system that is accessed by the Super admin and the registered admins to facilitate the different schools.

4.6.2 Entity Relational Diagram (ERD)

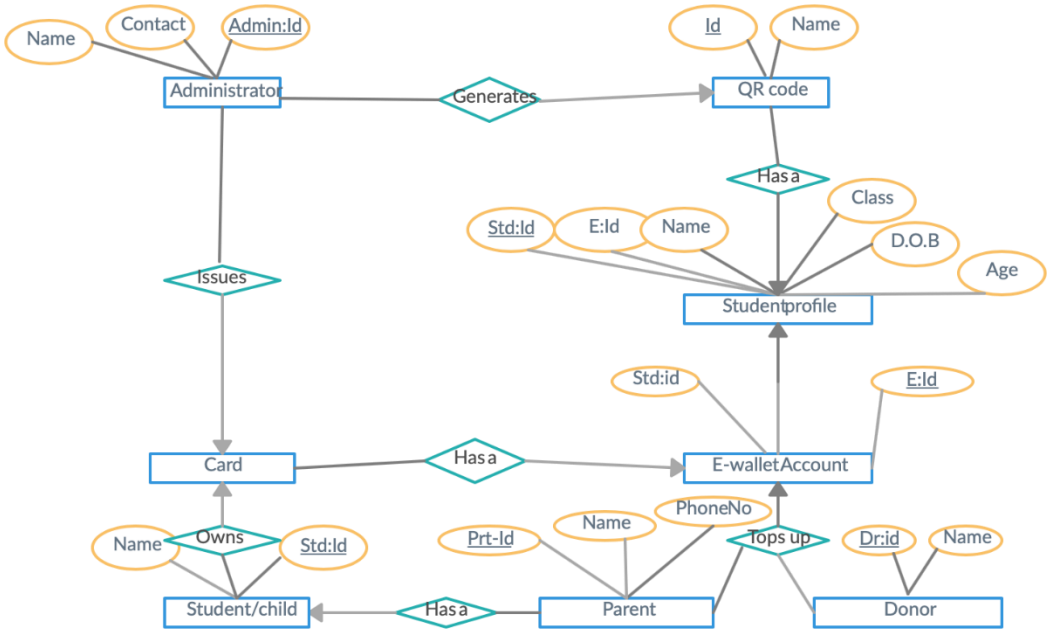


Figure 6 Entity Relationship Diagram

4.6.3 Sequence Diagram

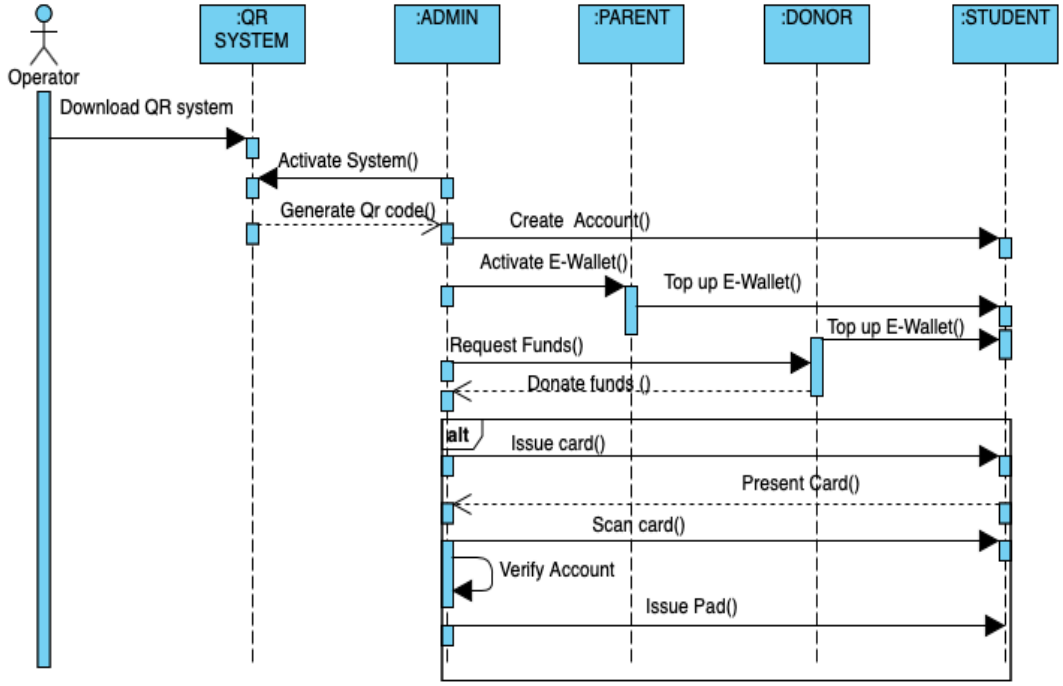


Figure 7 Sequence Diagram

4.6.4 Database Schema.

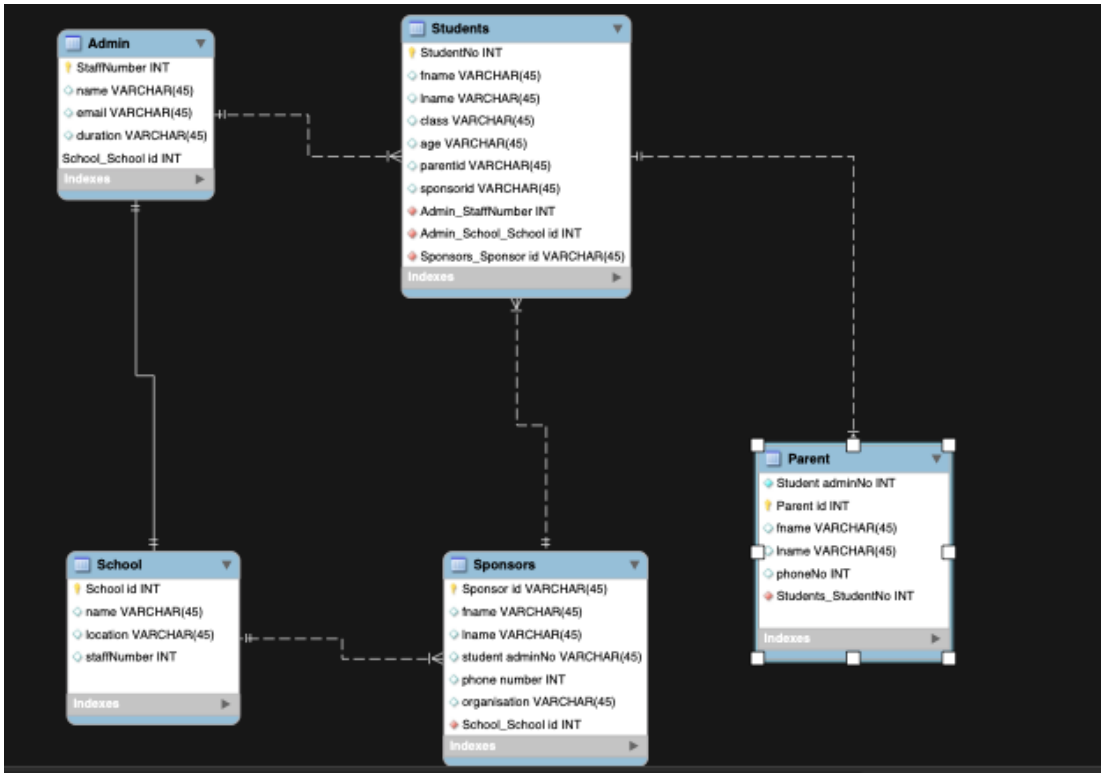


Figure 8 Database Schema

Figure 8 represents a database schema showing the relationships between the five modules objects and their attributes. This allows the creation of tables that will store data for the functioning of the system

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4.7 System Mock-ups

4.7.1 *Add student*

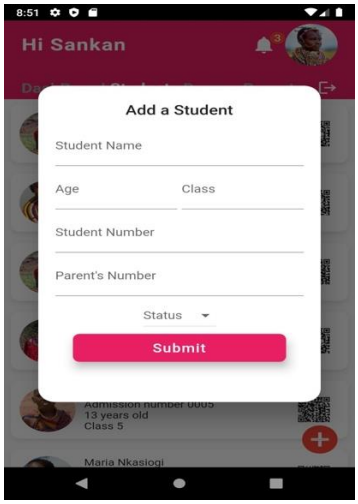


Figure 9 Add students

The figure above illustrates the student module on the mobile whereby the admin is able to add a new student. The student contains status button that displays if the student has paid or not paid to be make her eligible to receive a pad, if the status shows unpaid the admin is notified through the notification bell and is prompted to call the parent so as to follow up for payments.

4.7.2 *Add donor*

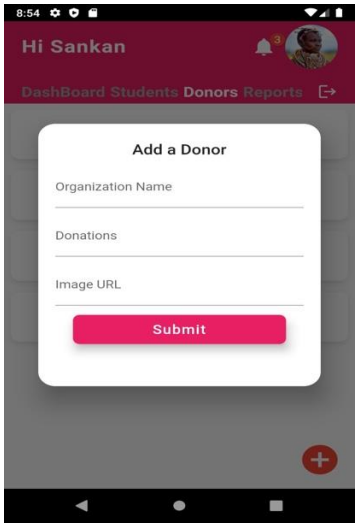


Figure 10 Add donor

The figure above illustrates the interface of the donor where the admin is able to update or delete a donor. It also shows the number of pads the donor has donated and the school he/she has donated to.

4.7.3 *Generate QR code*

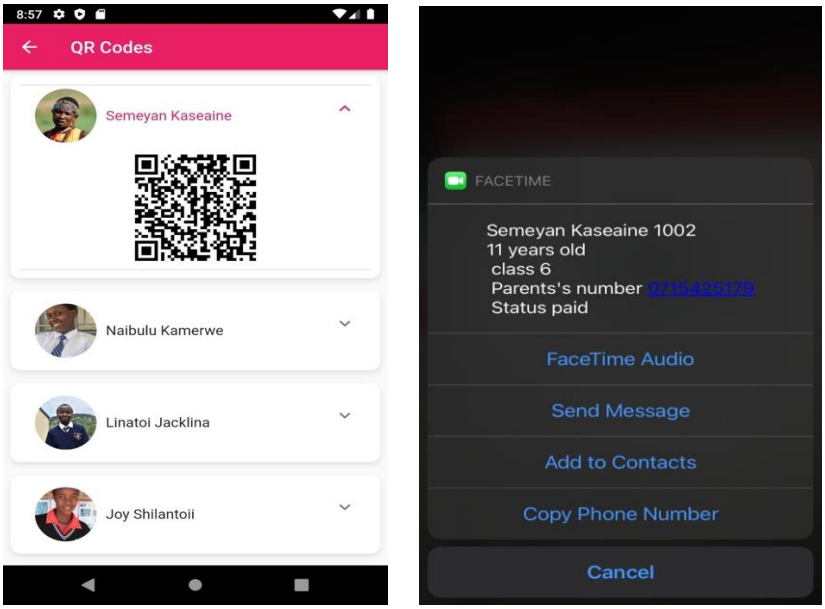


Figure 11 Generating QR code

The figure above displays the interface and outcome of the QR code which displays a student's profile when the admin inputs the data for the eligibility of receiving a pad.

4.7.4 *Generate Report*

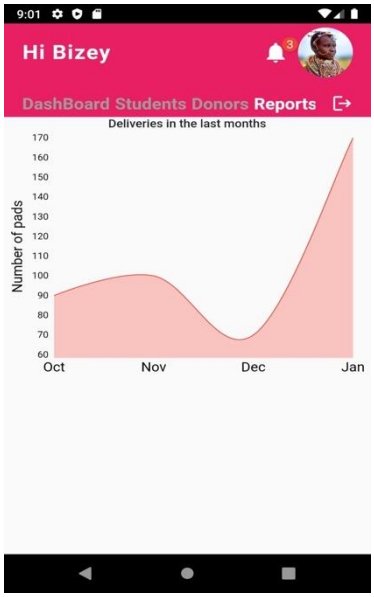


Figure 12 Generating Report

The figure above displays the interface of the monthly reports retrieved from the system to be able to manage and monitor the stock of pads being issued to the girls. It also shows the number of girls registered in the different schools.

4.7.5 *View student*

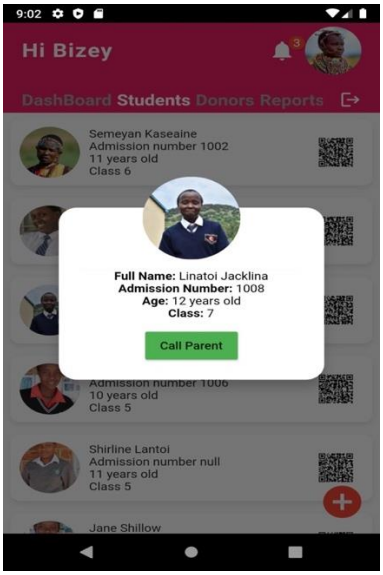


Figure 13 View students

The figure above displays the Student profiles registered on the application and their user profile pictures, parents phone numbers and the status for each student. This allows the admin to get the exact number of girls to receive the pads and generate reports accordingly.

4.7.6 *Update Admin Profile.*

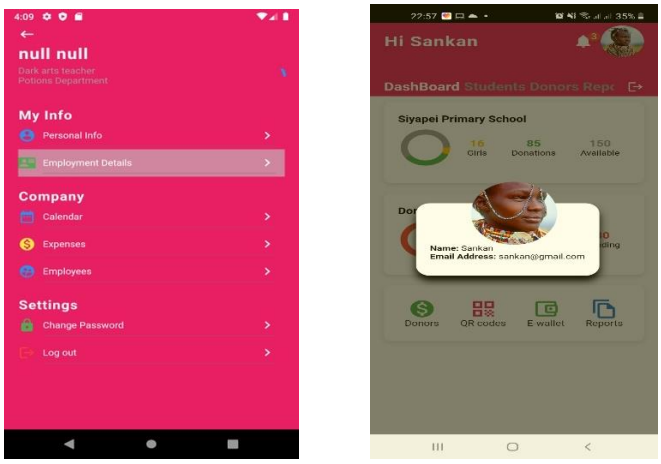


Figure 14 Admin Profile

The figure above displays the Admin profile where she updates details that make her eligible to manage the school that she/he has been allocated to. This allows the super admin to update and also manage from the firebase side.

Chapter 5: System Implementation and Testing

5.1 Introduction

This chapter seeks out to describe the working of the system the tools used, coding language and the back-end logic and front end (user interface for the Pad distribution system. In addition, it provides a detailed description on the security and authentication used for the purposes of a secure application and the fulfilment of the requirements specified to achieving the general objectives of the Information system.

5.2 System Implementation

This describes the system development with the regard of the system analysis and design methodology as discussed in the previous chapter 3 of this documentation

5.2.1 System logic construction

The system was built upon the MVC framework that entails a model, view and controller. The model refers to all the data-related logic that the system's user has to work with. On the other hand, the view refers to all the logic of the user-interfaces. Moreover, the controller refers to the interface between the model and the view that is involved in the processing of incoming requests, data manipulation employing the model component and rendering the final result through interaction with the view.

5.2.2 System backend

This consists of the logic behind the main functionalities of the Pad distribution including the authentications necessary for the efficiency of the system.

a) Auto-Hashing

```
TextFormField(
  controller: passwordCtrl,
  keyboardType: TextInputType.text,
  obscureText: obscurePassword,
  validator: (value) {
    if (value.isEmpty) return 'Password is required';
    if (value.length < 4)
      return 'Password has to be more than 4 characters';
    return null;
  },
  decoration: new InputDecoration(
    labelText: "Password",
    labelStyle: TextStyle(color: Colors.pink[300]),
    suffixIcon: new GestureDetector(
      onTap: togglePasswordVisibility,
      child: Icon(
        obscurePassword
            ? Icons.visibility
            : Icons.visibility_off,
        size: 20.0,
        color: Colors.pink[300],
      ),  // Icon
    ),  // GestureDetector
  ),  // InputDecoration
),  // TextFormField
```

Figure 15 Hashing Authentication

The process of declaring a password to have a fixed length compression of data while converting a given key into another key (Cyber security, 2021). In this situation transforming the alphabets into symbols for the purposes of security in the login in page for the admin this allows high accessibility and performance. The use of a firebase auto generates the hashing capabilities.lib>screens>login_screen.dart

b) Login in logic

```
import 'package:firebase_auth/firebase_auth.dart';
import 'package:fluttertoast/fluttertoast.dart';
import 'package:flutter/material.dart';

class AuthService {
  final FirebaseAuth _auth = FirebaseAuth.instance;

  signIn(String email, String password) async {
    try {
      var result = await _auth.signInWithEmailAndPassword(
          email: email, password: password);
      return result;
    } catch (e) {
      Fluttertoast.showToast(
          msg: "Incorrect Email or Password",
          toastLength: Toast.LENGTH_SHORT,
          gravity: ToastGravity.TOP,
          timeInSecForIosWeb: 1,
          backgroundColor: Colors.red,
          textColor: Colors.white,
          fontSize: 16.0);
      return null;
    }
  }
}
```

Figure 16 Login Logic

The authentication displayed allows the admin allocated to the specified school to login and gets redirected to the landing page in this case the dashboard displaying the graphs containing the donors, student and the pads received. It uses the auth.signInWithEmailAndPassword. Path>lib>services>auth.dart

c) Firebase and android studio connection

```
import 'package:firebase_core/firebase_core.dart';
import 'package:flutter/material.dart';
import 'package:pad_app/screens/login_screen.dart';

void main() async {
  WidgetsFlutterBinding.ensureInitialized();
  await Firebase.initializeApp();
  runApp(MyApp());
}
```

Figure 17 Database Connectivity

The figure above displays the logic of connecting the database into the dart flutter environment to be able to pull and allow the data added to be reflected on the user interface. The firebase package is imported and initialized before the application starts running. This package is located under lib> main.dat.

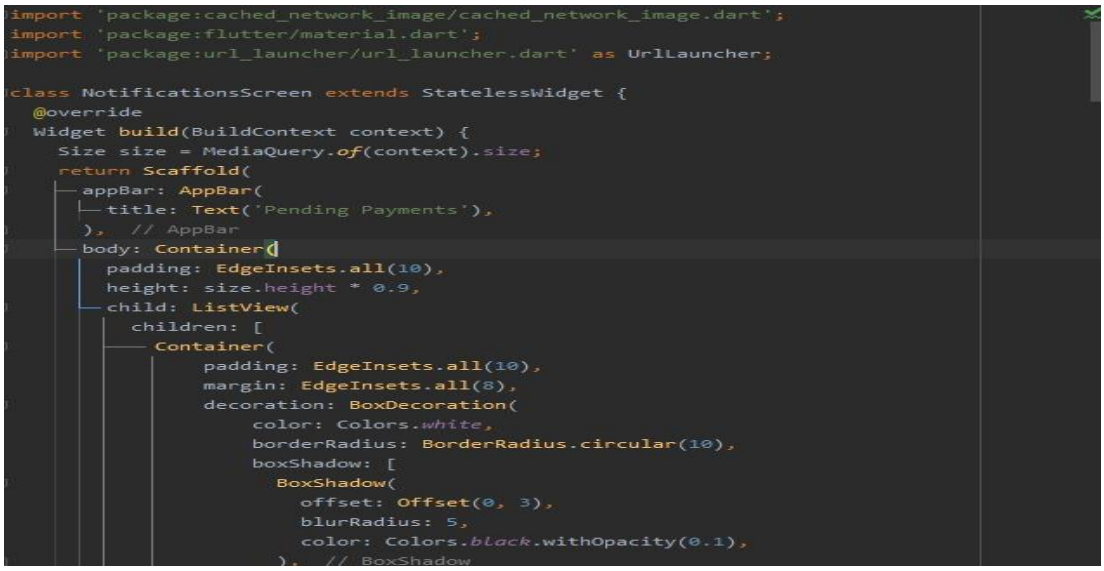
d) Administrator logic switching

```
void checkUser(String user) async {
  if (user == 'nabuyuni.sankan@strathmore.edu') {
    kName = 'Nabuyuni Sankan';
    kSchool = 'Narok Primary School';
    kDBtoUse = 'Narok Primary School';
  } else if (user == 'nabuyuni@strathmore.edu') {
    kName = 'Nabuyuni';
    kSchool = 'Olkeri Primary school';
    kDBtoUse = 'Olkeri Primary school';
  } else if (user == 'bizeysankan@gmail.com') {
    kName = 'Bizey';
    kSchool = 'Masikonde Primary School';
    kDBtoUse = 'Masikonde Primary School';
  } else if (user == 'sankan@gmail.com') {
    kName = 'Sankan';
    kSchool = 'Siyapei Primary School';
    kDBtoUse = 'BUShus6GvovjCb9lT48X';
  }
}
```

Figure 18 logic switching

The figure above displays the code to demonstrate how an administrator belonging to a specified school is able to log in to the authorized school only, if the admin is not associated to the school, he/she is denied access. It is located under lib>screens>home screen. dart.

e) Sending status notification.



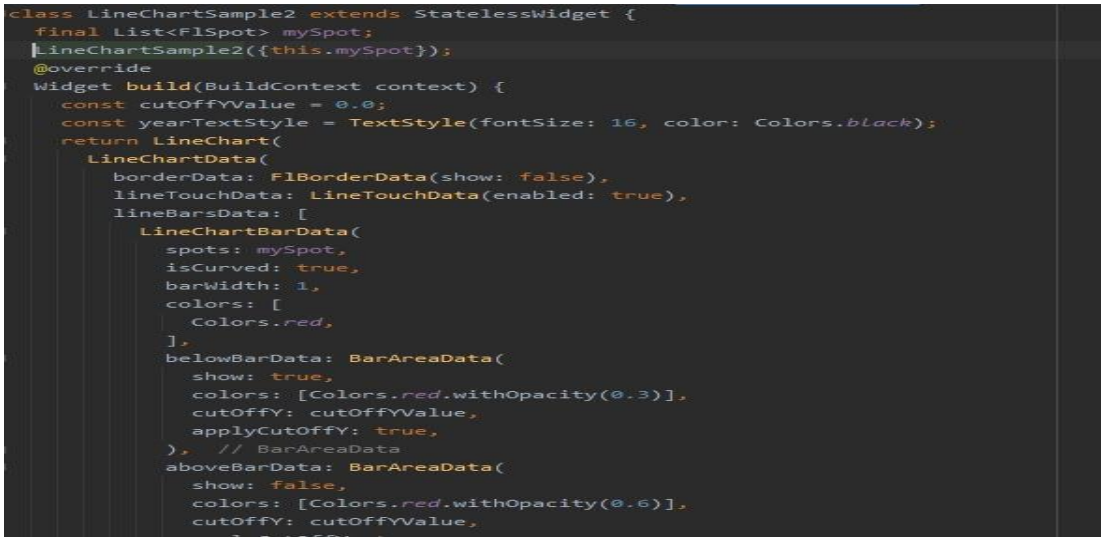
```
import 'package:cached_network_image/cached_network_image.dart';
import 'package:flutter/material.dart';
import 'package:url_launcher/url_launcher.dart' as UrlLauncher;

class NotificationsScreen extends StatelessWidget {
  @override
  Widget build(BuildContext context) {
    Size size = MediaQuery.of(context).size;
    return Scaffold(
      appBar: AppBar(
        title: Text('Pending Payments'),
      ),  // AppBar
      body: Container(
        padding: EdgeInsets.all(10),
        height: size.height * 0.9,
        child: ListView(
          children: [
            Container(
                padding: EdgeInsets.all(10),
                margin: EdgeInsets.all(8),
                decoration: BoxDecoration(
                    color: Colors.white,
                    borderRadius: BorderRadius.circular(10),
                    boxShadow: [
                      BoxShadow(
                        offset: Offset(0, 3),
                        blurRadius: 5,
                        color: Colors.black.withOpacity(0.1),
                      ),  // BoxShadow
```

Figure 19 Notification logic

The figure above displays the notification update being pushed to alert the admin to call a parent when a girl's profile status shows unpaid. It is located under lib>screens>notification_screens.dart.

f) Generating reports.



```
class LineChartSample2 extends StatelessWidget {
  final List<FlSpot> mySpot;
  LineChartSample2({this.mySpot});
  @override
  Widget build(BuildContext context) {
    const cutOffYValue = 0.0;
    const yearTextStyle = TextStyle(fontSize: 16, color: Colors.black);
    return LineChart(
      LineChartData(
        borderData: FlBorderData(show: false),
        lineTouchData: LineTouchData(enabled: true),
        lineBarsData: [
          LineChartBarData(
            spots: mySpot,
            isCurved: true,
            barWidth: 1,
            colors: [
              Colors.red,
            ],
            belowBarData: BarAreaData(
              show: true,
              colors: [Colors.red.withOpacity(0.3)],
              cutOffY: cutOffYValue,
              applyCutOffY: true,
            ),  // BarAreaData
            aboveBarData: BarAreaData(
              show: false,
              colors: [Colors.red.withOpacity(0.6)],
              cutOffY: cutOffYValue,
```

Figure 20 Generating reports

The figure above displays the code used to compile the data in a format that shows a graph and monthly outcomes of the number of pads donated, the number of girls registered in the specified school who received the pads and the number of remaining pads in the store.path lib>tabs>reports_tab.dart

g) Adding students.

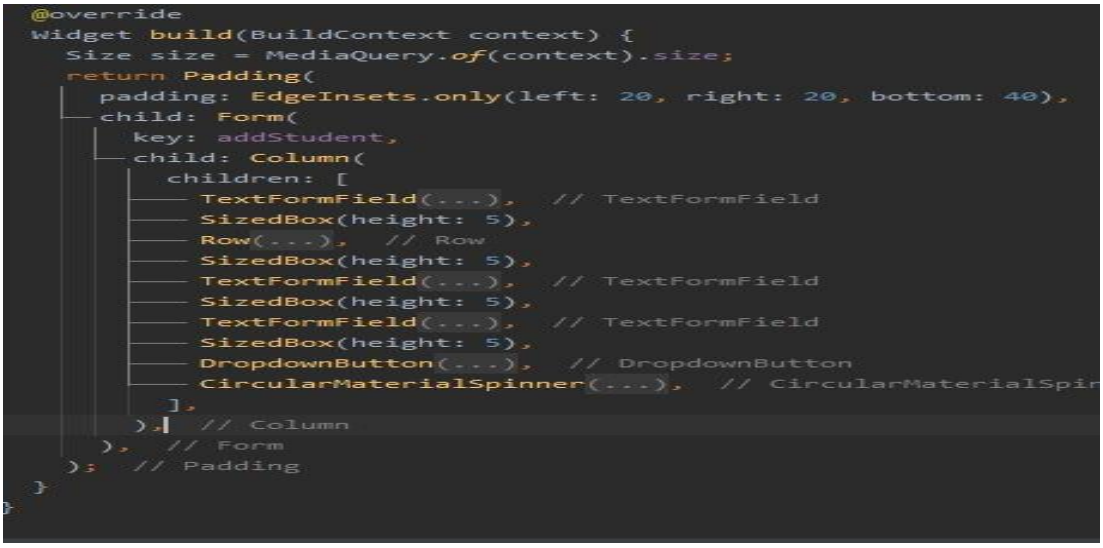
Figure 21 Add students

The admin is able to add a student via the firebase and application. The data is then executed and captured. Student number(id) Name (students name) age(int) class(int) and parent phone Number (id) as displayed in the diagram above.lib>widgets>add_student.dart

5.2.3 System's frontend

This refers to the codes and logic for the easy flow of the interface and interaction with the user. It uses flutter which is a framework for making cross-platforms apps.

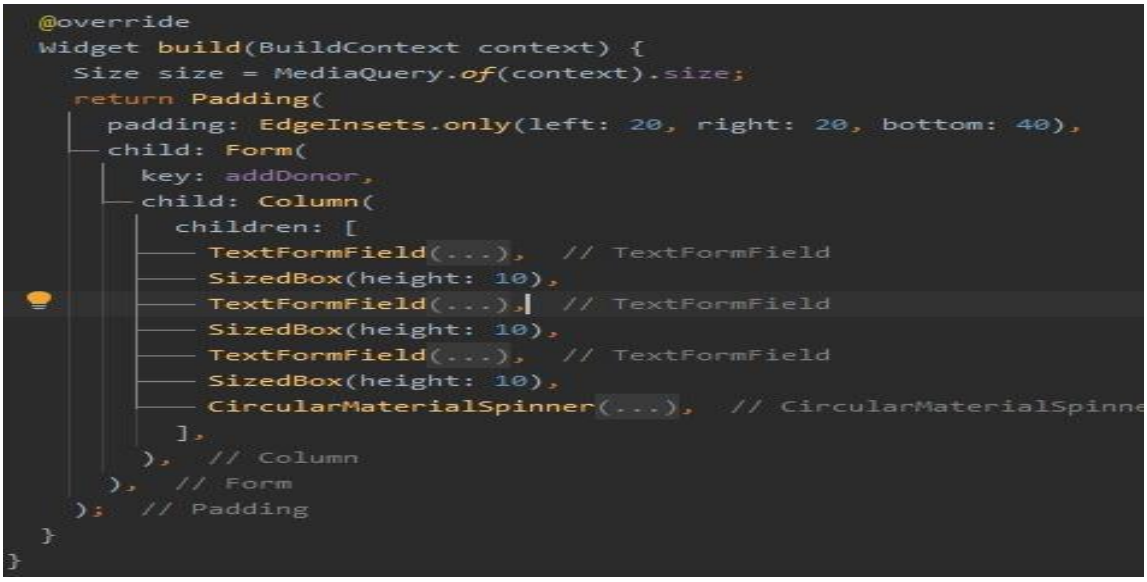
a) Adding a student



```
@override
Widget build(BuildContext context) {
  Size size = MediaQuery.of(context).size;
  return Padding(
    padding: EdgeInsets.only(left: 20, right: 20, bottom: 40),
    child: Form(
      key: addStudent,
      child: Column(
        children: [
          TextFormField(...),  // TextFormField
          SizedBox(height: 5),
          Row(...),  // Row
          SizedBox(height: 5),
          TextFormField(...),  // TextFormField
          SizedBox(height: 5),
          TextFormField(...),  // TextFormField
          SizedBox(height: 5),
          DropdownButton(...),  // DropdownButton
          CircularMaterialSpinner(...),  // CircularMaterialSpin
        ],
      ),  // Column
    ),  // Form
  );  // Padding
 }
}
```

The diagram above displays the code to generate a student's profile following consistency from chapter 4 section 4.7.1 of the mobile application. It entails a a drop-down menu to select the status. A drop-down menu to generate the QR code and a text area for student's details.

b) Adding a donor



```
@override
Widget build(BuildContext context) {
  Size size = MediaQuery.of(context).size;
  return Padding(
    padding: EdgeInsets.only(left: 20, right: 20, bottom: 40),
    child: Form(
      key: addDonor,
      child: Column(
        children: [
          TextFormField(...),  // TextFormField
          SizedBox(height: 10),
          TextFormField(...),  // TextFormField
          SizedBox(height: 10),
          TextFormField(...),  // TextFormField
          SizedBox(height: 10),
          CircularMaterialSpinner(...),  // CircularMaterialSpinne
        ],
      ),  // Column
    ),  // Form
  );  // Padding
 }
}
```

The diagram above displays code to add a new donor. The donor donates a number of sanitary towels and is able to donate to more than one registered school from the database.

c) View donors

```
child: Container(
    padding: EdgeInsets.all(10),
    margin: EdgeInsets.all(8),
    decoration: BoxDecoration(
        color: Colors.white,
        borderRadius: BorderRadius.circular(10),
        boxShadow: [
          BoxShadow(
            offset: Offset(0, 3),
            blurRadius: 5,
            color: Colors.black.withOpacity(0.1),
          ),   // BoxShadow
        ]),   // BoxDecoration
    child: Row(
      children: [
        Image.network(
          doc['photo'] == null ? '' : doc['photo'],
          height: 50,
          width: 50,
        ),   // Image.network
        SizedBox(width: 10),
        Column(
          crossAxisAlignment:
              CrossAxisAlignment.start,
          children: [
            Text('${doc['organization']}'),
            Text('Donations ${doc['donations']}'),
          ],
        ),   // Column
```

The figure above displays the code of viewing all the registered donors the organization they are from and the number of pads donated.

d) Display dashboard

```
Expanded(
  child: ListView(
    physics: BouncingScrollPhysics(),
    children: [
      CustomCard(
        height: size.height * 0.19,
        child: Column(
          crossAxisAlignment: CrossAxisAlignment.start,
          mainAxisAlignment: MainAxisAlignment.center,
          children: [
            Padding(...),   // Padding
            SizedBox(height: 20),
            GestureDetector(...),   // GestureDetector
            SizedBox(height: 20),
          ],
        ),   // Column
      ),   // CustomCard
      CustomCard(
        height: size.height * 0.19,
        child: Column(
          crossAxisAlignment: CrossAxisAlignment.start,
          mainAxisAlignment: MainAxisAlignment.center,
          children: [
            Padding(...),   // Padding
            SizedBox(height: 20),
            Row(...),   // Row
            SizedBox(height: 20),
          ],
        )),   // Column, CustomCard
```

The diagram displays the code used in the creation of the home screen and the landing page. The code displays the tabs created and the graphical representation that allows data that is being added to reflect on the home screen.

5.3 System Testing

This is process of checking authenticity, functionality, usability and performance of the system to meet the functional and non-functional requirements. The testing technique to be used is black box testing whereby the admin(user) will be allowed to insert data and expect a given outcome. This method is efficient as there will be cost and time reduction for training the users because they do not need to have technical knowledge.

5.3.1 Functionality testing

This refers to the requirements necessary to allow the system to provide data. The mobile based pad distribution system satisfied the requirements necessary to achieve the objectives. These functionalities include:

a) The super admin is able to assign admins to each school and allows them to login to manage data.
b) The admin is able to contact the parent
c) The Admin is able to view and display data
d) Un-authorized admins are not able to view the other registered school's data.

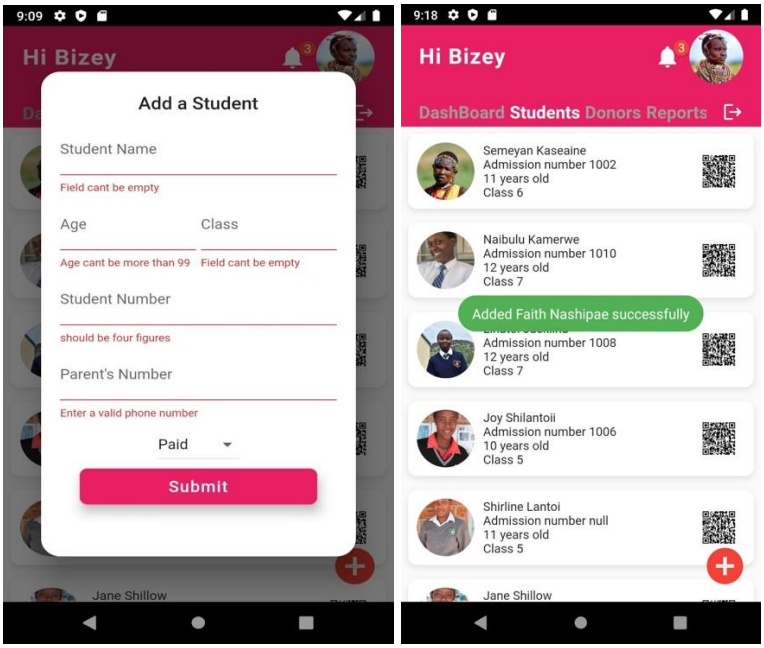
5.3.2 Usability testing

This is the efficiency to be able to navigate between the user interfaces to access the necessary functionalities.

a) The admin is able to login and logout from the school he/she has been allocated.
b) The Admin is able to create, update and delete the donors. students or pad donated from the firebase database and user interface.
c) There are pop up messages that are displayed when a new student or donor is added. Other messages pop up when there is a wrong insertion of data such as failed login attempts or successful login.

5.3.3 Unit testing

The modules respond independently for the purpose of record keeping, the database is able to retrieve data and notify the user if wrong, empty or null attributes have been inputted (field can't be empty, enter valid phone number) and if successful.



Chapter 6: Discussion, conclusion and recommendation

6.1 Introduction

The aim of this chapter is to provide a summary of the objectives that have been achieved, provide conclusions related to the discussion around automated pad distribution as opposed to a manual distribution and provide recommendations for future works in terms of technical aspects that will ensure the enhancement of desirable results.

6.2 Discussion

With the schools closed and health services disrupted in the country, there has been a significant decrease in the level of access to Menstrual Health and Hygiene education and access to sanitary materials which fuels the practice of harmful traditions and beliefs by girls and women in the community. One of these beliefs is that women are considered to be impure hence should not touch themselves using water and they should avoid using the community toilets as it contaminates the shared water resources. Under the COVID-19 global pandemic, such beliefs and practices prevent them from protecting themselves and the community against the disease.

The provision of a platform that will facilitate the distribution of pads at a subsidized rate will help improve the access to sanitary materials at a rate lower than the retail price. This allows parents to give priority to the personal health and well-being of their children as they will be able to not only provide food and water for their families but also facilitate access to sanitary towels and subsequently, their daughters' safety and comfort during their menses.

The proposed Pad IT system is aimed at the provision of a cost-effective and sustainable approach that will seek to solve period poverty both in the present times and even post the global pandemic through the adoption of the spiral method approach which seeks out to predict the risks involved in the project and mitigate them in a timely fashion. This will shed light on possible problems that might arise such as lack of smart android mobile phones in the community to be able to scan the QR codes that may lead to the provision of mobile phones to allow continuity of the work.

6.3 Conclusions.

Period Poverty has become a major area of focus that needs to be addressed while coming up with innovations that will facilitate the improvement of the admission, completion and transition rate of primary school children (class 6-8) with the focus on girls whose transition rate to high school has been significantly lower as compared to their male counterparts for other reasons besides the school dropouts that include early marriages and the practice of Female Genital Mutilation (FGM) both of which are very prevalent in the Maasai community. Through the provision of sanitary towels, we will help resolve missed school days which often happens due to high levels of poverty facing the girls and their families.

6.4 Recommendations

Pad IT is best suitable for schools whose administrators have android mobile phones which allows the access of the content. The users should have access to internet services which will facilitate the storage of data being gathered, this will work in schools which have a large number of registered students and need to be managed effectively and efficiently.

6.5 Future works

Based on the objectives, the application is aiming to implement the capability to allow the parent or donor to be able to directly donate through the application and it automatically updates the student's status to make her eligible to receive a pad while eliminating the process of manual status updates.

The system aims to provide the use of USSD technology for the main purpose of sending short messages (SMS) to interested registered donors and parents to keep them updated on their E-wallet account balance statements. This will give them an overview of the deadlines and amounts they will be required to top to avoid situations whereby the children are not receiving sanitary towels.

The implementation of this methods will allow the users to be able to have consistency on the flow of data and better outcomes.

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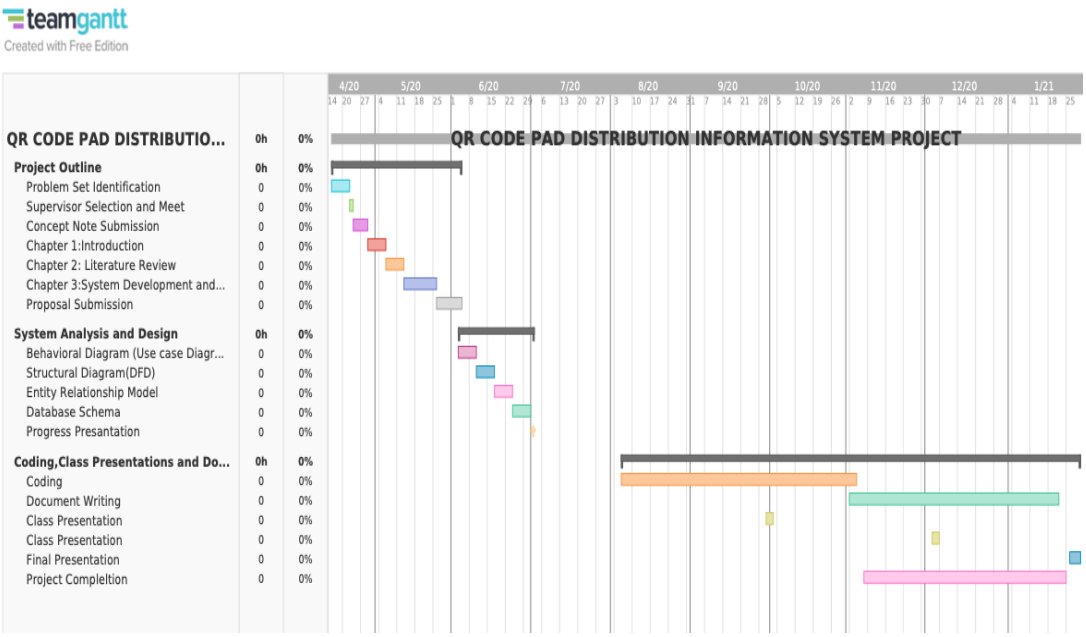
Appendix A- Time schedule



Appendix B-Interesting code

A) Deleting users

```
return Dismissible(
  key: Key(doc['name']),
  confirmDismiss: (direction) async {
    if (direction == DismissDirection.endToStart) {
      final bool res = await showDialog(
          context: context,
          builder: (BuildContext context) {
            return AlertDialog(
              content: Text(...),  // Text
              actions: <Widget>[
                FlatButton(...),  // FlatButton
                FlatButton(...),  // FlatButton
              ],  // <Widget>[]
            );  // AlertDialog
          });
      return null;
    } else {...}
  },
  child: Container(...),  // GestureDetector, Container
  secondaryBackground: Container(...),  // Container
  background: Container(...),  // Container
);  // Dismissible
```

Figure 22 Delete slider.

The figure above displays the code that used to swipe and delete a donor or student.it has an alert dialogue that shows an option of deleting or cancelling when the admin swipes to the left, at the same time it performs a different action which is null when swiped to the right. It contains a child which displays the attributes regarding a student or donor for example name/donor name/student name/student photo/donor name.

B) QR Code generator

Figure 23 QR code generator

The figure above displays the QR code generator. The generator is derived from a QR package downloaded from the internet allowing it to automatically reflect the details in a student's profile which is scannable by the admin. This shows whether they are eligible to receive the sanitary towels.

Appendix C. Flutter packages

```
dependencies:
  flutter:
    sdk: flutter

  # The following adds the Cupertino Icons font to your application.
  # Use with the CupertinoIcons class for iOS style icons.
  cupertino_icons: ^1.0.1
  flutter_spinkit: ^4.1.2+1
  firebase_core: ^0.5.3
  cloud_firestore: ^0.14.4
  firebase_auth: ^0.18.4+1
  fluttertoast: ^7.1.5
  url_launcher: ^5.7.10
  badges: ^1.1.6
  cached_network_image: ^2.3.3
  fl_chart: ^0.12.0
  qr_flutter: ^3.1.0
```

Figure 24 Flutter packages

The above figure displays different namespaces which contains similar types of classes and interfaces which contributes to the dart environment to allow the users(admin) to interact with systems.

Appendix D-Questionnaires

1. How effective is the manual distribution method in your school?.....
2. How many registered girl's in the school receive the pads?.....
3. How many teachers oversee the issuing and keeping records of the sanitary towels……..
4. How many donations does the school receive monthly?.....
5. What roles do the parents and the community play for the purpose of pad distribution?.....
   .....
6. What are the expectations of having an automated pad distributed system?.....