Faculty of Sciences and Technology

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Mobile Crowdfunding

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Abstract

In developing countries, mobile technologies have become an important factor for economic growth, health, education and technological development. Although the so-called ”smartphones” are still in a minority, the outlook is expected to change in the upcoming years and smartphones will start dominating the mobile market in these countries.

The banking card payment infrastructure is still quite limited in these countries, making mobile money the most widely used payment mechanism in daily life. One of the most used mobile money services in these countries is M-Pesa and WIT software developed the M-Pesa application for smartphones. With the development of an application comes the opportunity to develop services that take advantage of the mobile money system already developed which can have a positive impact both economically and socially in the communities of developing countries.

In this report, the prototype of a system is proposed that will give users of the M-Pesa android application access to a crowdfunding service within the application itself. This service will allow users to raise money for personal causes by creating and managing personalized campaigns. The prototype will also include the possibility for users to search campaigns by categories and keywords. For the donation mechanism, the service will be integrated in the M-Pesa application in order to use the payment system that already exists.

Keywords

Smartphones, Mobile money, M-Pesa, Crowdfunding, Campaign

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Resumo

Nos países em desenvolvimento, as tecnologias móveis têm-se tornado num factor importante para o crescimento a nível económico, de saúde, de educação e de desenvolvimento tecnológico. Embora os chamados ”*smartphones*” ainda estejam em minoria no mercado prevê-se que nos próximos anos o panorama se altere e que os smartphones dominem o mercado *mobile* nesses países.

Existe ainda pouca infraestrutura de pagamento através de cartões bancários neste países, tornando os sistemas de *Mobile Money* o mecanismo de pagamento mais utilizado no dia-a-dia. Um dos serviços de mobile money mais utilizadas nesses países é o M-Pesa e a WIT software desenvolveu a aplicação do M-Pesa para smartphones. Com o desenvolvimento de uma aplicação surge a oportunidade de desenvolver serviços que tirem partido do sistema de mobile money já desenvolvido e que possam ter um impacto positivo tanto a nível económico como social nas comunidades de países em desenvolvimento.

Neste relatório, é proposto o protótipo de um sistema que dará aos utilizadores da aplicação M-Pesa android acesso a um serviço de crowdfunding dentro da aplicação em si. Este serviço permitirá aos utilizadores angariar fundos monetários para causas pessoais através da criação e gestão de campanhas personalizadas. O protótipo incluirá também a possibilidade de utilizadores pesquisarem campanhas por categorias e por palavras-chave. Para o mecanismo de doações, o serviço será integrado de maneira a utilizar o sistema de pagamento já existente na aplicação M-Pesa.

Palavras-chave

Smartphones, *Mobile money*, M-Pesa, *Crowdfunding*, Campanhas

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Acronyms

API Application Programming Interface.

CRUD Create, Read, Update, and Delete.

CSS Cascading Style Sheets.

HTML HyperText Markup Language.

MSISDN Mobile Station International Subscriber Directory Number.

PPL People with Portugal.

REST Representational State Transfer.

UI User Interface.

URL Uniform Resource Locator.

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Contents

Chapter 1

Introduction

This report intends to describe the work carried out during the 1st and 2nd semester of the curricular internship for the academic year 2019/2020. This internship is included in the academic program of the Master's Degree in Informatics Engineering in the Software Engineering branch and it is hosted by WIT Software.

1.1 - Scope, Motivation and Opportunities

The growth of the mobile market in emerging countries is having a huge economic and social impact.

There are about 774 million users of mobile services in the sub-Saharan Africa region and the number of users is expected to reach 1000 million by 2025. In this region, 301 of the 774 million current users use smartphones and the number of smartphone users is expected to reach 632 million by 2025[1].

In these countries, there is a lack of banking card payment infrastructures and they make use of **mobile money** services for day-to-day payments. At the end of 2018 about 395 million mobile money accounts were registered in the sub-Saharan Africa region[1].

At this juncture, arises the opportunity to create new services that do not exist in that region or to extend services that are normally only available in a conventional way to services in smartphones that can help improve the lives of the people in the region.

Crowdfunding is a growing phenomenon in both developed and developing countries, contributing to economic and social improvements of the countries. The figure below 1 shows the growth of various types of crowdfunding in Africa.

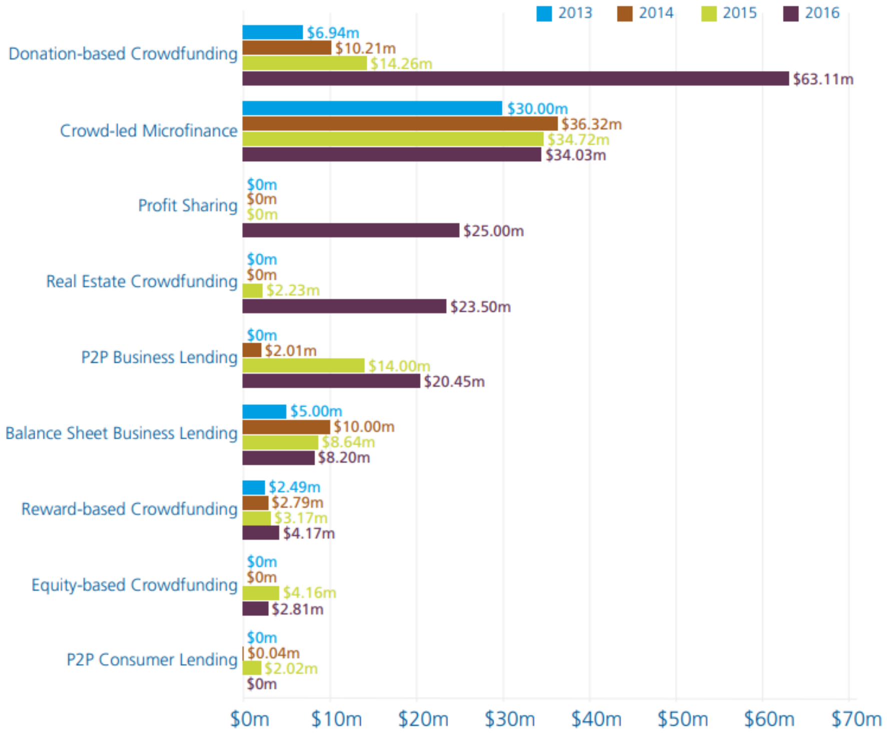

Figure 1: Online Alternative Finance by Model for Africa[2]

The donation-based crowdfunding has the most funds raised across Africa in that time frame (2013-2016) and is expected to continue growing. Crowdfunding as a whole has still a lot of room to grow in such countries[3].

This internship combines the two concepts, mobile money and donation-based crowdfunding by proposing a prototype of a crowdfunding service for personal causes integrated in a mobile money application.

1.2 - Objectives

The main objective is to create a prototype of a mobile web application that will allow users to create and manage campaigns to raise money. During the campaign creation process, users should be able to describe the cause they are creating, and illustrate it with images. For each campaign, users should be able to define the goal they want to achieve. The prototype will also include the possibility for users to research campaigns organized by category and relevance, as well as share through social networks.

WIT is a software company that ”creates advanced solutions and white-label products for the mobile telecommunications industry” which works with entities all around the globe[4]. It is a growing company that strives to produce successful products. The prototype is intended to work in integration with M-Pesa android application, a product developed by WIT, which will allow donations to be made and linked to a M-Pesa account using M-Pesa payment system.

The definition and analysis of solutions that have similar behavior to the one proposed in this document is an equally important goal since it will allow create the crowdfunding platform concept and choose the most relevant features for the users in the targeted market.

Ultimately, it is expected to report on these goals, the analysis of existing crowdfunding platforms, the development of a crowdfunding platform and its integration with the existing M-Pesa application structure, as well as, to break down both the information obtained and the choices made through the course of the internship.

1.3 - Document Structure

In chapter 2, the findings of concept and market research are addressed. A contextualization about mobile money, crowdfunding is presented and also a comparative analysis of available personal crowdfunding solutions in the market.

In chapter 3 of this document it is described the planning followed in the first semester, the planning slated for the second semester and the methodology of the internship.

The chapter 4 contains the prototype requirements specification. The terminology and structure used for requirements description are specified for a better understanding, and then the requirements are listed.

In chapter 5, a system architecture and database model are presented along with an overview of the technical choices made.

In chapter 6, the development of the front-end and back-end prototype is described, as well as the decisions made through the process. Furthermore the validations made to the system are presented.

In chapter 7 it is presented an overview of the main features developed during the internship.

Finally, in chapter 8, the final thoughts on the course of the internship so far and a perspective for its future are presented.

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Chapter 2

State of the Art

In this section, several online crowdfunding platforms will be presented, analysed and compared. The ones chosen were the most popular worldwide (Facebook, GoFundMe and Fundrazr) and relevant in specific markets (PPL and M-Changa) that explored the concept of fundraising for personal causes.

2.1 - Mobile Money

Mobile money is a technology that enables people to use a mobile phone to obtain, store and spend money. It is sometimes referred to as a ”mobile wallet” or the name of a particular service like mPesa, EcoCash, GCash, Tigo Pesa and many more. Although they are most common in Africa, Asia and Latin America, ”there are more than 270 different mobile money services around the world” according to WorldRemit[5]. Mobile money is a popular alternative to both cash and banks as it is simple to use, safe and can be used wherever a mobile telephone signal is present.

2.1.1 - M-Pesa

M-Pesa is ”Africa’s most successful mobile money service. It provides access to financial services to the millions of people who have a mobile phone, but do not have or have only limited access to a bank account. M-Pesa provides people with a safe, secure and affordable way to send and receive money, top-up airtime, make bill payments, receive salaries, get a short-term loan and much more”.[6]

Established on 6th March 2007 by Vodafone’s Kenyan associate, Safaricom, M-Pesa is Africa’s leading mobile money service, with over 37 million active customers and almost 400,000 active agents operating across 7 countries: the Democratic Republic of Congo, Egypt, Ghana, Kenya, Lesotho, Mozambique and Tanzania.[6] M-Pesa enables customers to send, receive and store money safely and securely via a basic smartphone. Most of M-Pesa markets have launched the M-Pesa smartphone application, providing customers with a digital platform to manage their M-Pesa accounts, and also to make faster purchases at merchant points via QR code.[6]

M-Pesa significantly reduces the potential risks of street robbery, burglary and petty corruption within cash-based economies where only a small proportion of the population benefit from access to conventional financial services.[6]

2.2 - Crowdfunding

Crowdfunding is a way of obtaining funding by asking a large number of people, each for a small amount of money. Or, as GoFundMe.com one of the biggest fundraising platforms puts it, ”Crowdfunding harnesses the power of social networks and the internet to give people the means to raise funds, help others overcome hardship and meet aspirational goals”[7].

The three most fundamental elements of online crowdfunding are[8]:

- A single promotion or solicitation platform
- Relatively small contributions made by large volumes of individuals from the public
- Reward or recognition for contributing

In the aftermath of the financial crisis of 2008, online crowdfunding arose largely due to the difficulty of artisans, entrepreneurs, early-stage companies, and philanthropists to raise money from conventional capital sources. It started being used for venture with reward-based crowdfunding and began to gain traction in many developed economies, including the United Kingdom, Canada, Italy, and the United States. The trend is now starting to draw significant interest in developing economies as well[8].

Online fundraising facilitates when it comes for asking for support, making it easy to overcome a financial barrier quickly or raise money for worthy causes. With the growth in popularity of online crowdfunding, the platforms have adopted a variety of financing models, such as [8]:

Reward-based crowdfunding - Individuals invest money in a project and in return receive perks such as early or exclusive access of a funded product. financial return.

Equity-based crowdfunding - Project creators sell small ownership stakes in their firm in exchange for investment.

Debt-based crowdfunding - Involves investors making microloans to entrepreneurs and then receive their investment with interest.

Donation-based - Collective effort of individuals to help charitable causes. Funds raised by donations are intended to improve social or environmental ills and improve public life and resources as a result.

In this internship, the model explored is the donation-based one directed to personal causes.

2.3 - Competitors Analysis

As mentioned in the previous chapter, the goal of this project is to focus on donation based crowdfunding targeted at personal causes such as illness, education and celebrations. In this section it is given an analysis and summary of the best solutions of donation-based crowdfunding that exist in the market today, accessible by smartphones. The analysis will focus the features and the accessibility of each solution in a web application or in a android application if it exists.

2.3.1 - Facebook

Facebook is a social networking platform, which allows people to communicate with their family, friends, and coworkers. Its services include timeline, news feed, messages, lists, mobile applications and a fundraising feature that was launched in 2017[9]. It allows Facebook users to start fundraisers for the causes that they care about or for personal matters[10]. The analysis will be about the fundraising service features that the platform has available through a browser at *www.facebook.com* and through the Facebook mobile application.

Product features

- **Web application**
  - **Authentication**: Users need to create a Facebook account and log-in with it to use the crowdfunding service.
  - **Search**: Ability to filter the search using categories (Animals, Environment, Education, Community and social action, Sport and several more). Users don't have access to search bar.
  - **Campaign creation**: Users can create a campaign to an existing charity or for a personal cause defining a goal, a deadline and also personalize them with a title, description, categories and images.
  - **Campaign Management**: After creating a campaign users have the ability to edit all the fields, post updates and delete the campaign.
  - **Share**: Allows users to share their own campaigns or other campaigns inside the

platform to friends or to the Facebook wall (Facebook Profile). Also provides access to a link that can be used to share through other means, such as e-mail or messaging services.

  - **Follow**: Users can follow a campaign and receive updates via notification inside the Facebook platform about that campaign.
  - **Notification**: Notification system used in the whole Facebook platform that notifies the users about their campaigns and campaigns they followed or donated to.
  - **Payment**: Donors need to have a Facebook account and are only able to use credit/debit card as payment method.
  - **Withdraw**: Facebook holds the money given to the campaign , then the campaign creators can withdraw it to their bank accounts.

- **Android Mobile application**
  - **Search**: Static results, users need to write something and then press search button. Users can filter between fundraiser and non-profits. Fundraiser being a campaign created by a person and non-profits being campaigns created by an organization.
  - **Donation listing**: Users can see a list of all their donations.

  The following features are the same as in the web application: **Authentication**, **Campaign creation**, **Campaign Management**, **Share**, **Follow**, **Notification**, **Donations (Payment)**, **Withdraw**.

Analysis

Facebook approach to a crowdfunding/fundraiser service is interesting. Users can create campaigns for themselves or friends and also for a charity/organization. It provides all the features needed to manage a campaign and the means to make it successful with the sharing functionality. Since it uses an ”internal” payment service it is mandatory to have a Facebook account associated with a credit/debit card to donate or withdraw money and that can be seen as a negative aspect. Still related to the mentioned above, users can see their donations but only inside the Facebook general account settings, in the payments menu relative to all payments operations of the users in the platform (using fundraiser service or any other service that Facebook has available). The browser version has almost all the features as the mobile application except for the donation listing. The search feature has a few differences that can be confusing for users that alternates between the two.

2.3.2 - GoFundMe

Crowdfunding platform that allows ”people to raise money for events ranging from life events such as celebrations and graduations to challenging circumstances like accidents and illnesses”[7]. It is available through a browser at *www.gofundme.com* and through their mobile application.

Product features

- **Web application**
  - **Authentication**: User can sign in using a Facebook account or the standard e-mail and password account.
  - **Search**: Static results, users need to write something and then press search button. Ability to filter the search using categories (Animals, Emergencies, Events, Education, Community, Family, Competitions and several more)
  - **Campaign creation**: Users are able to create a personal or group campaigns by defining a goal, a deadline and also personalize it with a title, description, categories and images. Group campaigns are campaign where the users can associate other users to raise funds.
  - **Campaign Management**: After creating a campaign, users have the ability to edit all the fields available in campaign creation and set campaign configurations (deactivate/activate the campaign, deactivate/activate comments and donations)
  - **Share**: Users are allowed to share their campaigns and other campaigns to social networks such as Facebook, Twitter, to messaging services (WhatsApp and Messenger) or using a Link provided that can be sent in different channels. There is also a piece of HyperText Markup Language (HTML) that can be embed to a blog or website code.
  - **Donate**: Users can donate using only credit/debit card method.
  - **Donation listing**: Users can see a list of all their donations.
  - **Withdraw**: GoFundMe holds the money given to the campaign, then the campaign creators can withdraw to their bank accounts.
- **Android Mobile application**
  - **Share**: The users are allowed to share their campaigns and other campaigns to social networks and to all the applications that have the share function in the mobile phone such as social media and messaging services.
  - **Notification**: Notification system used to inform the users of donations made to their campaigns and updated about campaign the users donated to.
  - **Follow**: Users can ”Like” a campaign and receive updates via notification about that campaign.

  The following features are the same as in the web application:**Authentication**, **Search**, **Campaign creation**, **Campaign Management**, **Donate**, **Donations listing** and **Withdraw**

Analysis

This solution is available in two different platforms, through a browser or using the GoFundMe mobile app. Both ways have similar features designed in different styles adapted to platform (mobile browser and mobile app). In terms of features it is a very complete solution. It allows users to create, manage the campaigns and share them to multiple social media and messaging services. Also has a consistent and easy to use user interface both in mobile browser and mobile application. This solution is available to mostly developed countries due to the limitation of the payment method partners[11].

2.3.3 - M-Changa

M-Changa is Africa's largest online fundraising platform. Their platform allows to create campaigns for personal causes that include medical, funeral, weddings, churches, businesses, education, projects, sports, construction and disasters. It is only available through a browser at *www.changa.co.ke*.

Product features

- **Authentication**: Users can sign-in using standard e-mail and password account but need to verify their account by making a symbolic payment using M-PESA (a mobile money system used in African countries).
- **Search**: Static search, users need to press search button. Ability to filter the search using 4 categories (health, education, life, community) and each category has several sub-categories.
- **Campaign creation**: Users can create campaigns with a defined goal, a deadline and personalize them with a description, images and videos.
- **Share**: Users can share their campaigns and other campaigns to social networks (Twitter and Facebook) and also to messaging applications such as WhatsApp, Telegram and E-mail.
- **Notification**: Users are notified about the progress of campaigns that they donated to, via SMS or E-mail.
- **Donate**: The platform offers the following payment method: mobile payments (M-PESA, Equitel, Airtel, T-Kash), Paypal and credit/debit cards.
- **Donations listing**: Users can see a list of all their donations.
- **Withdraw**: M-Changa holds the money given to the campaign, then the campaign creators can withdraw it to their bank account or to their mobile money account (MPESA, Airtel Money, Equitel).

Analysis

This platform is only available through a web application by using a browser. In this solution it was not clear that it has all the tools needed to create and manage a campaign due to access limitations. Although, by analysing the campaigns already created and reading their FAQ section, it is possible to see that the user is able to create a personal campaigns defining a goal, a deadline and also personalize them with a title, description, categories and images as well. The payment methods available make this solution stand out from the others since they allow the use of several mobile money services that are relevant to their market. A big problem comes from the user interface while using a mobile phone since it isn't optimized for mobile phone users. Also has a big limitation since only users that have access to M-PESA can authenticate in order to be able to create a campaign using the platform. To donate, any person can do it without logging in.

2.3.4 - Fundrazr

FundRazr is an online fundraising platform that has helps thousands of people and organizations raise money for causes they care about. It is only available through a browser at *www.Fundrazr.com*.

Product features

- **Authentication**: Users can sign in using Facebook, LinkedIn, Google or standard e-mail and password account
- **Search**: Static search, users need to press search button. Ability to filter the search using 18 categories and browse by near me, friends, offering perks, trending, ending soon, newest.
- **Campaign creation**: Users are able to create a personal or group campaigns defining a goal, a deadline and also personalize it with a title, description, categories and images. Users also needs to add a payment provider account (Paypal or Stripe) to where the funds will be directly sent.
- **Campaign Management**: After creating a campaign, users have the ability to edit the all the fields and set campaign configurations.
- **Share**: The users are allowed to share their campaigns and other campaigns to social networks (Facebook, Twitter and LinkedIn) and to Email or using a link given that can be sent in any messaging service. There is also piece of HTML that can be embed to a blog or website code.
- **Follow**: Users can follow a campaign and receive updates via e-mail about that campaign.

- **Notification**: Message feature inside the platform, where users can directly contact campaign creator, receive notification of new donations to their campaigns and updated to campaign that they donated.
- **Donate** - Users can donate using credit/debit card method or PayPal.
- **Donations listing**: Users can see a list of all their donations.
- **Withdraw**: Fundrazr holds the money given to the campaign, then the campaign creators can withdraw the money to their bank accounts.

Analysis

This solution has many similarities to the ones analysed before. Offers the common features but in contrast with the others, no money passes through the platform, it goes directly to the campaign creator. Also it has a features for users to see all their donations. It has a multiple sharing options as the others solutions analysed. The options to donate are quite limited since it is only done using credit/debit card or Paypal account.

2.3.5 - PPL

People with Portugal (PPL) (People with Portugal) ”is a collaborative way to raise funds for ideas and projects”[12]. PPL ”provides an online platform for any entrepreneur to find support from a large community, in a simple and transparent way”[12]. Although it presents itself as a reward-based crowdfunding platform it can also be used for personal causes as a donation based one and the reward can be as simple as a simple ”thank you” message. Although it follows a light reward-based model, it also has a default restriction that every campaign is an all or nothing campaign, meaning that the campaign creator only receives the money if he reaches the goal. The donor can choose to overrule that restriction and select an option before donating stating that the campaign creators can keep the money even they don’t reach the goal. The platform can be accessed through a browser at *www.ppl.pt*.

Product features

- **Authentication**: To create campaigns the users need to create an account using standard e-mail and password or Facebook. To donate the users don’t need authentication.
- **Search**: Static search, users need to press search button. Ability to filter the search using 20 categories and browse by popularity, amount raised, amount required, due date, published last and published first.
- **Campaign creation**: Users are able to create a personal or group campaigns defining a goal, a deadline and also personalize it with a title, description, categories and images.

- **Campaign Management**: After creating a campaign users have the ability to edit the all the fields of the campaign and set campaign configurations.
- **Share**: Users can share their campaigns or other campaigns through Facebook, Twitter, WhatsApp, Pinterest, email, embed, link and Flyer.
- **Follow**: Users can follow campaigns and receive updates from those campaigns.
- **Donations (Payment)**: The platform offers several payment method such as MBWay (mobile payment), Paypal, credit/debit cards, bank transfer and banking reference.
- **Donations listing**: Users can see a list of all his donations.
- **Withdraw**: PPL holds the money given to the campaign, then the campaign creators can withdraw it to their bank accounts.

Analysis

This solution is only available through a web application by using a browser but offers a good user experience even when using a mobile phone browser. It has all the features needed to create any type of crowdfunding, for a personal project or cause, like an illness. Even though it's a Portuguese platform, it can be used worldwide. PPL follows the same process of campaign creation like the other solutions, allowing personalized campaigns and the option to share them in social media and messaging services. It has an embed option meaning that the users can copy some HTML and put it in their own blog or website to increase the reach of the campaign. As for the payments method, it has one option not seen in the other platforms, a mobile one, called MBWay that it's mostly used by Portugal residents since it's a SIBS (main service of electronic payments in Portugal) solution.

2.4 - Comparative analysis

Table 2.1 below summarises the data collected on the online crowdfunding solutions described in the above sections in this chapter, indicating the differences between the systems taking into account the defined comparative factors, features and accessibility.

Comparative factors		Online crowdfunding solutions				
		Facebook	Gofundme	Fundarz	M-Changa	PPL
Accessibility	Web Application	Yes	Yes	Yes	Yes	Yes
	Mobile App	Yes	Yes	No	No	No
Features	Search	Yes	Yes	Yes	Yes	Yes
	Create personalized campaigns	Yes	Yes	Yes	Yes	Yes
	Manage Campaign	Yes	Yes	Yes	N/A	Yes
	Donation	Yes	Yes	Yes	Yes	Yes
	Withdraw	Yes	Yes	Yes	Yes	Yes
	Notifications	Yes	Yes	Yes	Yes	No
	Share	Yes	Yes	Yes	Yes	Yes
	Follow	Yes	Yes	Yes	N/A	Yes
	Donations listing	No	No	Yes	N/A	Yes

Table 2.1: Summary of solutions analysis

It shows that most platforms have common features and all of them have responsive web applications while only GoFundMe and Facebook have the service in mobile apps. The big differences are in the payment methods available as can be seen in table 2.2. The solutions most used in a single country and region tend to provide specific methods that are most used in that region or country like the case of M-Changa and PPL.

Solution	Mobile payment methods	Other methods
Facebook	None	Credit/debit card
GoFundMe	None	Credit/debit card
Fundrazr	None	Credit/debit card, PayPal
M-Changa	M-PESA, Equitel, Airtel, T-Kash	Credit/debit card, PayPal
PPL	MBWay	PayPal, bank transfer

Table 2.2: Summary of payment methods available

Even though the business model of each solution wasn't analysed above it might be important to refer that Facebook, GoFundMe and Fundrazr don't charge a platform fee while M-Changa and PPL do, with 4,25% and 5% of the total amount raised, respectively. In all presented solutions a payment processing fee is charged depending on the payment method chosen.

Although these five solutions explore really well the crowdfunding concept for personal causes, the one with the mobile payment methods, M-Changa has the worst user experience while using it on the mobile phone.

In this internship, a new solution is proposed. The solution takes advantage of M-Pesa payment system that will allow the M-Pesa users to make donations without leaving the smartphone application and also receive the funds directly to the account while providing a good user experience throughout the entire process, it being creation, management of campaigns or donation.

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Chapter 3

Planning and Methodology

This chapter presents the task planning of the internship, covering the work carried out, the work to be done and the methodology adopted throughout the internship.

3.1 - Process Management

An agile methodology was used in the development of this project. Concretely, an adaptation of the SCRUM methodology was made since this is an iterative and incremental methodology.

The requirements defined at the beginning of the project can be changed as the development progresses and an AGILE methodology gives the flexibility needed. Based on the requirements a list of features to be implemented is defined in a project backlog. Then, before each sprint starts, a set of tasks will be chosen and added to the spring log, in a meeting between the adviser, the tutor and the intern .

Although the methodology is based on SCRUM, since the intern is mostly developing independently, there are no daily meetings. Even though there aren't daily meeting, it was assigned a tutor to the intern to help in case of day to day doubts that the intern might have about the project. There are meetings between the adviser, the tutor and the intern after each sprint ends to assess the progress made and to re-define the next sprint if needed.

3.2 - First Semester Planning

The first semester was mainly focused on research, planning future work and getting familiarized with the technologies. Overall, the work done in this semester involved the following tasks:

1. **State of the art**

   This task involved continuous research about concepts around mobile money, crowdfunding, crowdfunding platforms and similar products available to the one detailed on this document. For the available products on the market, an effort was made to try each product and evaluate their features.

2. **Requirements Specification**

   For this task, a few meetings were held both with the intern and the WIT's advisor. The intern gathered the requirements after analysing the most relevant features identified in the state of the art. Afterward, the requirements gathered were discussed and reviewed with the advisor.

3. **Mock up Design**

   This task was accomplished at the same time as the requirements specification and the training ones. It started by the intern drawing low fidelity wireframes and then those were sent to the WIT design team together with the user journeys from the user-stories (functional requirements). This process involved the WIT adviser, the intern and the designer where several iterations happened until the most recent version.

4. **Architecture and technologies**

   For this task, the requirements already gathered were taken into the process of drawing an initial architecture. After that, the most appropriated technologies to use were analyzed.

5. **Training**

   For the development, the intern needed to learn and get familiarized with the technologies chosen, during two weeks. It was crucial for the next task concerning front-end development.

6. **Implementing Interface Prototypes** After the high fidelity mock ups were defined, the intern started to implement the user interface.

7. **Intermediate Internship Report**

   The writing of the intermediate report was done alongside all the other tasks and with the help and feedback of both advisors.

Below in table 3.1, it's presented the time used of each task in the first semester, taking into account that the average week of work was of about 25 hours.

Task	Description	Duration
1	State of the art	2 Weeks
2	Requirements Specification	2 Weeks
3	Architecture and technologies	1 Weeks
4	Mock up Design	3 Week
5	Training	2 Weeks
6	Implementing Interface Prototypes	8 Weeks
7	Intermediate report	4 Weeks

Table 3.1: First Semester Planning

3.3 - Second Semester Planning

The second semester focused on the implementation, integration and validation of the solution. The work done in the second semester involved the following tasks:

1. **Micro service Implementation**

   This task involved creating a Micro service in JAVA that answers the functional requirements regarding the creation and managing of crowdfunding campaigns.

2. **Prototyping of the campaign creation system and content management**

   This task took place after the previous one, and it consisted in integrating the front-end prototype and the micro-service to arrive at an intermediate prototype of the campaign managing system without the payment system.

3. **Design and Implementation of the location screens**

   This task was not planned but with the adding of insert location user story, the intern had to draw low-fidelity mockups and repeat the same process with the designers. After that, its implementation both front-end and back-end was made.

4. **Configuration of Demo environment**

   This a new task defined in the second semester. Since the goal was to make a functional prototype, after discussing it within WIT, it was decided that the service needed be available outside of WIT network for demonstrations. This task was about configuring an apache server to expose both the web application to a public URL and the microservice to a public URL. Also includes the changes in configuration in both, the web application and microservice.

5. **Integration with M-Pesa android app**

   This was the main task, where the intern worked in integrating his prototype with the M-Pesa android application. This task involved learning how the system works and how it could be integrated. Also included the implementation of the share, upload image and share location features in the android app API.

6. **Functional tests**

   This task was divided in 2 phases. First functional tests were made after the Prototyping of the campaign creation system and content management task. In the second phase the tests were re-done the after the integration with M-Pesa application.

7. **Non-functional requirements evaluation**

   The evaluation of non-functional requirements were the last task done, and its purpose was to analyse if the quality attributes were met by the proposed solution.

8. **Demo preparation**

   This task had not yet been defined in the first semester. It involved creating videos of the prototype and a presentation with the context and use cases of the Crowdfunding service to accompany the demonstration itself.

9. **Final report**

   The writing of the final report was be done alongside all the other tasks and with the help and feedback of both the advisors.

Below in table 3.2, it's presented the time used to each task for the second semester, considering that the average week of work will be 40 hours.

Task	Description	Estimated time	Real Time
1	Micro service Implementation	2 Weeks	2 weeks
2	Prototyping of the campaign management system and content management	3 Weeks	4 weeks
3	Design and Implementation of the location screens	New task	2 weeks
4	Configuration of demo environment	New task	1 Week
5	Integration with M-Pesa android app	6 Weeks	5 Weeks
6	Functional tests	1 Week	1 Week
7	Usability tests	2 Week	Removed
8	Non-functional requirements evaluation	1 Week	0.5 Week
9	Demo preparation	New Task	1 Week
10	Final report	3 Weeks	4 Weeks

Table 3.2: Second Semester Planning

Although the first tasks were completed within the timeframe set, there were some variations in the execution of the planning. New tasks arised, such as Design and Implementation of the location screens and Configuration of demo environment. There was also the removal of the Usability tests since the final product is a prototype and it didn't make sense to do such test at this point of development. This task was replaced by "Demo Preparation" which involved making an internal presentation of the prototype for internal validation. Due to a delay in the implementation of the interfaces needed by the WIT android team, the Integration with

M-Pesa android app was started later than expected. It was then decided that the intern would also implement those interfaces and integrating them with the web application. As a result the integration with M-Pesa overlapped with the writing of the final report which then caused a need for 2 more weeks of work to finalize the report.

3.4 - Risks Management

Over this section, all the factors that could lead to an unsuccessful internship are gathered and analyzed.

Risk Management is the process of identifying, assessing, responding to, monitoring, and reporting risks. A risk is an event or condition that may have a positive or negative impact on the goals of a project if it occurs. The risk management plan outlines how to classify, assess and handle risks associated with the project.

3.4.1 - Internship Success Criteria

The success of this project implicates success from the point of view of the intern and the success of the management process adopted. Knowing this, the intern defined 3 crucial conditions of success. Conditions:

- The final prototype must fulfill all the “must have” requirements defined.
- A working prototype should be available at the end of the project, which can be easily demonstrated
- The internship finishes with all the goals previously defined, accomplished within the expected time frame.

3.4.2 - Risk analysis

Based on a qualitative assessment of the risks relative impact (catastrophic , critical or marginal) and the likelihood of its occurrence (high, medium or low), will be decided which risks needs the most attention.

Probability Scale

- High – High probability of occurrence.
- Medium – Medium probability of occurrence.

- Low – Low probability of occurrence.

Impact Scale

- Catastrophic – Risk that has the potential to greatly impact project schedule or performance.
- Critical– Risk that has the potential to slightly impact project schedule or performance.
- Marginal – Risk that has relatively little impact schedule or performance.

Risk Identification

ID	R1
Description	The intern has to use tools and technologies that he is not familiar with (such as ReactJS and Kotlin)
Project impact	This can lead to the resolution of any problems being much longer.
Impact	Marginal
Probability	High

Table 3.3: Risk #1 - Use of new technologies

ID	R2
Description	The crowdfunding service will be dependent on the WIT mobile money system and problems can occur in its use
Project impact	Might result in the impossibility of adding the payment feature
Impact	Critical
Probability	Low

Table 3.4: Risk #2 - Dependency on the WIT mobile money system

ID	R3
Description	The intern is dependent on the WIT M-Pesa android team to add the interfaces to allow the use of native features
Project impact	Might result in the impossibility of adding the share, share location and upload feature or the delay subsequent tasks
Impact	Critical
Probability	Medium

Table 3.5: Risk #3 - Dependency on the WIT mobile money system

Mitigation Plans

Risk management plan defines how the risks associated with projects will be identified, analysed but also managed to reduce the probability or the impact of the risk.

The following mitigation plan was defined to prevent each risk:

- **R1**

  Allocate more time to learn these new technologies. Keep contact with WIT developers who already have working with these technologies

- **R2**

  Reading the documentation and understand as much as possible how the system works to be able to identify problems in a early stage. If a problem is identified, ask the developer team for help.

- **R3** Intern should keep constant communication to the android team to know status of development. In case of delays the intern might have to implement those interfaces himself.

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Chapter 4

Requirements Specification

In this section the functional requirements of the application will be described. The quality attributes (non-functional requirements) will also be described.

4.1 - Terminology

Since the methodology chosen was agile, the intern used the user story technique to capture and prioritize the software requirements. User stories are part of an agile approach that helps change the focus from writing about requirements to discussing them. User stories are brief, clear descriptions of a feature told from the point of view of the person who needs the new functionality, usually a device user or client.[13]

The format used by the intern for the user stories was the one adopted by WIT software. It is comprised of a description, pre-conditions, a user journey, dependencies and priority. This technique together with the AGILE methodology allowed the intern to use the user stories as project backlog.

4.2 - User Stories Structure

The requirements gathered in this internship adopt the following structure:

US#ID

- **Description:** As a <role>, I want <feature>.
- **Preconditions :** Some pre-condition

- **User Journey :** Some determinable business situation
- **Dependencies:** US#ID
- **Priority:** Must Have, Should have, Nice to Have

4.3 - User Stories

US#1

- **Description:** As a user, I want to search for campaigns by keyword.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - The platform has to have one or more campaigns created
- **User Journey :**
  - User selects the search bar
  - User will input text related to what he looks for
  - User will see a list of filtered campaigns
- **Dependencies:** None
- **Priority:** Must Have

US#2

- **Description:** As a user, I want to search for campaigns by category.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - The platform has to have one or more campaigns created
- **User Journey :**
  - User selects the search bar
  - User will have an option to select one of four categories to narrow the search
  - User selects one category
  - User will see a list of filtered campaigns
- **Dependencies:** None
- **Priority:** Must Have

US#3

- **Description:** As a user, I want to search for campaigns by keyword and category.
- **Pre-conditions :**

  - User is authenticated through the M-Pesa app
  - The platform has to have one or more campaigns created
- **User Journey :**
  - User selects the search bar
  - User will input text related to what he looks for
  - User will have an option to select one of four categories to narrow the search
  - User will select one category
  - User will see a list of filtered campaigns
- **Dependencies:** None
- **Priority:** Must Have

US#4

- **Description:** As a user, I want to see the details of a campaign.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
- **User Journey :**
  - Users can find campaigns by:
    - Scrolling in the ”All Campaigns” tab
    - Searching/Selecting Category
    - Opening a link shared by other users
  - User will select the campaign that he is interested
  - User will be able to see all of the details of the campaign, such as:
    - Big picture/video
    - Campaign title
    - Progress bar
    - Campaign description
    - Posts updating the campaign
    - Comments written by previous donors
    - Buttons to Donate and Share
- **Dependencies:** US#1
- **Priority:** Must Have

US#3

- **Description:** As a user, I want to create a campaign.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app

- **User Journey :**
  - **Scenario :** User select the create campaign in ”All campaigns” tab:
    - User selects the ”Create Campaign” button
  - **Scenario :** User select the create campaign in ”My campaigns” menu:
    - User selects the ”My campaigns” tab
    - User identifies and selects the ”+” button to create a campaign
  - User will be presented a new screen
  - User will choose the campaign type
  - User will choose the campaign category
  - User will write a name to the campaign
  - User will write a campaign description
  - User will choose the amount of money
  - User will be shown a summary of the campaign information with option to add a picture/video
  - User will click ”Create campaign” button
  - User will receive a ”Success” message and click ”Go to My Campaigns”
- **Dependencies:** None
- **Priority:** Must Have

US#4

- **Description:** As a user, I want to donate to campaigns.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
- **User Journey :**
  - Users can find campaigns by:
    - Scrolling in the ”All campaigns” tab
    - Searching/Selecting Category
    - Opening a link shared by other users
  - User can start a donation from:
    - Campaign Details
    - Campaign Card
  - User should see the campaign, identify the donate button and click it.
  - User will need to choose the amount and click continue
  - User will write a message to the campaign (Optional),
  - User will set the privacy of donation (if private only the campaign creator will see the message and donation)
  - User sees confirmation screen with campaign name, amount and fee

  - User will click continue
  - User will insert PIN
  - User will see a success screen with Campaign name, amount and fee
- **Dependencies:** US#2
- **Priority:** Must Have

US#5

- **Description:** As a user, I want to edit the title of my campaign.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - User has created one or more campaigns
- **User Journey :**
  - Users will select the ”My Campaign” tab
  - User will select the campaign
  - User will click in the ”EDIT” button
  - User will edit the title field
  - User presses the ”Save changes” button and saves the changes
- **Dependencies:** US#3
- **Priority:** Must Have

US#6

- **Description:** As a user, I want to edit the description of my campaign.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - User has created one or more campaigns
- **User Journey :**
  - Users selects the ”My Campaign” tab
  - User will select the campaign
  - User will click in the ”EDIT” button
  - User will edit the description field
  - User will press the ”Save changes” button and saves the changes
- **Dependencies:** US#3
- **Priority:** Must Have

US#7

- **Description:** As a user, I want to edit the amount goal of my campaign.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - User has created one or more campaigns
- **User Journey :**
  - Users will select the ”My Campaign” tab
  - User will select the campaign
  - User will click in the ”EDIT” button
  - User will edit the amount goal field
  - User will press the ”Save changes” button and save the changes
- **Dependencies:** US#3
- **Priority:** Must Have

US#8

- **Description:** As a user, I want to edit the image my campaign.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - User has created one or more campaigns
- **User Journey :**
  - Users selects the ”My Campaign” tab
  - User selects the campaign
  - User will click in the ”EDIT” button
  - User will select the edit image button
  - User will select an image from his mobile phone
  - User will press the ”Save changes” button and saves the changes
- **Dependencies:** None
- **Priority:** Should Have

US#9

- **Description:** As a user, I want to post an update to my campaign.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - User has created one or more campaigns
- **User Journey :**
  - Users will select the ”My Campaign” tab

  - User will select the campaign
  - User will click in the ”POST” button
  - User will input the text to be in the post
  - User will select ”New Post” button
  - User will be re-directed to his campaign with the post he just created
- **Dependencies:** US#3
- **Priority:** Should Have

US#10

- **Description:** As a user, I want to disable comments to my campaign.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - User has created one or more campaigns
- **User Journey :**
  - Users will select the ”My Campaign” tab
  - User will select the campaign
  - User will click in the ”OPTIONS” button
  - User will press the toggle to disable comments
- **Dependencies:** US#3
- **Priority:** Should Have

US#11

- **Description:** As a user, I want to withdraw money from my campaign.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - User has created one or more campaigns
  - The campaign the user wants to withdraw money received donations
- **User Journey :**
  - Users selects the ”My Campaign” tab
  - User will select the campaign
  - User will click in the ”WITHDRAW” button
  - User will select the amount he wants to withdraw
  - User will click continue
  - User will insert PIN
  - User will see a success screen with Campaign name, amount, fee

  - User will click continue
  - User will be re-directed to his campaign
- **Dependencies:** US#3
- **Priority:** Nice to Have

US#12

- **Description:** As a user, I want to share my campaign.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - User has created one or more campaigns
- **User Journey :**
  - Users selects the ”My Campaign” tab
  - User will select the campaign
  - User will click in the ”SHARE” button
  - User will select the platform where he wants to share
  - User will share the campaign to the platform
  - User will be re-directed to his campaign
- **Dependencies:** US#3
- **Priority:** Should Have

US#13

- **Description:** As a user, I want to share a campaign.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - There are campaigns in the platform
- **User Journey :**
  - Users can share campaigns by:
    - ∗ selecting ”Share” button in the big cards
    - ∗ Selecting a big card opening the campaign details and clicking ”Share” button
    - ∗ Selecting a small card opening the campaign details and clicking ”Share” button
  - User will select the platform where he wants to share
  - User will share the campaign to the platform
  - User will be re-directed to his previous screen
- **Dependencies:** US#2

- **Priority:** Should Have

US#14

- **Description:** As a user, I want to see all update posts of a campaign.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - There are campaigns in the platform
- **User Journey :**
  - User can find a campaign by:
    - Scrolling in the ”All campaigns” tab
    - Searching/Selecting Category
    - Opening a link shared by other users
  - User will select the campaign
  - User will identify ”Posts” section
  - User will select ”See all” button in Posts section
  - User will see all the posts made in the campaign
- **Dependencies:** US#2
- **Priority:** Should Have

US#15

- **Description:** As a user, I want to see all comments of a campaign.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - There are campaigns in the platform
- **User Journey :**
  - User can find a campaign by:
    - Scrolling in the ”All campaigns” tab
    - Searching/Selecting Category
    - Opening a link shared by other users
  - User will selects the campaign
  - User will identify ”Comments” section
  - User will select ”See all” button in Comments section
  - User will see all the comments made to the campaign
- **Dependencies:** US#4
- **Priority:** Should Have

US#16

- **Description:** As a user, I want to select my location.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
- **User Journey :**
  - User will open the ”All campaigns” tab
  - User will identify the ”Near you” section
  - User will select a country and then a city from the respective drop-down list.
- **Dependencies:** None
- **Priority:** Should Have

US#17

- **Description:** As a user, I want to change my location.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
- **User Journey :**
  - User will open the ”All campaigns” tab
  - User will identify the ”Near you” section
  - User will identify the ”Change location” button
  - User will select a country and then a city from the respective drop-down list.
- **Dependencies:** None
- **Priority:** Should Have

US#18

- **Description:** As a user, I want to see a list of campaigns near my location.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - There are campaigns in the platform
- **User Journey :**
  - User will open the ”All campaigns” tab
  - User will identify the ”Near me” section
  - User will see a list of campaigns near his location
- **Dependencies:** None
- **Priority:** Should Have

US#19

- **Description:** As a user, I want to see a list of popular campaigns.
- **Pre-conditions :**
  - User is authenticated through the M-Pesa app
  - There are campaigns in the platform
- **User Journey :**
  - User will open the ”All campaigns” tab
  - User will identify the ”Popular” section
  - User will see a list of popular campaigns
- **Dependencies:** None
- **Priority:** Should Have

4.4 - Non-functional Requirements

This section outlines the main concerns regarding non-functional requirements. The scope will only be to describe the quality attributes by which the application will be guided and not the strategies to consolidate them. Those will be presented in the next chapter, about the system architecture.

For this purpose, quality attributes that describe how the system should behave are enumerated in this section:

- **Usability** - The system should adapt itself to be presented similarly in all devices. Its features should be easily accessible across devices, with the main focus on the end-user experience.
- **Security** - The system should be capable of denying any unauthorized access or malicious attack to the platform. It should also ensure the user’s privacy during and after the usage of the platform, storing all the sensitive data encrypted.
- **Maintainability** - The developed product should follow good practices so that in the future it can be easily expanded or modified by the hosting company.

The above quality attributes are now taken into consideration in the following scenarios to be later used in a system validation:

Scenario 1

Quality Attribute:	**Usability**
Source of stimulus:	Crowdfunding service
Stimulus:	User accesses different pages of the application
Environment Conditions:	Normal Conditions
Artefacts:	System
Response:	The system should have a consistent format and design around all pages
Response Measurement:	User can identify where to perform the actions needed to interact with the system on all different pages

Table 4.1: Usability Scenario

Scenario 2

Quality Attribute:	**Usability**
Source of stimulus:	Mobile Device
Stimulus:	User accesses crowdfunding service on a mobile device
Environment Conditions:	Normal Conditions
Artefacts:	System
Response:	The system adapts its interface to best fit on the device
Response Measurement:	User can identify where to perform the actions needed to interact with the system on the new device

Table 4.2: Usability Scenario #2

Scenario 3

Quality Attribute:	**Security**
Source of stimulus:	Unauthorized User
Stimulus:	User tries to access private data
Environment Conditions:	Normal Conditions
Artefacts:	System
Response:	The user gets a rejected response
Response Measurement:	The system rejects the request of this user, and the user cannot access any private data

Table 4.3: Security Scenario

Scenario 4

Quality Attribute:	**Maintainability**
Source of stimulus:	Maintenance Developer
Stimulus:	Developer who has at least one year of experience supporting this project, adds new feature to the system
Environment Conditions:	Development Branches
Artefacts:	System
Response:	The system should maintain its normal behavior, having a new feature integrated
Response Measurement:	The feature should be developed, tested and integrated in the system within a week of labor

Table 4.4: Maintainability Scenario

4.5 - Restriction

Below are described both, the technical and business restrictions of the project.

4.5.1 - Technical

The prototype of the service had to be a web application and the back-end part had to be made in JAVA. The reasoning behind was that the prototype is to be integrated within a mobile application and had to run independently of the hardware used by the end-user. This is will be explained in chapter 5. Also, those are technologies that WIT already uses and this way, facilitates the help from experienced professionals in case of difficulties from the intern in the development. Since the prototype is to be integrated within M-Pesa application, it will be heavily dependent on the M-Pesa application regarding security.

4.5.2 - Business

From a business perspective, the intern should take in consideration that the service will be running in a M-Pesa android application targeted for a international market, specifically to African countries. In this case in particular it will influence the design and usability of the crowdfunding platform, as it will have to follow similar guidelines to the ones used in the existing M-Pesa android application to provide a consistent user experience.

4.6 - Mock ups

The creation of mock ups aims to align the previously specified requirements of the application with its design and interaction, and also to verify that the design and the interaction between the screens are as desired. The elaboration of mock ups will minimize the time and effort consumed during the implementation phase of the application.

This stage was split in 2 phases, a first phase where the intern created low fidelity wireframes according to the most relevant modules defined for the application after the analysis of similar solutions: campaign management, campaign listing, campaign details and search. The wireframes were validated and corrected with the internship advisor. In the second phase, the wireframes were sent together with the user journeys previously defined to the WIT design team who then created high fidelity mock ups. These mock ups were validated and corrected with the internship advisor again. Figures 2 and 3 below show the main screen (”All campaigns” tab) with campaign listing as an example in the low fidelity and high fidelity mock ups respectively.

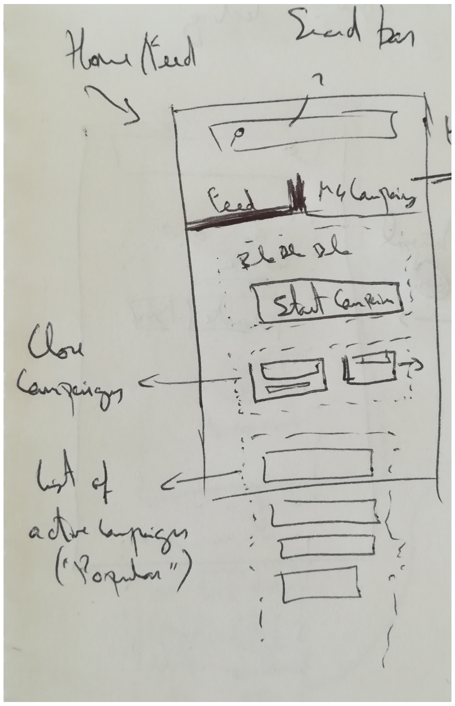
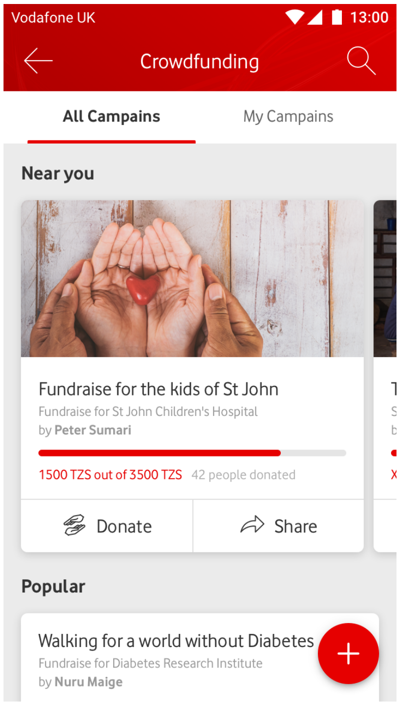


Figure 2: Low Fidelity Mock up example



Fundraise for the kids of St John
Fundraise for St John Children's Hospital
by **Peter Sumari**
1500 TZS out of 3500 TZS 42 people donated

Walking for a world without Diabetes
Fundraise for Diabetes Research Institute
by **Nuru Maige**

Figure 3: High Fidelity Mock up example

The other mock-ups of the application can be found in the annexes.

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Chapter 5

Architecture and Technology

In this chapter a description of the architecture and the database that was developed and implemented in the project is given. It starts by defining the terminology used to present the solution, then proceeds to explain both the architecture design and the decisions taken. For this task, the previously defined requirements, restrictions were taken into account, as the end goal of the proposed architecture is to implement a system that satisfies them.

By the end of this chapter, the technologies chosen to implement the system are presented, along with the reasoning behind the choices.

The design of the views of the system architecture were based on the C4 model[14] which consists of a model simplified to facilitate how to describe and understand how a software system works. The C4 model was designed to resolve the inconsistent notation and levels of detail on the design of software architectures [14]. It describes a procedure for documenting and designing architecture. Essentially, it specifies guidelines to represent a software system architecture, providing detail on how to increase the level of the specification through each of the diagrams. In the figure 4, it's presented the labels used in the diagrams.

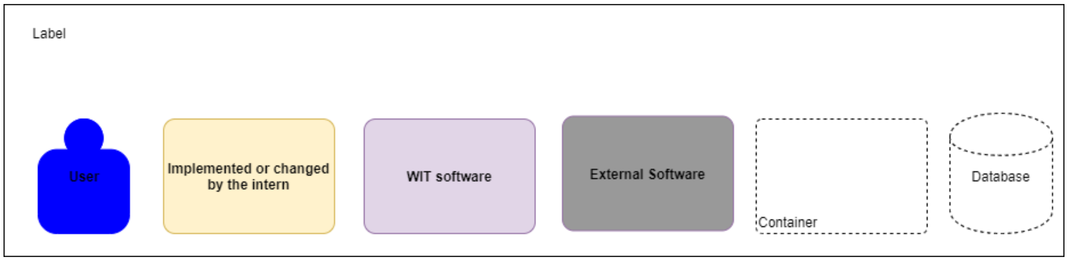


Figure 4: Label of the diagrams

5.1 - Architecture

As stated in previous chapters, the final product is aimed to provide a crowdfunding platform to users of M-Pesa android application. This prototype must integrate with WIT M-Pesa app to manage the transfer of funds to the campaigns owners inside the mobile application.

The first diagram of the C4 model, the context diagram, shows these relationships. In figure 5, we can see an overview of the whole system. It shows how the system will interact with external components, such as the M-Pesa payment system.

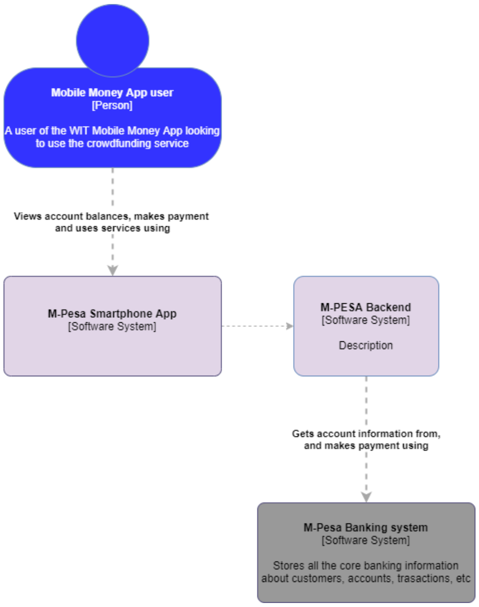

Mobile Money App user
[Person]
A user of the WIT Mobile Money App looking to use the crowdfunding service
Views account balances, makes payment and uses services using
M-Pesa Smartphone App
[Software System]
M-PESA Backend
[Software System]
Description
Gets account information from, and makes payment using
M-Pesa Banking system
[Software System]
Stores all the core banking information about customers, accounts, trasactions, etc

Figure 5: Context Diagram

The main purpose of the system is to interact with end-users, fulfill the requirements of the previous chapter and to integrate with WIT M-Pesa smartphone application without changing the mobile application itself. So, the development of a mobile web application was the solution. It implied the development of both the user interface and the server-side component. And in future iterations can also be transitioned to a standalone web application.

In figure 6, it is possible to see a view of the system that will allow the web application services to run within the android application. It shows the components and how they interact with each other.

As mentioned before the orange components, are the ones the intern needed to make additions or changes.

Since the intern project is part of a product that pretends to offer several services, there were two approaches. One being a monolithic and the second a micro services oriented one. It was important to decide if this system would use a monolithic or micro services approach. These approaches are described as:

- **Monolithic** - the system is built as one single component, being developed, tested and deployed as a whole.
- **Micro services** - the system is split into different, independent components, while still maintaining possible interactions between them.

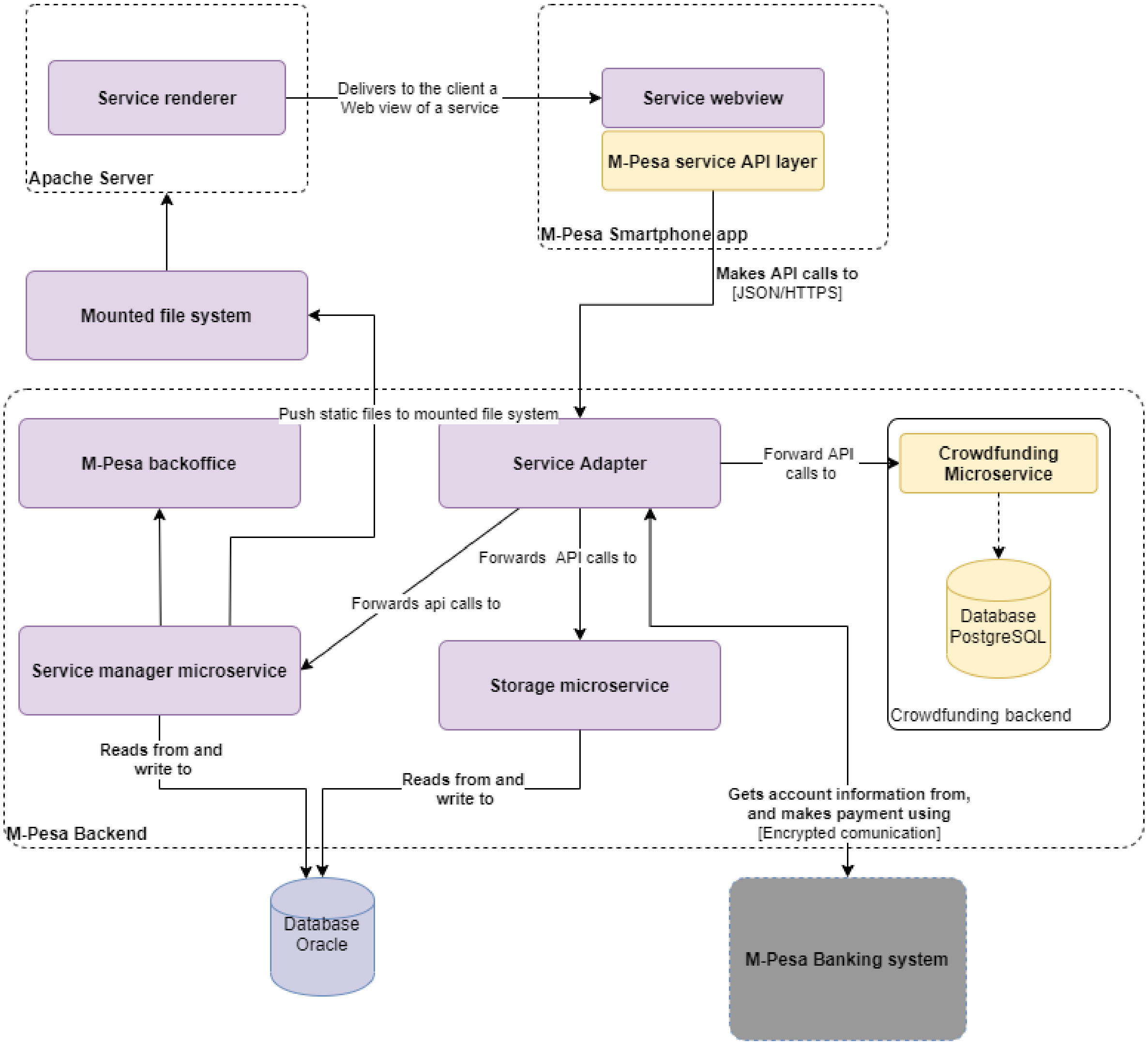


Figure 6: Container Diagram

Since the objective of the internship is to implement a crowdfunding service it was decided that the intern would implement a micro service that will take care of all business logic of crowdfunding service separated from all the other services that might be developed at the same time.

As stated before, M-Pesa smartphone will integrate a list of services and display the deployed web application services. For that, two components were needed. A content webview, that allows to load the service website so it can be displayed to the user. This webview is sandboxed which means all http/https traffic is blocked as well as ajax requests. The webview also applies default behaviour to cache pages and resources locally to improve performance. The second component, Service API layer provides the services with two layers of native APIs that can be called in the website javascript code. One allows the use of M-Pesa APIs to perform transfer of money through a M-Pesa account and request for user information permission (MSISDN, balance, name). The other, Request API allows the services to perform requests and handle responses through a secure channel.

The service API layer communicates with the service adapter which is a service facade that exposes the Service Build microservices APIs and specific 3rd party APIs to the M-Pesa application, such as, the crowdfunding API. This service is deployed along the M-Pesa back-end and is a self-contained springboot application.

The microservices or in this case, the crowdfunding one, is deployed along the M-Pesa back-end and each is a self-contained springboot application with a database to store all the related information. This microservice will expose a Representational State Transfer (REST) Application Programming Interface (API) that handles the requests made by the crowdfunding service surrounding the creation and management of campaigns.

Afterward, there is a service manager back-end that splits in 2 microservices. A service manager microservice which provides a set of APIs for the backoffice to manage service details and versioning as well as to manage the deployment/underployment of services packages to the apache web server. And a storage microservice which provides a set of REST APIs to set/clear/get configurations store for a given service/user and manages service stored information. These microservices will use an Oracle database to store the information needed.

The Apache server is responsible for exposing the images used by the M-Pesa App and also the M-Pesa service websites uploaded in the backoffice to the internet. The M-Pesa services websites will be deployed in a mounted file system accessible to both the apache webserver and the service builder back-end who will handle the deployment.

Finally, M-Pesa backoffice is responsible for exposing a interface for Administrators to manage the services creation, versioning and lifecycle. It will connect to the Service Manager back-end through a set of REST APIs.

5.2 - Generic request flow

In figure 7 an overview of a request from the service to the the micro service is presented. All requests sent from the web application are proxied by the service adapter to ensure that the request is valid. The service adapter will validate the service routing configuration of the specific web application, along with its permissions for sharing user-specific data and, if no conflicts are found, it will perform the request on behalf of the web application.

The successful response to be sent back to the web application will be extracted from the response obtained from the service adapter and composed into a JSON document.

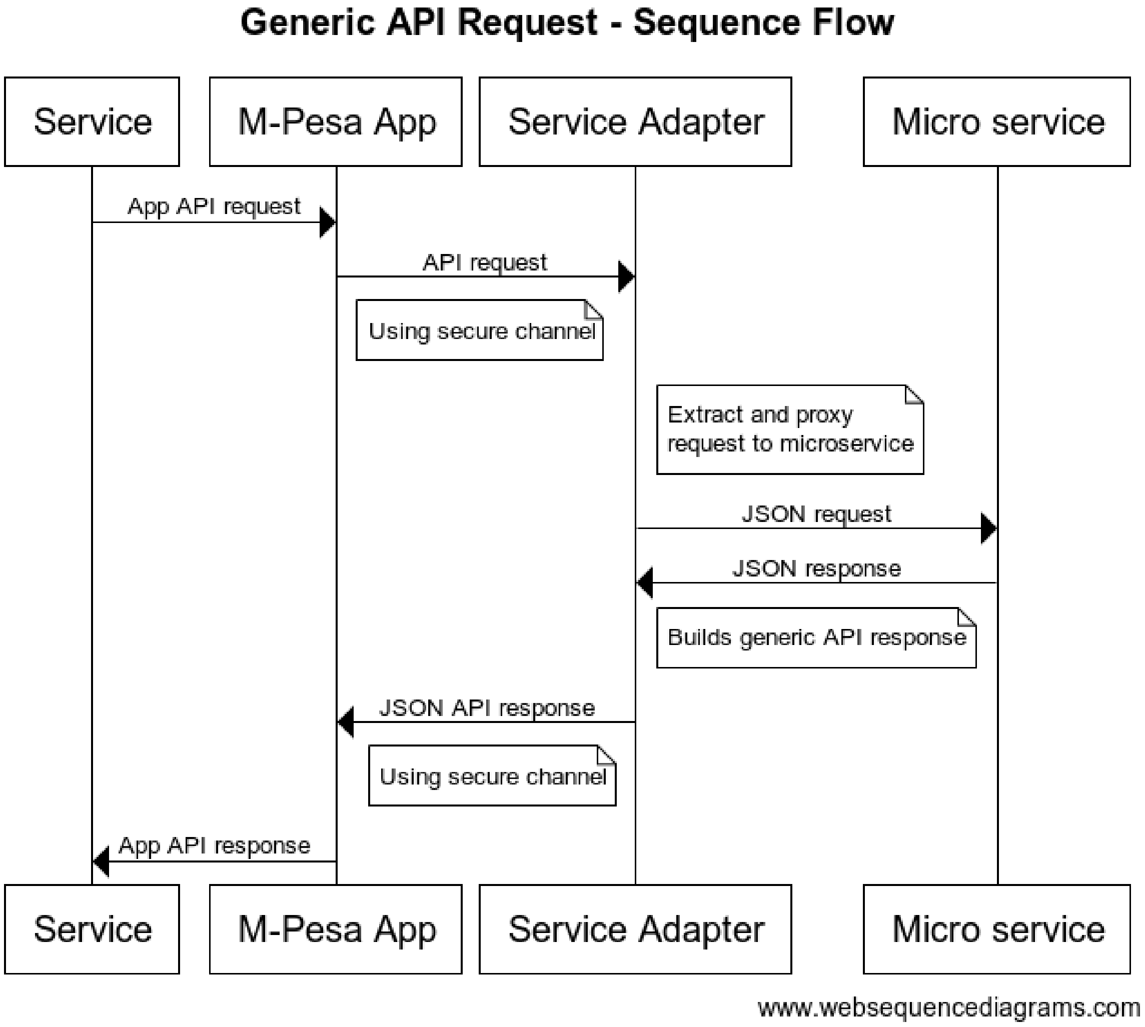


Figure 7: Generic Request flow

5.3 - Technologies

The main criterion used for the choice of technologies for the project were ones that WIT already had experienced professionals to guarantee project maintenance. Another criterion was the benefit of each option given by WIT, that was then analysed by the intern. The only restriction by WIT was that the back end had to be implemented in JAVA using the Spring boot framework.

5.3.1 - Front-End

For the front-end, the intern was given two choices, Angular and ReactJS. After looking at both options the choice was ReactJS, a Javascript library created and maintained by Facebook, since it is considerably easier to learn than Angular (Javascript framework created and maintained by Google), while also having a better performance in terms of rendering[15]. Another reason was that the project the intern is integrated has experienced developers in ReactJS that can help the intern learn the technology and in the developing phase.

5.3.2 - Back-End

For the implementation of the micro service the intern had the restriction of having to use JAVA and spring boot which is a framework that makes it easy to create stand-alone production-grade Spring based Applications with an embedded servlet container [16]. In this case the embedded servlet container used will be Undertow, since it has better performance and better memory usage. than the Tomcat, the other one taken into consideration [17].

For the database, the first decision was to decide between a relational SQL and Non-Relational NoSQL. When analysing the requirements, it was clear that the database model wasn't going to be very complex and there wouldn't be a need to save lots of information so the choice was relational SQL since Non-Relation NoSQL is a better choice when dealing with huge amount of data and with complex database models[18]. Within relational databases the option was between Oracle and PostgreSQL, the ones used by WIT. PostgreSQL was chosen to serve the micro service to be implemented. PostgreSQL database is open-source and object-relational database management system whereas Oracle is a commercial relational database management system. Oracle would be more useful if the service was more complex but since it is for a single micro service, PostgreSQL is more than enough, as it supports all the features needed such as Create, Read, Update, and Delete (CRUD) operations and indexation[19].

5.4 - Final Overview

The architecture here defined was designed to assure all the requirements gathered in the previous section. Moreover, both the design and the technologies are chosen had in mind the system requirements. Therefore, to assure the system was implemented as it was intended, the following measures were taken to assure the non-functional requirements:

- **Usability** - For the development of the web application, design guidelines were used to develop a consistent and with the best practices around web development. Moreover, the chosen technology, ReactJS, encourages the use of flexible and reusable components along with the application, promoting a more consistent User Interface (UI).
- **Security** - The crowdfunding service inherits the authentication system(PIN) of the android app. Moreover, the webview in which the service will run is sandboxed, all HTTP/HTTPS traffic is blocked as well as AJAX requests. Requests coming from the web application are proxied and then routed through a secure channel by a another component to the respective microservice.
- **Maintainability** - The services are built using a microservices approach, meaning all the services are decoupled from each other, and each has a distinct purpose on the system. With this, developers can change components without affecting the functioning of the remaining services. Moreover, with the usage of the service adapter to route incoming requests, the swap of defective or legacy components becomes a more simple task and has less impact on the remaining system.

Chapter 6

Development

The implementation was dividing in 3 parts: front-end, back-end, integration. This chapter describes the implementation details of the front-end which began in the first semester.

6.1 - Front-end

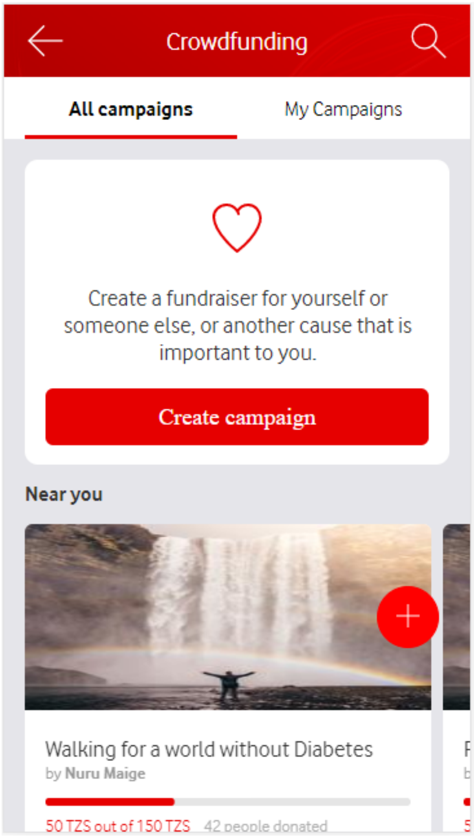
As stated before, ReactJS was the technology chosen. It is a JavaScript library for building user interfaces and it allows to create web applications as a single page applications. Single-page applications are different from the more traditional multi-page applications that are everywhere. The biggest difference is that navigating a single-page application doesn't involve going to an entirely new page. It is just one web page which then loads all the other content using JavaScript[20].

Since the goal was to display this mobile web application inside a WebView container, a single page application made more sense as the resources ("HTML" and Cascading Style Sheets (CSS)) are only loaded once at the beginning and after that only data is transmitted back and forth.

This first iteration of the front-end development was focused on the visual aspect of the app and the flows between screens while the API requests and data management within the react application were explored in the second semester after the back-end was done.

6.1.1 - User Interface

After the process of creating mock ups and the approval by the advisor the intern started implementing a front-end prototype in ReactJS using the mock ups and design guidelines defined by WIT design team, to a more simple and consistent interface. Below in figure 8 it is displayed the opening screen.



Create a fundraiser for yourself or someone else, or another cause that is important to you.

Walking for a world without Diabetes
by Nuru Maige
50 TZS out of 150 TZS 42 people donated

Figure 8: Front-end prototype - Opening screen

The other prototype screens created can be seen in the Annexes.

To create the react application, JSX (React syntax that allows to put HTML into JavaScript) is used and CSS to style the components created. React allows to create visual components and re-utilize them. The intern divided the views defined in the mock ups into components and created most of them by scratch including the CSS. WIT also provided the fonts to be used and a few components that were already made to other projects to facilitate the work of the intern.

This was the first iteration of the implementation of the front-end. In the second semester the user interface continued to be improved. Logic aspects like API requests and state management were also addressed in the second semester. During the integration phase there were changes to the scale of the components made since the area available in the screen in the webview container is smaller than the one used for the creation of this prototype.

6.2 - Back end

As previously mentioned, it was necessary to create an REST API that would allow the storage and management of all information related to the crowdfunding service. For that, a restful web service was created in Java. In this case specifically the intern used the spring boot framework to set up a service to answer the web application's needs.

6.2.1 - Microservice - REST API

REST is an architectural style for developing web services. It is a popular style to develop APIs due to its simplicity, flexibility, and the fact that uses the already standard HTTP protocols to accomplish its purpose. It allows seamless communication between systems, due to being data-independent, meaning that the exchange of resources is not tied to a format, unlike other popular specifications such as SOAP.

The framework used, gives us the means to build a system that[21]:

- is client-server base, by separating the user interface concerns from the data storage concerns, we improve the portability of the user interface across multiple platforms and improve scalability by simplifying the server components.
- is stateless, meaning that operations are independent of each other, and each call should contain the required data to complete successfully.

By using springboot framework the developers can pack these Boot applications into a small unit. The framework is then capable of generating the microservice in a self-contained server. In this case, the intern used Undertow as the server.

6.2.2 - Database

This section presents the entity–relationship model developed for the application and also a brief description of the entities represented in figure 9. The entity–relationship model has 5 entities, as can be seen in the relational model in figure 9 below:

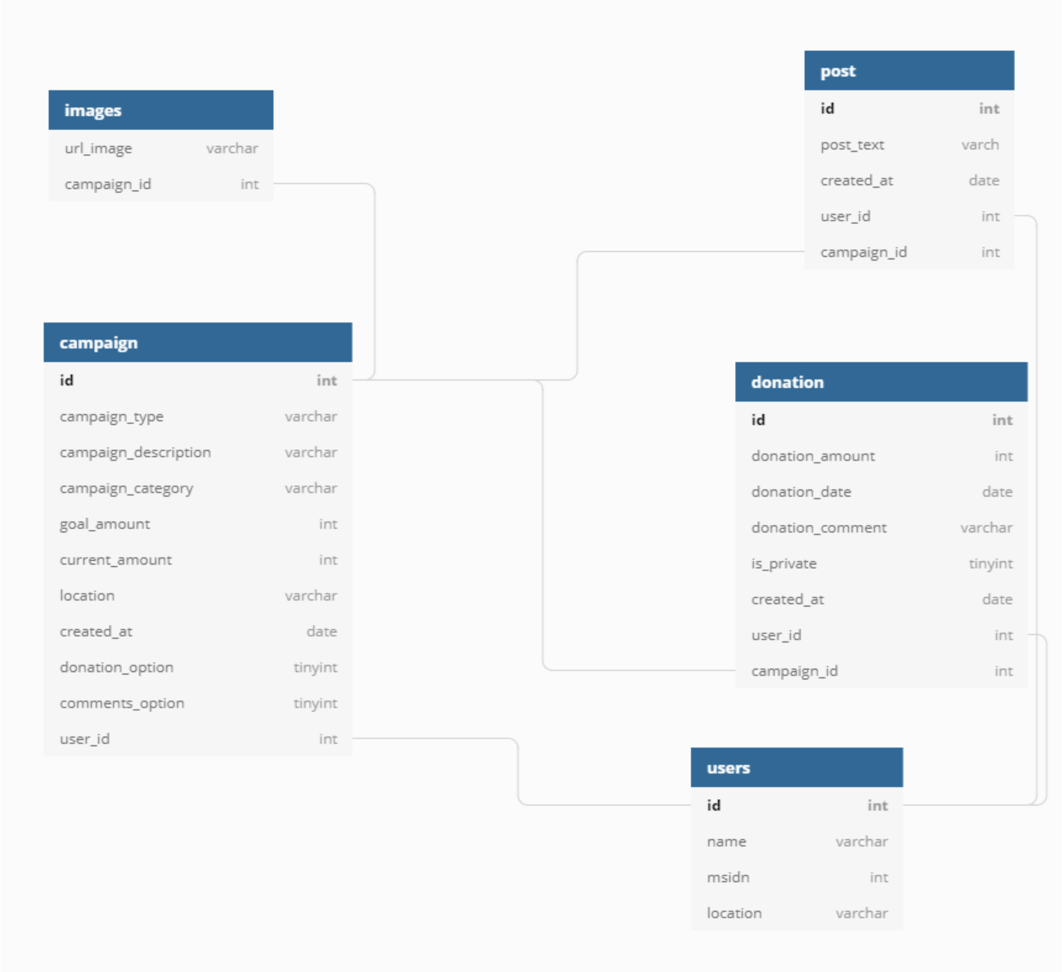


Figure 9: Entity Relationship Diagram

6.2.3 - Entities Description

- **User**: Saves information about the user such as name and number associated to the mobile phone (Mobile Station International Subscriber Directory Number (MSISDN)) that will be utilized establish ownership of the remaining entities.
- **Campaign**: Saves all the information about the campaign
- **Post**: Saves information about the posts
- **Donation**: Saves information about donations
- **Image**: Saves Uniform Resource Locator (URL) of images

6.3 - M-Pesa Integration

This development phase involved adding 4 features to the crowdfunding web application: campaign sharing, location sharing, upload image and payment via M-Pesa. This phase can be split in two steps, first the changes made to the service layer API to expose the 4 features mentioned above, and the creation of a set of functions in the React app that allow the communication with the Android layer API.

6.3.1 - Android layer API

The campaign sharing, native location sharing and upload image features, were implement by the intern in the service API layer while the payment API was already implemented. Since the intern had no experience with Kotlin, ”an OSS statically typed programming language that targets the JVM, Android, JavaScript and Native, developed by JetBrains”[22], he had the accompaniment of an android developer during the implementation. The implementation of this 3 features included the study of android documentation and understanding the existing code.

In a interface, already created by WIT developers were added three methods, one for each feature that allows to exposes those same methods to JavaScript code[23]. It’s this interface that allows the communication between the android APIs and the crowdfunding web application.

The implementation of each feature was done as if it was for a normal android application. The intern had to implement the management of the authorizations related to phone location and to access the mobile phone file system to upload pictures. For phone location it was used a Google API, FusedLocationProviderClient to retrieve the latitude and longitude[24]. Then with that information it was used a geocoder to transforming a (latitude, longitude) coordinate into an address[25]. The difference was that it was needed to return a response to the web application. For that the intern used a function previously implemented by WIT android developers that allows to sent data to a callback in the web application.

As for the feature of sharing through social networks since it was a proof a concept and the objective was to send only text, it was straight forward to develop. It only requires to execute an action, in this case ”ACTION_SEND” and the native share menu of the phone appears. Then the users simply chooses the application and a person to share a link of a campaign.

6.3.2 - React API functions

It was in this step that the last changes to the web application code were made, to execute this functions with the appropriate data and reacting to the respective response. For this specific type of of API calls it was needed to use asynchronous requests. The way to do it in JavaScript was using Promises. Promises is a JavaScript object that works as ”a proxy for a value not necessarily known when the promise is created. It allows to associate handlers with an asynchronous action’s eventual success value or failure reason. This lets asynchronous methods return values like synchronous methods, instead of immediately returning the final value, the asynchronous method returns a promise to supply the value at some point in the future”[26]. For this case in particular it was also necessary to create specific callback functions to process the responses coming from the Android API layer.

After this functions were defined, it was just invoking them in the corresponding buttons previously defined.

6.4 - Demonstration Environment

Demonstration environment refers to the setup necessary to run the final prototype. Since part of the M-Pesa back-end that would manage and deploy the services web application were still in development when the prototype was ready, a few changes had to be made to the general architecture. Instead of having the web application deployment controlled by the back-end, it was managed by the intern. The web application as defined in the architecture was running in an apache server in a machine running in WIT network. Since the M-Pesa application is connected to the internet, all the components had also to be available through the internet. For this reason, WIT provided a public address that was then connected to the apache server running the web application.

The crowdfunding back-end, that exposes an REST API was running as a standalone application in the same machine in WIT network alongside the database. Another public address was provided by WIT so the API could be used through the crowdfunding service running inside the M-Pesa application.

This configuration was a learning process as the intern had no experience in configuring apache servers or react application for production. Finally, after all obstacles have been overcome, the intern moved to the functional testing of the prototype.

6.5 - Testing

Tests are also a very important component of a software project, since they allow to check software aspects such as functionality, code quality and usability. The tests focused in this project were functional tests to determine if the prototype fulfilled all the requirements.

6.5.1 - Functional testing

Functional testing verifies that each requirement operates according to the specifications. This type of testing is not concerned with how each feature was implemented, but simply on its behavior. Before each test, a scenario is assumed, with predetermined conditions, and afterward, an input or an action is performed. The test succeeds if the output matches the one specified beforehand [27].

The functional testing done within this internship had the acceptance criteria of each user story in consideration and assessed whether the requirement had been implemented as expected. For each scenario, the given action was performed, always following what was previously defined in each one. The results of the tests can be found in the Annexes C, where each has the scenario tested, as well as the corresponding user story.

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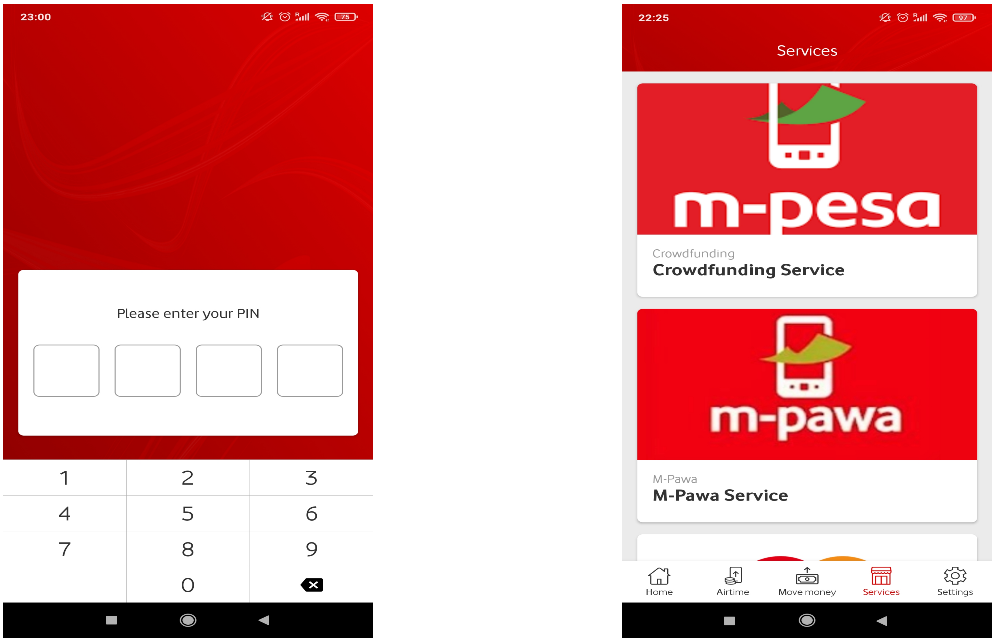
Chapter 7

Final Prototype

In this chapter, the prototype developed through the internship's duration is presented. The interfaces here shown are the final implementation of the prototyped system.

As mentioned before, the crowdfunding service runs within the M-Pesa application. For the user to access the crowdfunding service, he will have to open the M-Pesa application, authenticate by inserting his personal PIN, select the services tab and then choose the crowdfunding service.



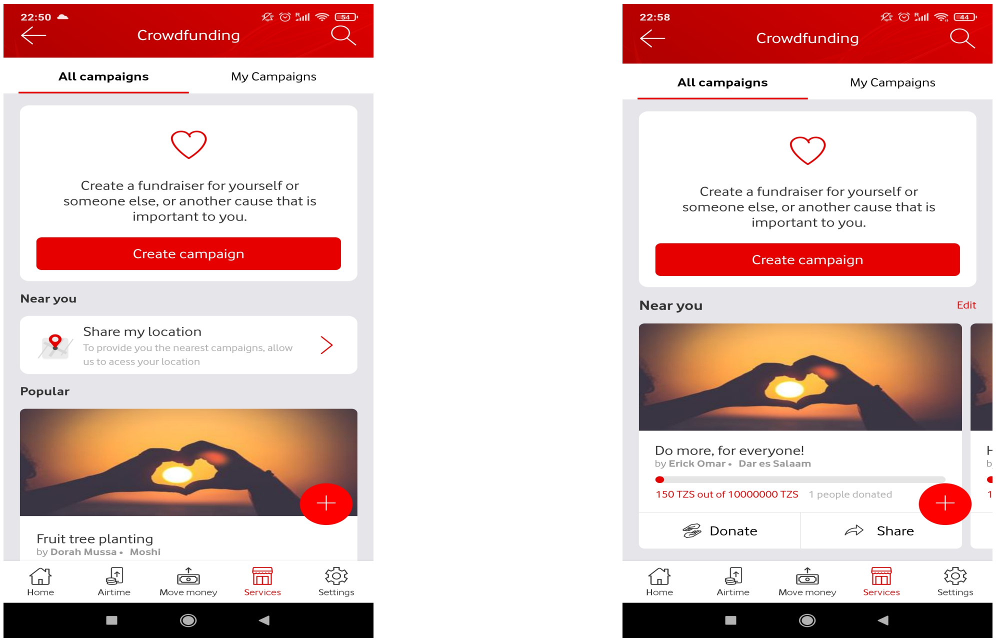
(a) M-Pesa account authentication

(b) M-Pesa Services

Figure 10: M-Pesa android application

One of the first things to mention, is that the user does not need to register. When entering the crowdfunding service an account is automatically created in the crowdfunding database based on the data (Name, MSISDN) of the user M-Pesa account.

When entering the service the user is presented with the initial page composed by ”Create New campaign” card, a section dedicated to campaigns near the user location and a third section for popular campaigns.


Create a fundraiser for yourself or someone else, or another cause that is important to you.

Share my location
To provide you the nearest campaigns, allow us to acess your location

Fruit tree planting
by Dorah Mussa • Moshi

Create a fundraiser for yourself or someone else, or another cause that is important to you.

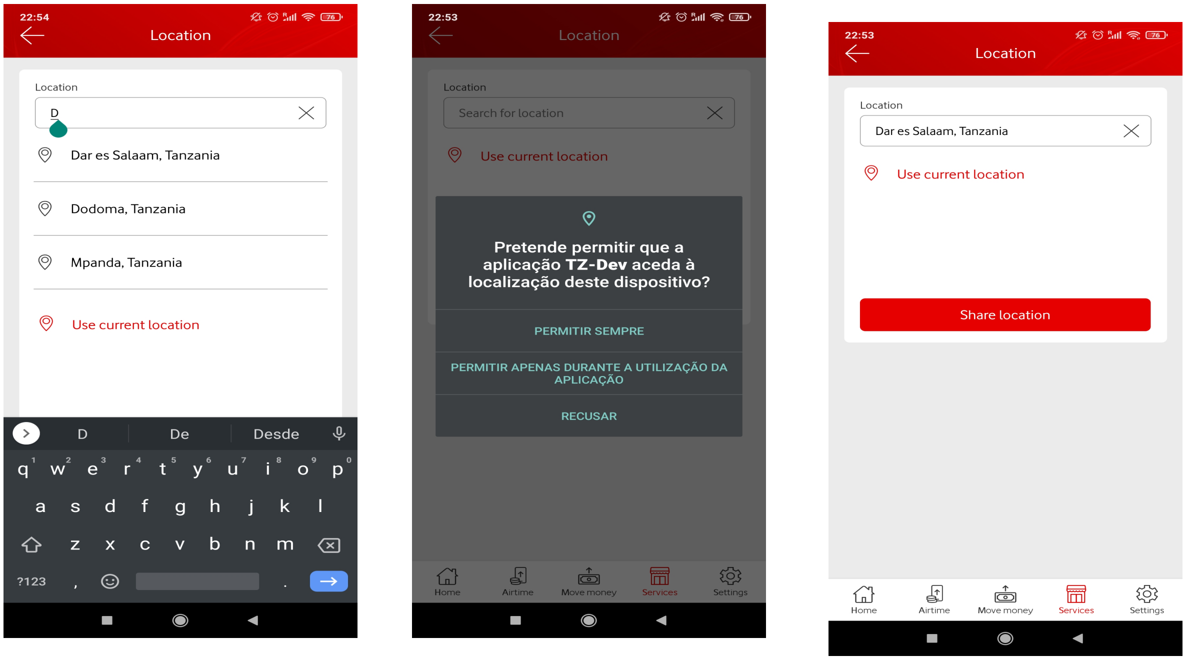
Do more, for everyone!
by Erick Omar • Dar es Salaam
150 TZS out of 10000000 TZS 1 people donated

(a) Main page before sharing location

(b) Main page after sharing location

Figure 11: Contrast of the main page before and after sharing location

If the user decides to share his location by pressing the ”Share my location” card presented, a screen will be displayed that allows the user to choose one from a list of locations or use the current location of the smartphone. In the case of choosing the current location and not having yet given the M-Pesa app to access his location, a native authorization pop-up will prompt as shown in Figure 12b.



Pretende permitir que a aplicação **TZ-Dev** aceda à localização deste dispositivo?

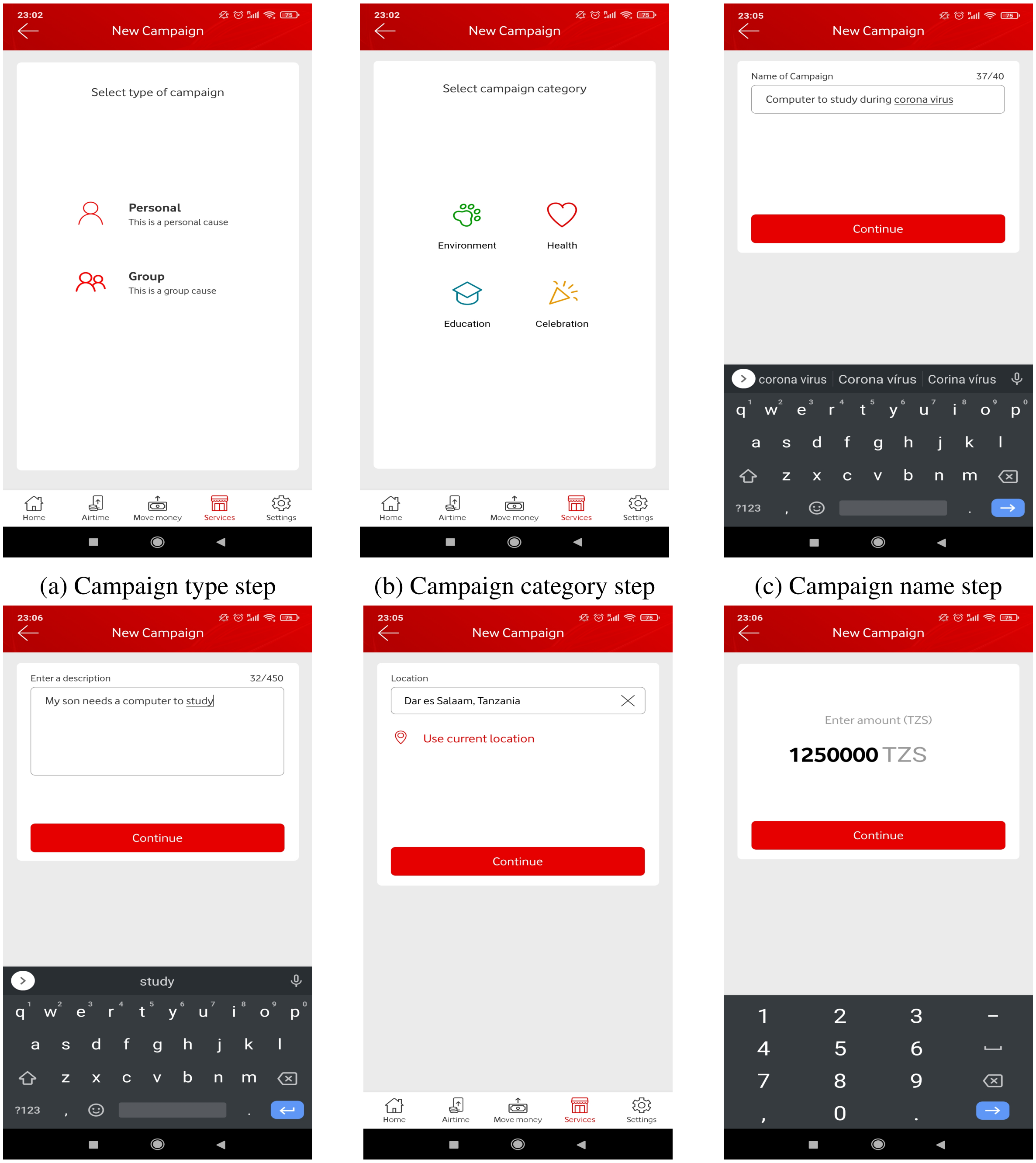
(a) Selecting location from the list

(b) Share location authorization pop-up

(c) Location selected

Figure 12: Sharing Location Screen

The process of creating campaigns by filling out forms can be tedious. To provide a better experience, the forms on the web application were deconstructed into single steps. The creation of a new campaign is made in seven steps, as shown in figure 13. It begins by asking the type (personal or group) and category (Environment, Health, Education or Celebration). The next two steps are the name and description of the campaign, followed by the location. The user is allowed to choose one from a list of locations or use the current location of the smartphone that works the same way as in share location feature explained before. After that, the goal amount is asked.



Computer to study during corona virus

My son needs a computer to study

Dar es Salaam, Tanzania

1250000 TZS

(a) Campaign type step

(b) Campaign category step

(c) Campaign name step

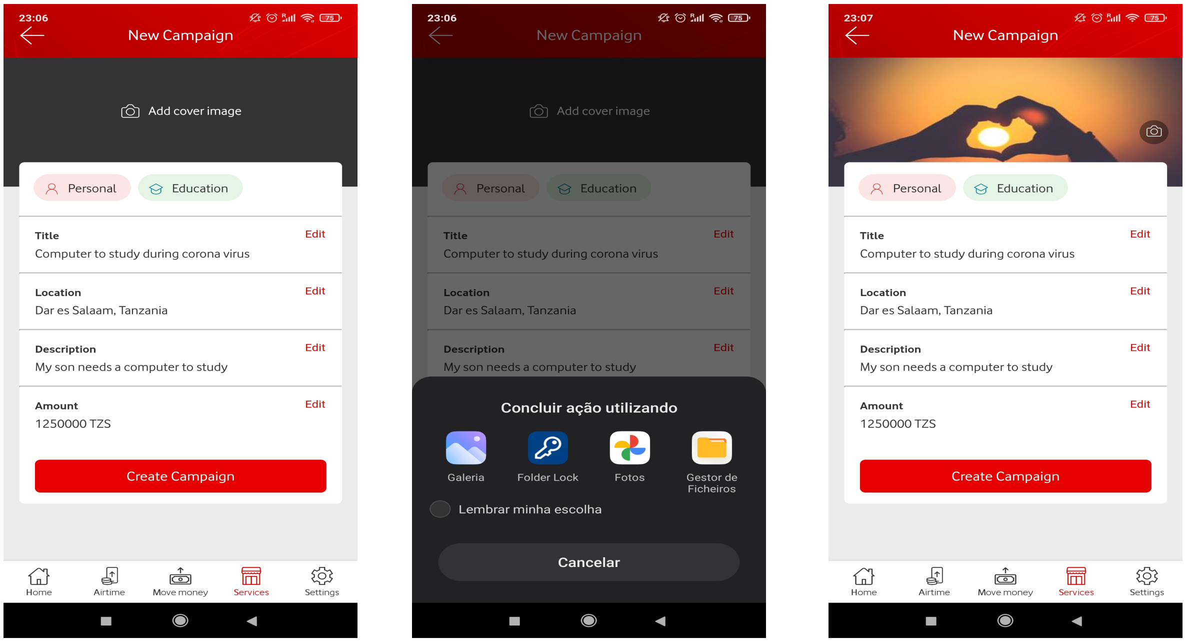
(d) Campaign description step

(e) Campaign location step

(f) Campaign Amount step

Figure 13: Campaign creation steps

In the last step the user can upload an image from the smartphone gallery as shown in Figure 14, confirm all the submitted details of the campaign and proceed to its creation.



Title
Computer to study during corona virus

Location
Dar es Salaam, Tanzania

Description
My son needs a computer to study

Amount
1250000 TZS

Title
Computer to study during corona virus

Location
Dar es Salaam, Tanzania

Description
My son needs a computer to study

Concluir ação utilizando

○ Lembrar minha escolha

Title
Computer to study during corona virus

Location
Dar es Salaam, Tanzania

Description
My son needs a computer to study

Amount
1250000 TZS

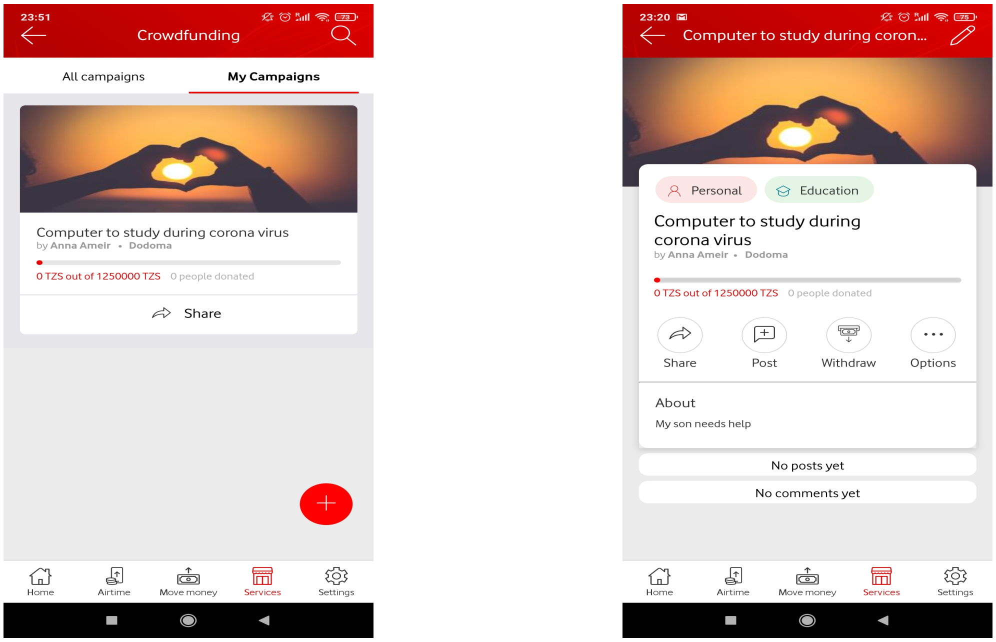
(a) Campaign summary with option to upload image

(b) Image upload using android upload feature

(c) Campaign summary with uploaded image

Figure 14: Campaign creation steps

After creating a campaign, the user can then access it through the ”My campaigns” tab in the main page as the figure 15 illustrates.



Computer to study during corona virus
by Anna Ameir • Dodoma
0 TZS out of 1250000 TZS 0 people donated

Computer to study during corona virus
by Anna Ameir • Dodoma
0 TZS out of 1250000 TZS 0 people donated

About
My son needs help

No posts yet

No comments yet

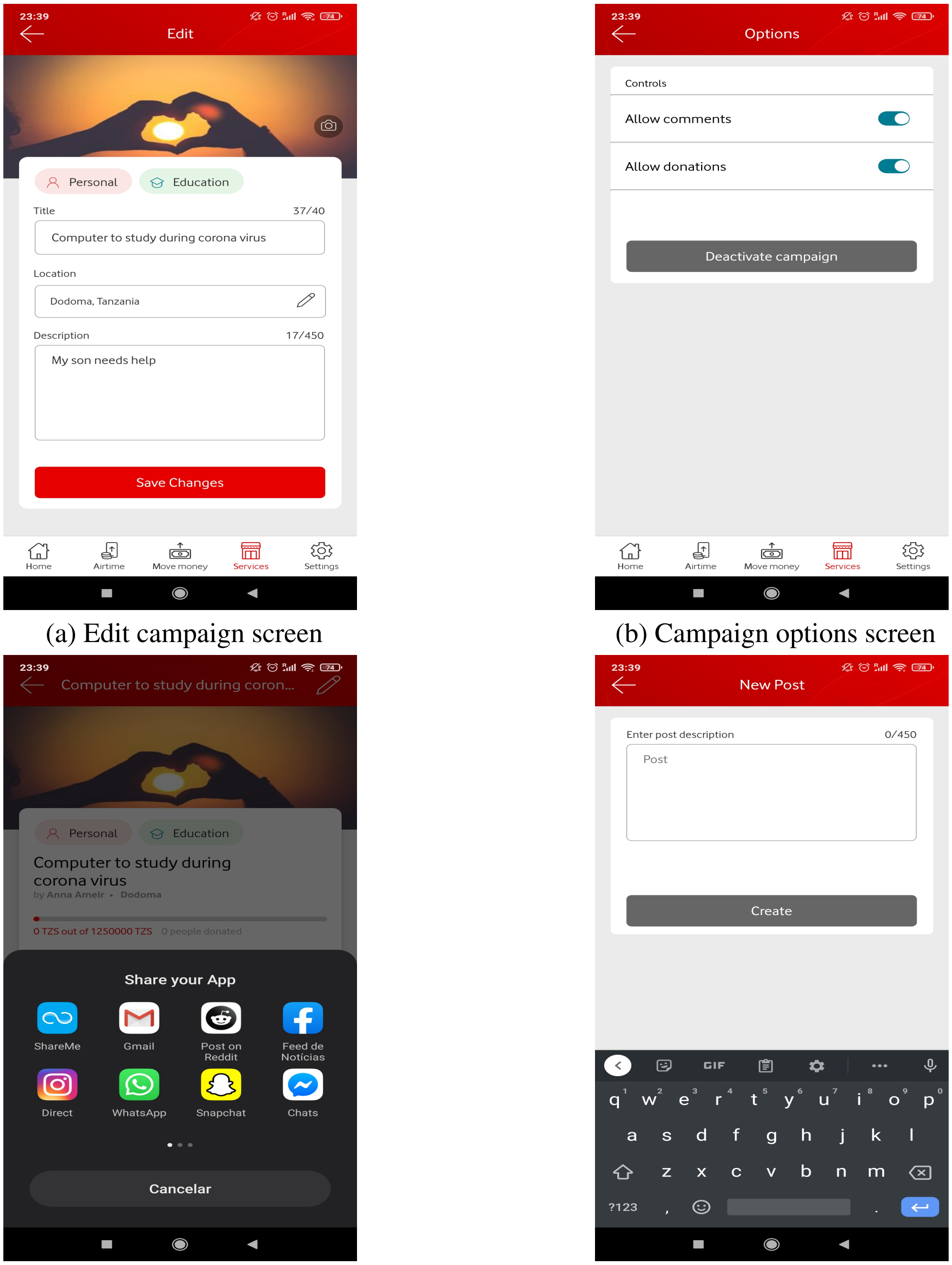
(a) All campaigns created by the user

(b) Campaign page - creator view

Figure 15: Campaign creator campaign

The figure 15b shows a campaign page from the perspective of the campaign creator. Besides showing all the information about the campaign, he has 5 actions at his disposal. The first is the Edit campaign, where he can edit some campaign details (Name, description and image),then option to share a campaign link through the available apps in his smartphone, change campaign options (e.g. Deactivate comment) and can also add a post (update) to the campaign. The withdraw options wasn't implemented.

In figure 16 it is presented each option screen to better understand what each option allows the user to do.



Title 37/40
Computer to study during corona virus

Location
Dodoma, Tanzania

Description 17/450
My son needs help

Allow comments ☑
Allow donations ☑

Computer to study during coron...

Computer to study during corona virus
by Anna Ameir • Dodoma
0 TZS out of 1250000 TZS 0 people donated

Enter post description 0/450
Post

(a) Edit campaign screen

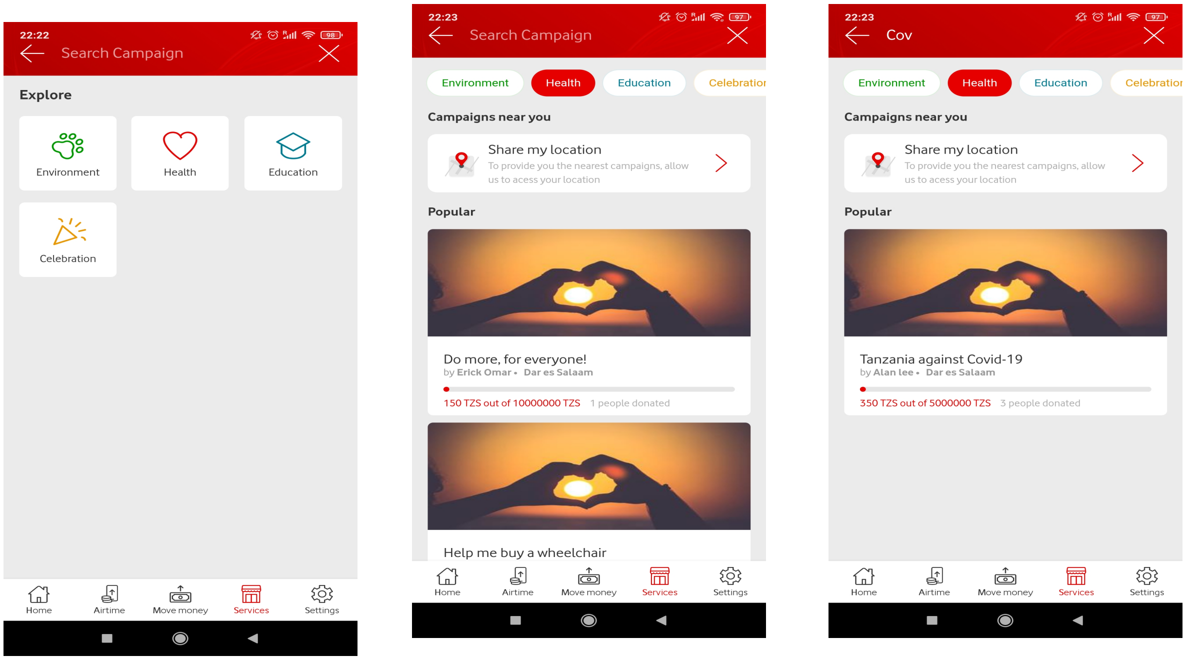
(b) Campaign options screen

(c) Share campaign

(d) Creating a post screen

Figure 16: Campaign management actions

The users can search campaigns by keyword using the search bar and by category as shown in the next figure 21. If the user has already given his location, he will be given 2 listings, campaign near his location and popular ones filtered by keyword and/or category.



Share my location
To provide you the nearest campaigns, allow us to acess your location

Do more, for everyone!
by Erick Omar • Dar es Salaam
150 TZS out of 10000000 TZS 1 people donated

Help me buy a wheelchair

Share my location
To provide you the nearest campaigns, allow us to acess your location

Tanzania against Covid-19
by Alan lee • Dar es Salaam
350 TZS out of 5000000 TZS 3 people donated

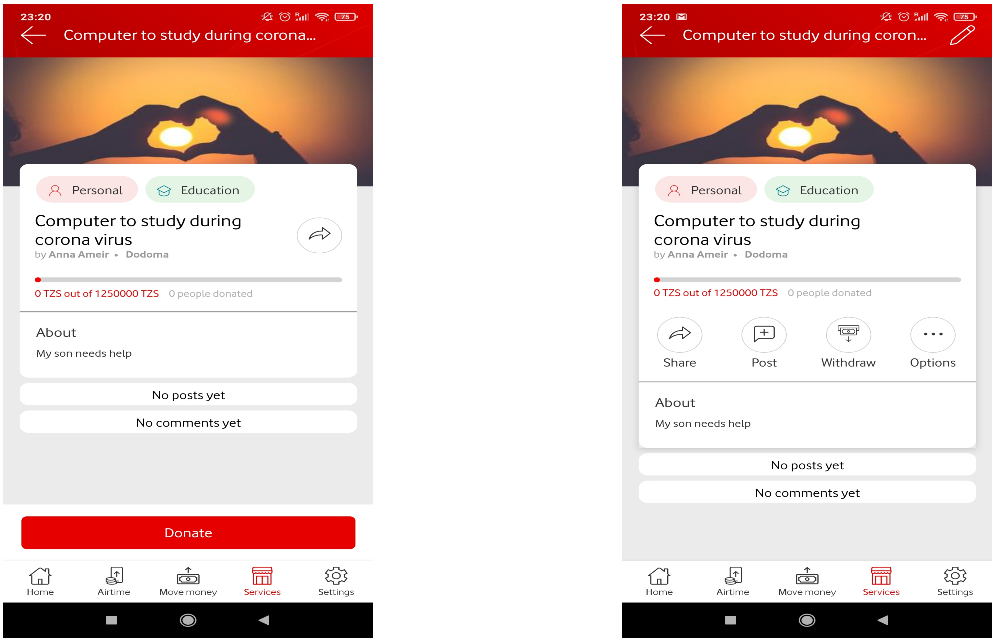
(a) Search initial page

(b) Filtering campaigns by category

(c) Filtering campaigns by keyword and category

Figure 17: Campaign Search

After a user finds a campaign that catches his attention, he can open it and find out a little more information about it as shown in figure 18a.



23:20

Computer to study during corona...

Computer to study during corona virus

by Anna Ameir • Dodoma

0 TZS out of 1250000 TZS 0 people donated

About

My son needs help

No posts yet

No comments yet

(a) Visitor view of the campaign page

23:20

Computer to study during coron...

Computer to study during corona virus

by Anna Ameir • Dodoma

0 TZS out of 1250000 TZS 0 people donated

About

My son needs help

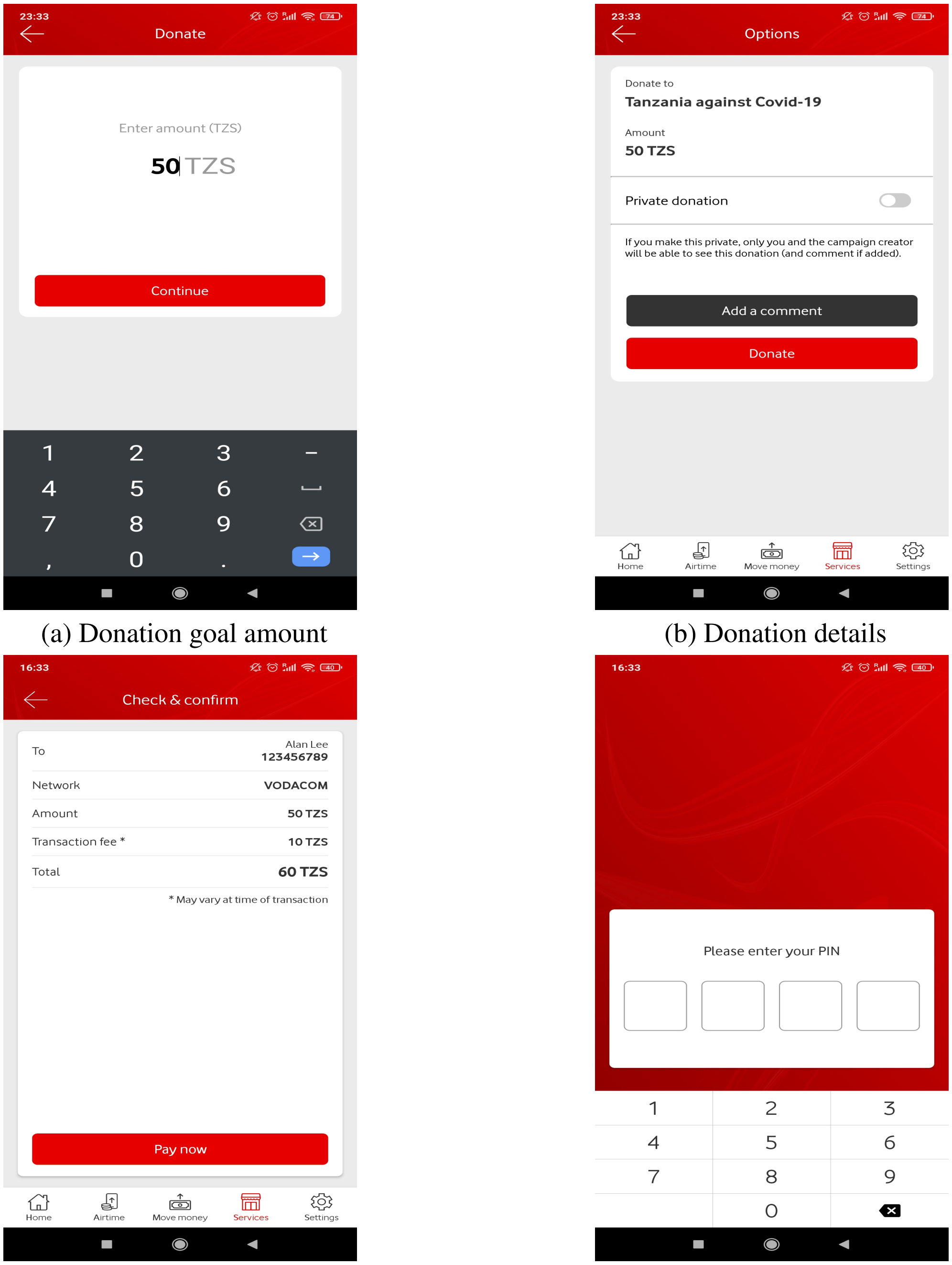
No posts yet

No comments yet

(b) Owner view of the campaign page

Figure 18: Contrast of the visitor and owner campaign page

If the user chooses to donate he to go through 2 main steps. First enter the amount with the possibility of leaving a comment to the campaign creator. Then the second step, the payment, he is redirected to the WIT M-Pesa app payment screen as it can be seen in 19c where he can confirm the payment information. By pressing Pay now, the user has then to confirm the transaction by inserting his PIN. When the payment is processed, he is redirected back to the campaign page in the crowdfunding service.



Enter amount (TZS)

50 TZS

(a) Donation goal amount

Donate to

Tanzania against Covid-19

Amount

50 TZS

Private donation

If you make this private, only you and the campaign creator will be able to see this donation (and comment if added).

(b) Donation details

To	Alan Lee 123456789
Network	VODACOM
Amount	50 TZS
Transaction fee *	10 TZS
Total	60 TZS

* May vary at time of transaction

(c) M-Pesa transaction summary

Please enter your PIN

(d) M-Pesa PIN confirmation

Figure 19: Donation steps

Chapter 8

Conclusions

This chapter is divided into 3 sections: the first presents an overview of the experience acquired. Secondly, a short reflection on what could be done to improve this project in the future. Finally, the author's final considerations about the whole year and its result.

8.1 - Experience acquired

During the internship, the intern got acquainted with the front-end and back-end technologies. It was a good opportunity to learn more about the front-end world since he had close to no experience with ReactJS and CSS. The intern also had the opportunity to experiment the back-end framework, Spring Boot, that was used to implement the micro service. Although he had some experience in JAVA, the framework makes it easier to create stand-alone applications, such as the one he needed to implement.

In addition to this, when integrating the crowdfunding with the M-Pesa android application the intern had to study android documentation and implement android features to answer a requirements such as sharing location and uploading image for the campaign.

8.2 - Future Work

Although the product is not finished, it shows it has the potential to become a real product. It still needs a lot of development to be able to use it in a real-life situation, though it can be used to validate and demonstrate certain capabilities of the M-Pesa services as web applications.

One of the aspects that were not explored in the design of this prototype was fraud. Fraud in crowdfunding platforms is a known problem and a solution would be a solution would pass through a curatorship tool. This tool would be a platform used by administrators of the crowdfunding service to filter campaigns. In addition to this tool, implementing a feature for regular users to report suspicious campaigns, which would then be reviewed by an admin.

Moreover, although the crowdfunding service is implemented with web technologies (React) as it is, it cannot be used as a standalone app since the authentication system used is connected to the M-Pesa android application. Therefore, to expand the service to a browser the solution would be to create an authentication component independent of the M-Pesa.

8.3 - Final Considerations

Finally, it can be stated that the objectives of the project were achieved, namely the development of a web application, both the front-end and the back-end, and its integration with the M-Pesa android application. Like any project, this one also had its difficulties mainly in the of implementation of android features and its integration with the web application where it was necessary to get acquainted with asynchronous requests and android programming.

At a personal level, i gained new skills by contacting the professional world for the development of the project and was able to apply the training acquired throughout the course of Informatics Engineering. The whole process, starting in the definition of concept for crowdfunding service, the interaction with the design team, the implementation of all the requirements and then the integration with a professional android app was an enriching experience to become a better software developer.

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Annexes

Available documents in annex:

Annex A : Wireframe Mockups

Annex B : Front-end Screens

Annex C : Functional Tests

Annex A - Wireframes

Low fidelity wireframes

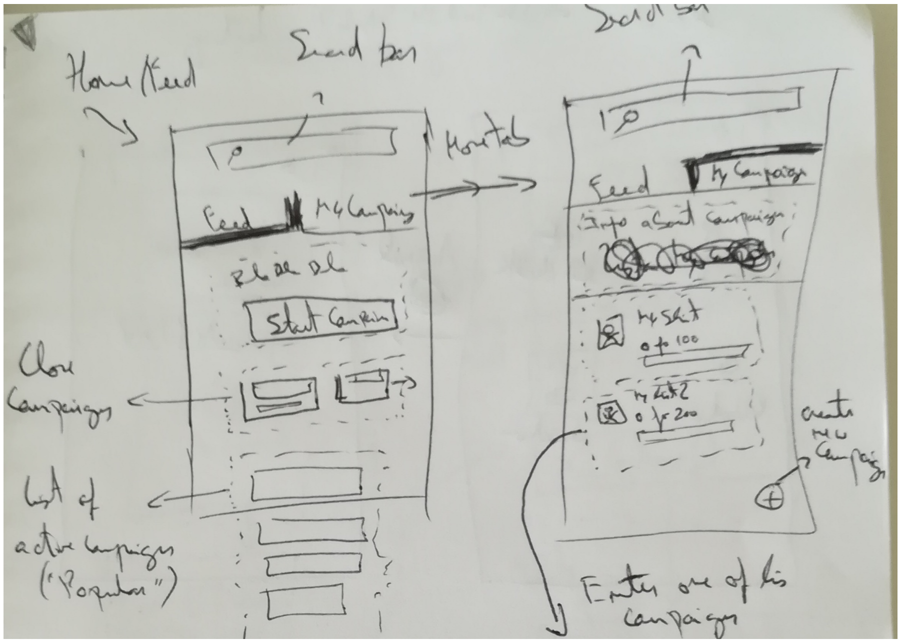


Figure 20: Feed and My campaign tab

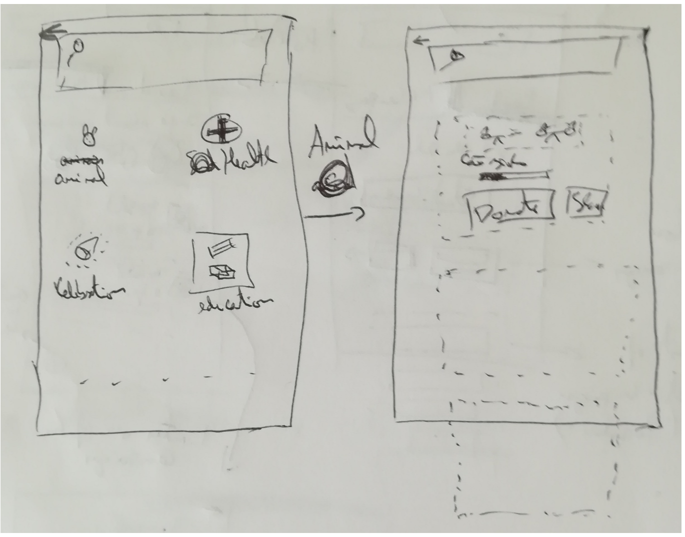


Figure 21: Search

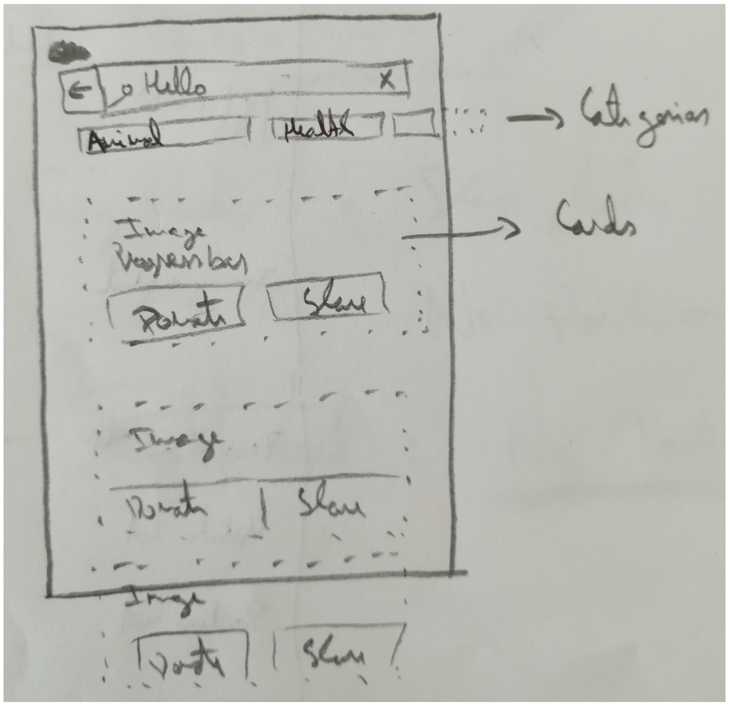


Figure 22: Search Listing - option 2

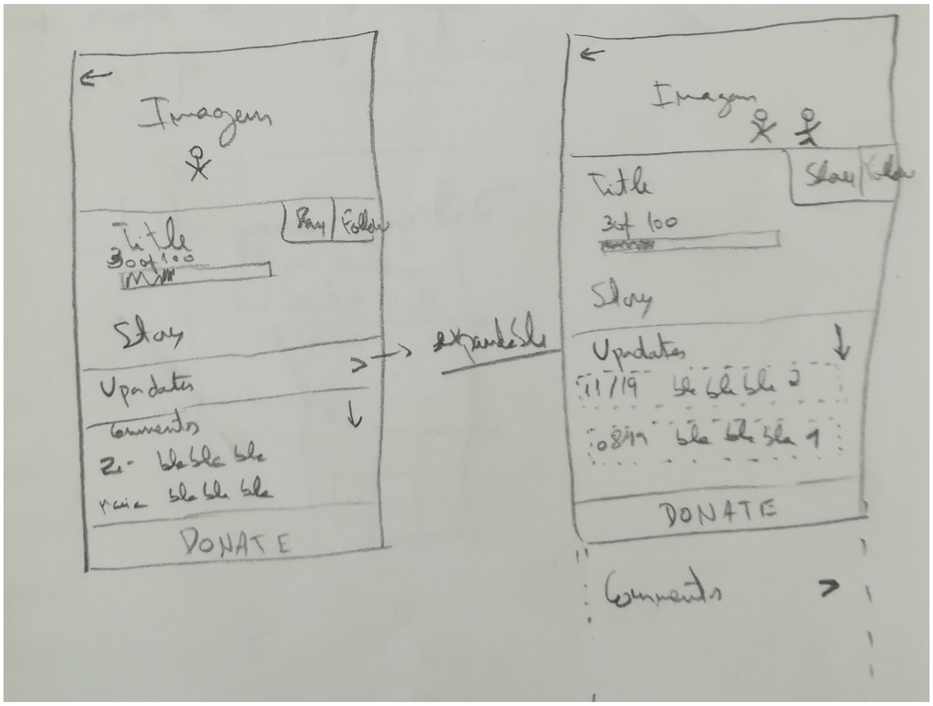


Figure 23: Campaign detail expandable comments/posts section - option 1

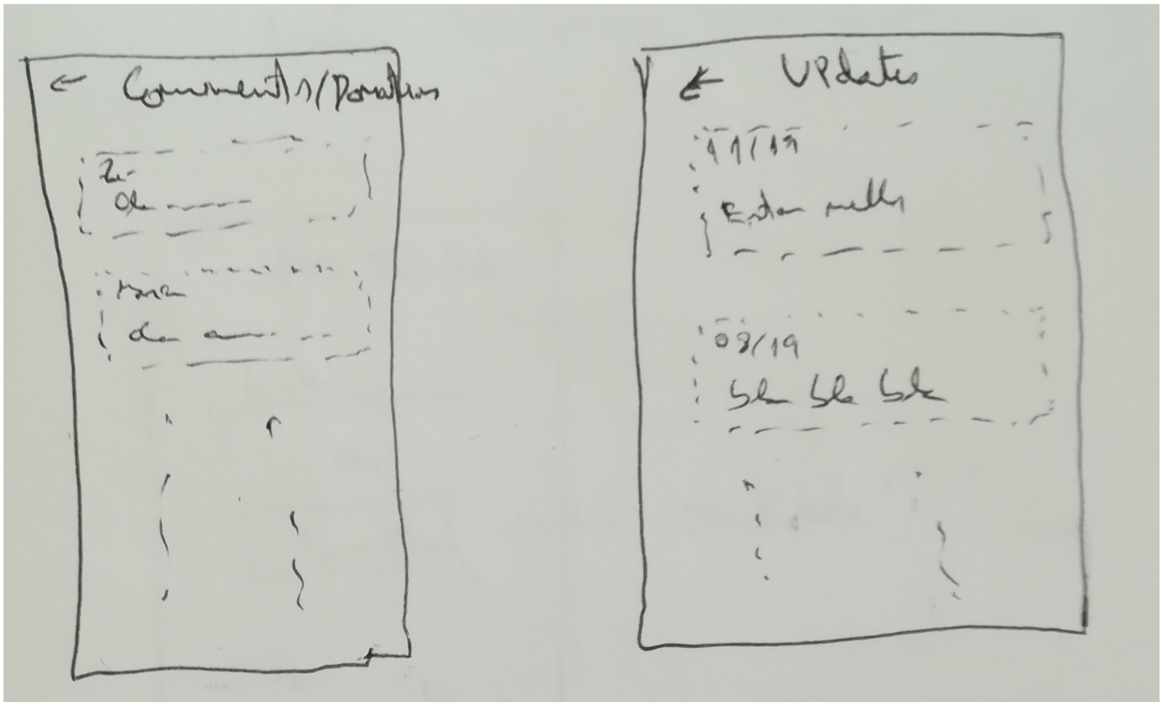
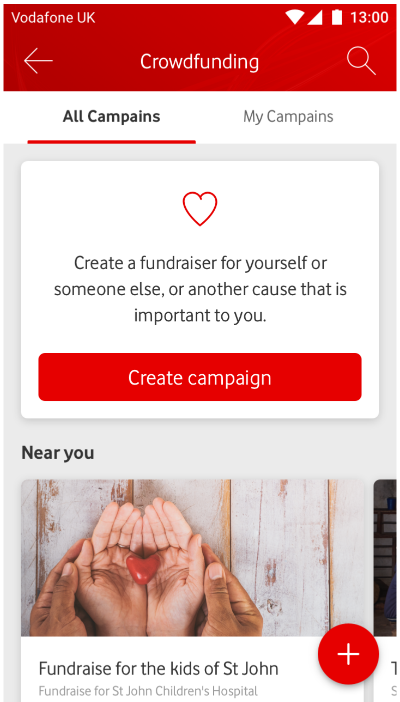


Figure 24: New page for comments/posts listing - option 2

High fidelity wireframes

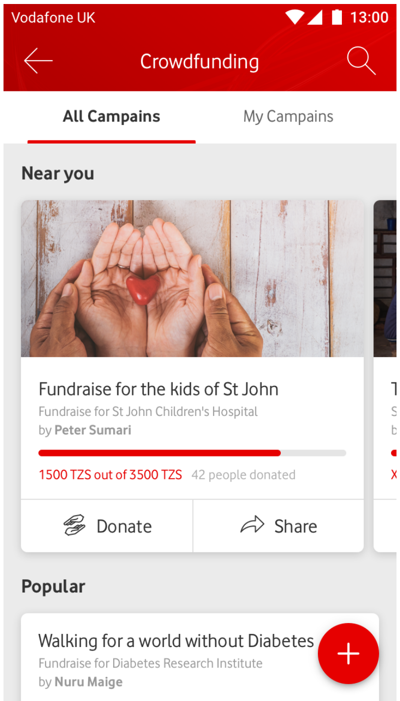


Create a fundraiser for yourself or someone else, or another cause that is important to you.

Fundraise for the kids of St John

Fundraise for St John Children's Hospital

Figure 25: Feed 1/2



Fundraise for the kids of St John

Fundraise for St John Children's Hospital

by **Peter Sumari**

1500 TZS out of 3500 TZS 42 people donated

Walking for a world without Diabetes

Fundraise for Diabetes Research Institute

by **Nuru Maige**

Figure 26: Feed 2/2

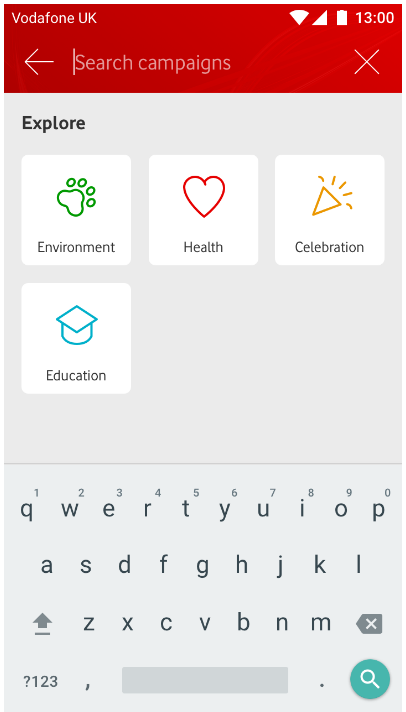
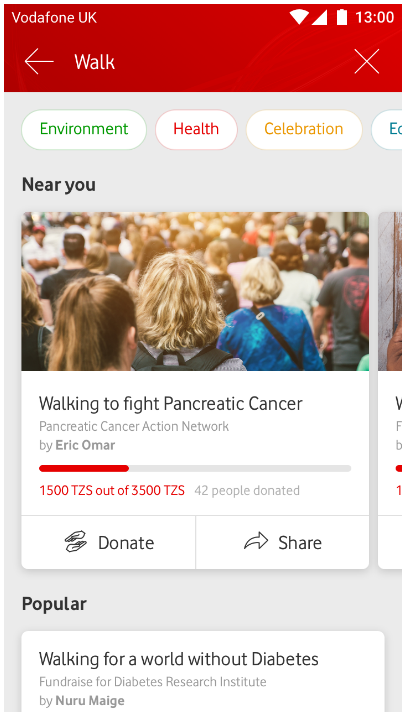


Figure 27: Search by categories



Walking to fight Pancreatic Cancer

Pancreatic Cancer Action Network

by **Eric Omar**

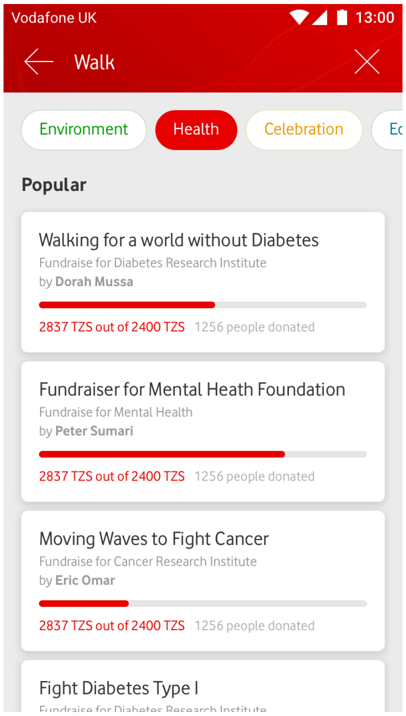
1500 TZS out of 3500 TZS 42 people donated

Walking for a world without Diabetes

Fundraise for Diabetes Research Institute

by **Nuru Maige**

Figure 28: Search results screen



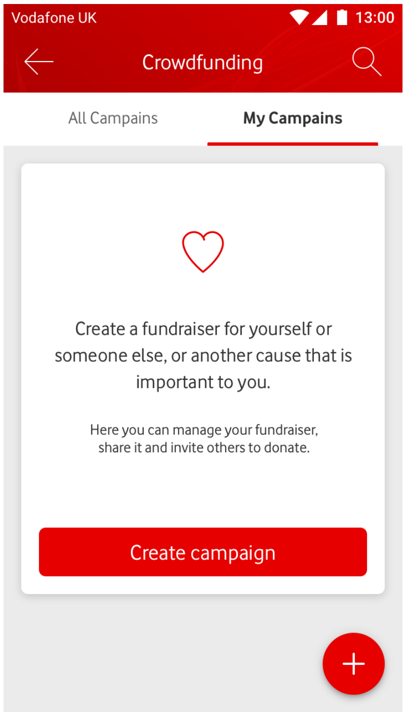
Walking for a world without Diabetes
Fundraise for Diabetes Research Institute
by Dorah Mussa
2837 TZS out of 2400 TZS 1256 people donated

Fundraiser for Mental Heath Foundation
Fundraise for Mental Health
by Peter Sumari
2837 TZS out of 2400 TZS 1256 people donated

Moving Waves to Fight Cancer
Fundraise for Cancer Research Institute
by Eric Omar
2837 TZS out of 2400 TZS 1256 people donated

Fight Diabetes Type I
Fundraise for Diabetes Research Institute

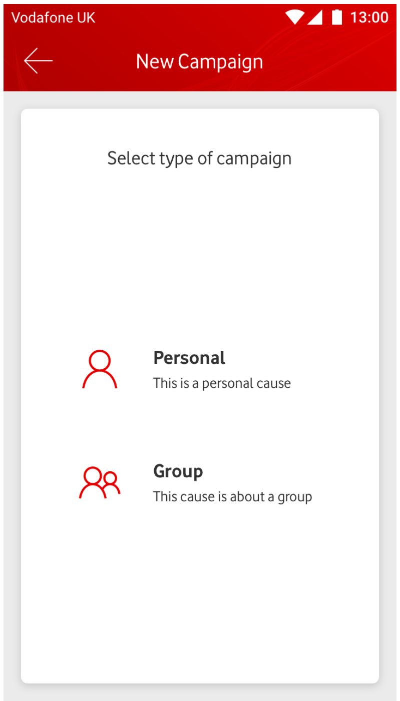
Figure 29: Search results filtered by category



Create a fundraiser for yourself or someone else, or another cause that is important to you.

Here you can manage your fundraiser, share it and invite others to donate.

Figure 30: My campaigns

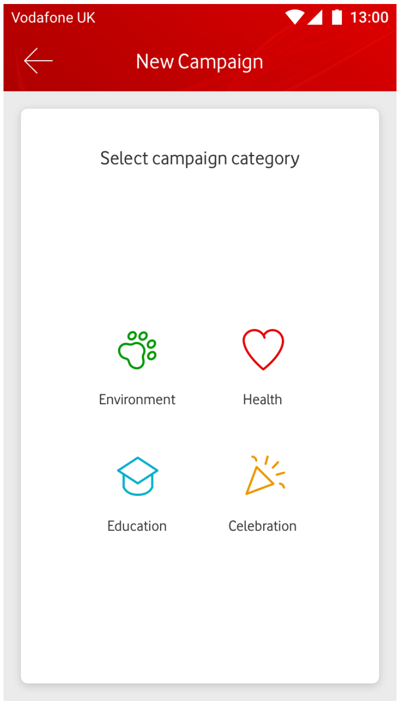


Select type of campaign

Personal
This is a personal cause

Group
This cause is about a group

Figure 31: New campaign - Choosing type



Select campaign category

Figure 32: New campaign - Choosing category

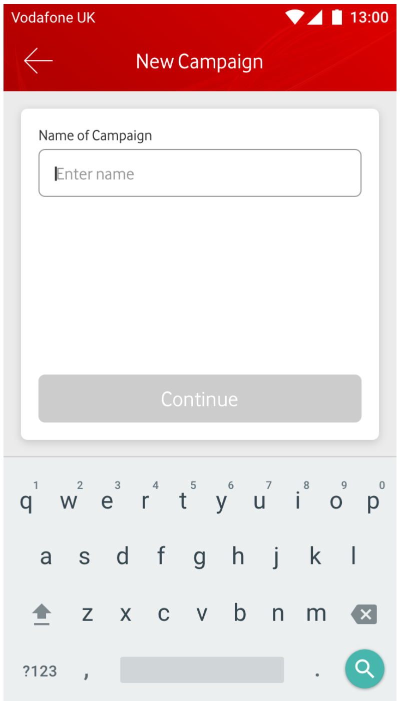
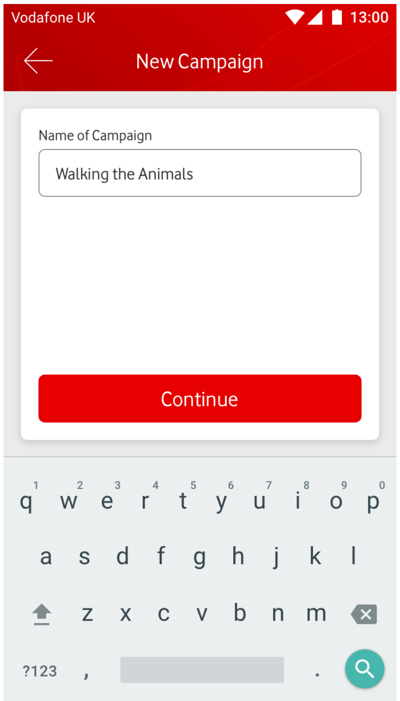


Figure 33: New campaign - Campaign title empty



Walking the Animals

Figure 34: New campaign - Writing campaign title

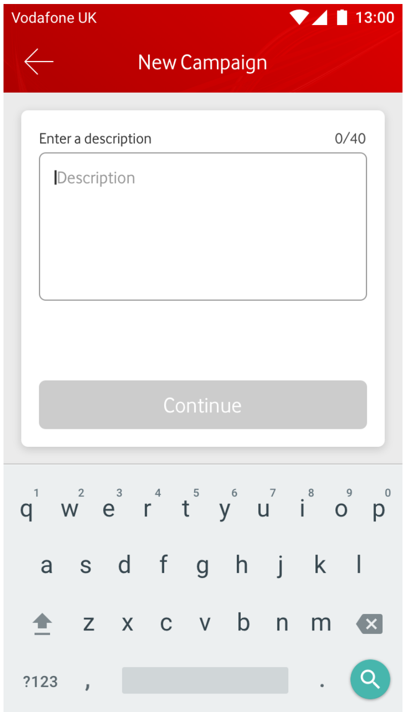
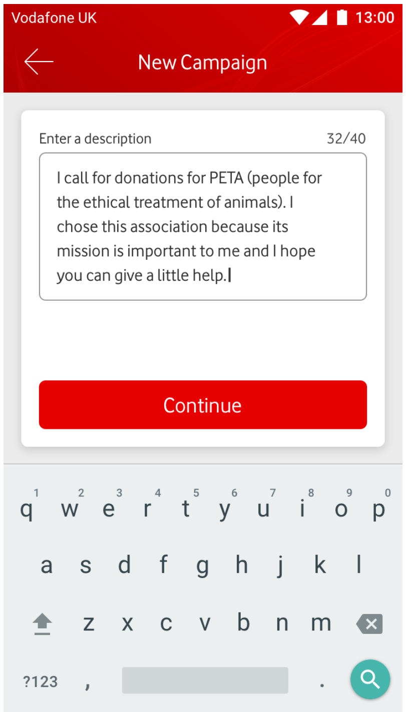


Figure 35: New campaign - Campaign description empty



I call for donations for PETA (people for the ethical treatment of animals). I chose this association because its mission is important to me and I hope you can give a little help.

Figure 36: New campaign - Writing campaign description

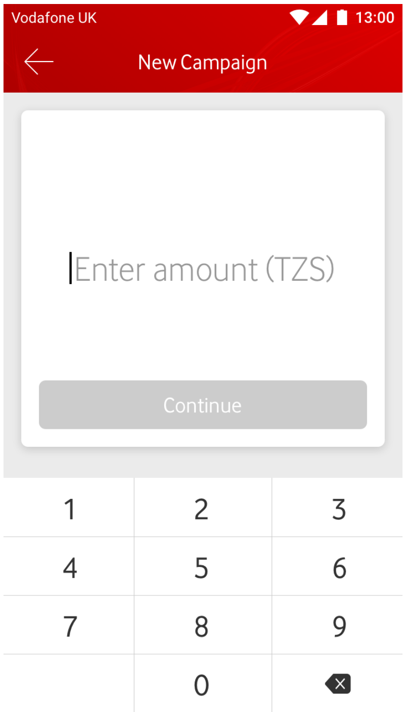
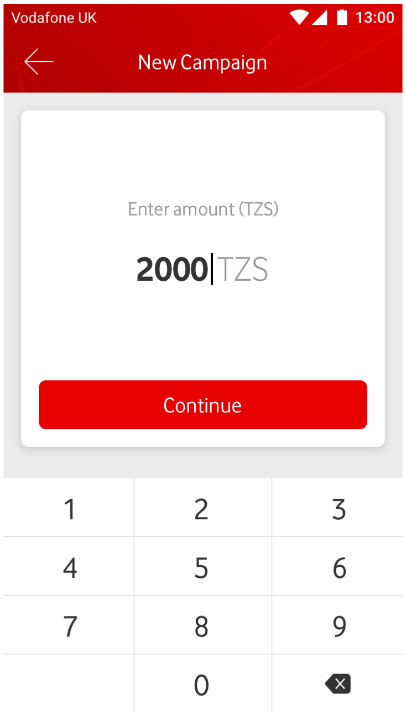
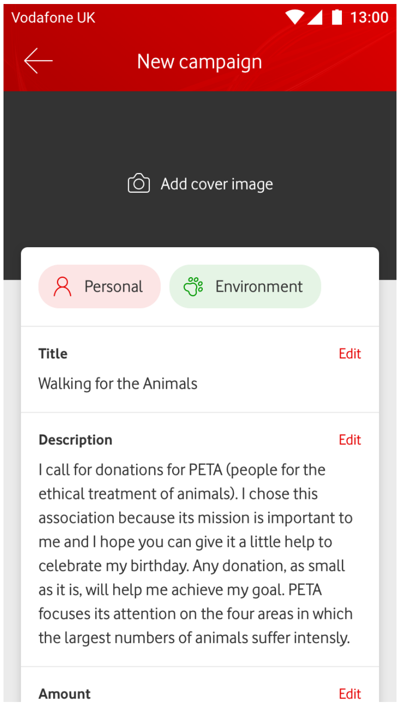


Figure 37: New campaign - Goal Amount Empty



2000 TZS

Figure 38: New campaign - Inserting goal amount



Title

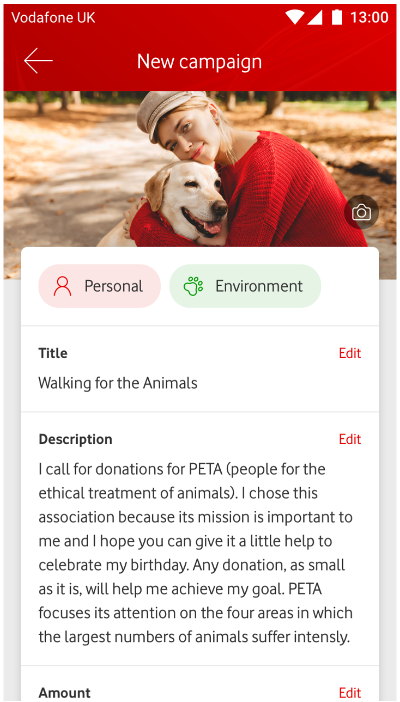
Walking for the Animals

Description

I call for donations for PETA (people for the ethical treatment of animals). I chose this association because its mission is important to me and I hope you can give it a little help to celebrate my birthday. Any donation, as small as it is, will help me achieve my goal. PETA focuses its attention on the four areas in which the largest numbers of animals suffer intensly.

Amount

Figure 39: New campaign - Summary of campaign



Title

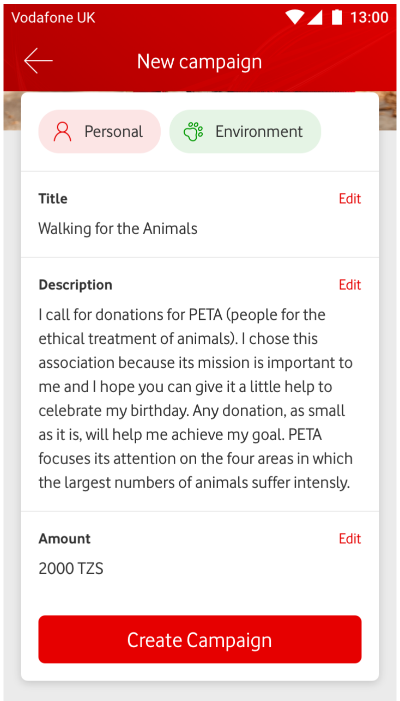
Walking for the Animals

Description

I call for donations for PETA (people for the ethical treatment of animals). I chose this association because its mission is important to me and I hope you can give it a little help to celebrate my birthday. Any donation, as small as it is, will help me achieve my goal. PETA focuses its attention on the four areas in which the largest numbers of animals suffer intensly.

Amount

Figure 40: New campaign - Imaged Added 1/2



Title

Walking for the Animals

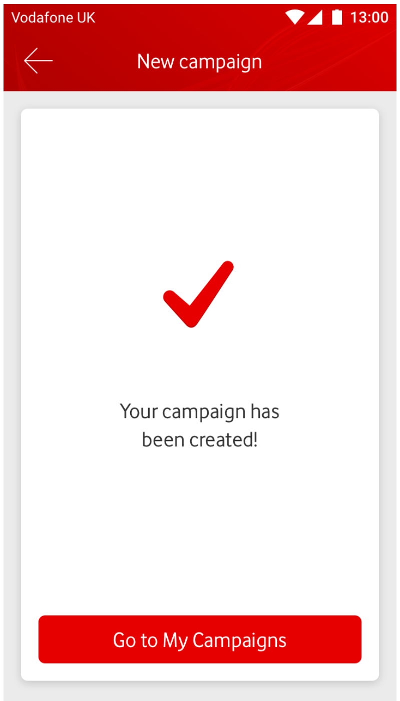
Description

I call for donations for PETA (people for the ethical treatment of animals). I chose this association because its mission is important to me and I hope you can give it a little help to celebrate my birthday. Any donation, as small as it is, will help me achieve my goal. PETA focuses its attention on the four areas in which the largest numbers of animals suffer intensly.

Amount

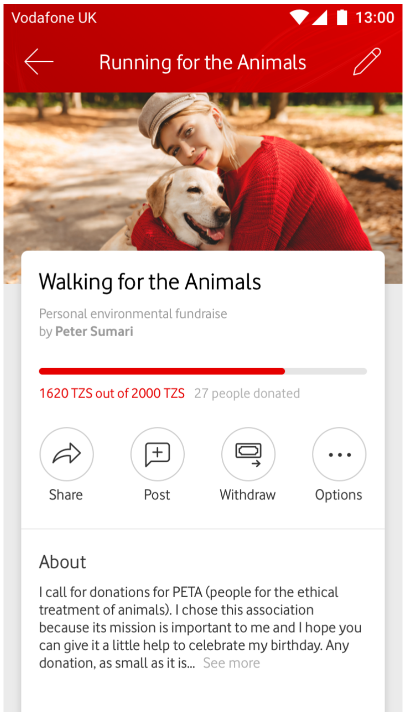
2000 TZS

Figure 41: New campaign - Imaged Added 2/2



Your campaign has been created!

Figure 42: New campaign Added



Walking for the Animals

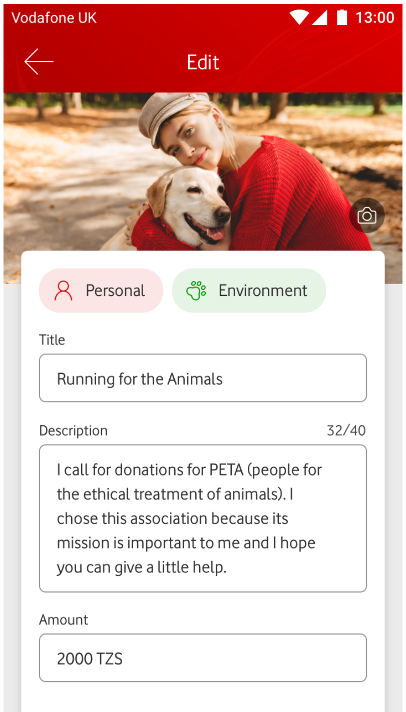
Personal environmental fundraise
by **Peter Sumari**

1620 TZS out of 2000 TZS 27 people donated

About

I call for donations for PETA (people for the ethical treatment of animals). I chose this association because its mission is important to me and I hope you can give it a little help to celebrate my birthday. Any donation, as small as it is... See more

Figure 43: Campaign details - creator view



Title

Running for the Animals

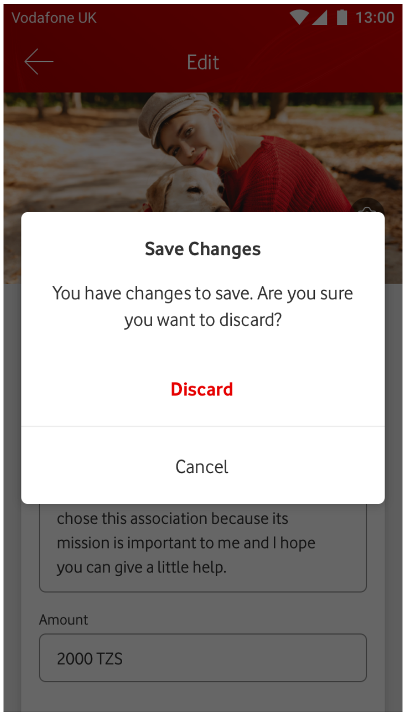
Description 32/40

I call for donations for PETA (people for the ethical treatment of animals). I chose this association because its mission is important to me and I hope you can give a little help.

Amount

2000 TZS

Figure 44: Campaign Edit



Save Changes

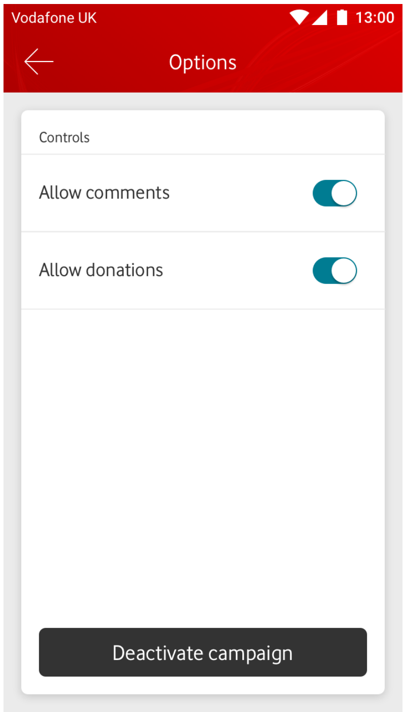
You have changes to save. Are you sure you want to discard?

chose this association because its mission is important to me and I hope you can give a little help.

Amount

2000 TZS

Figure 45: My Campaign Edit confirmation

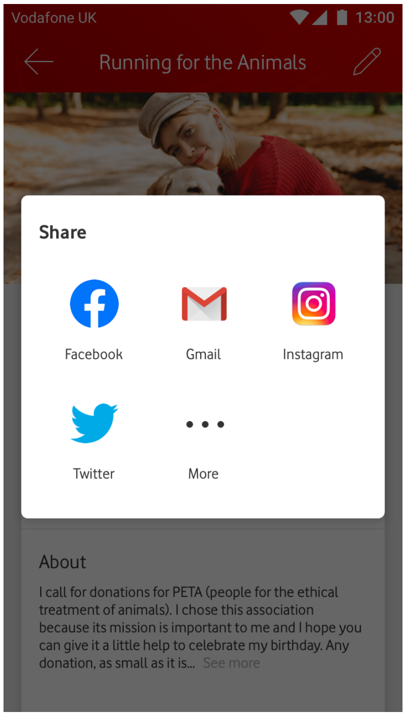


Controls

Allow comments ●

Allow donations ●

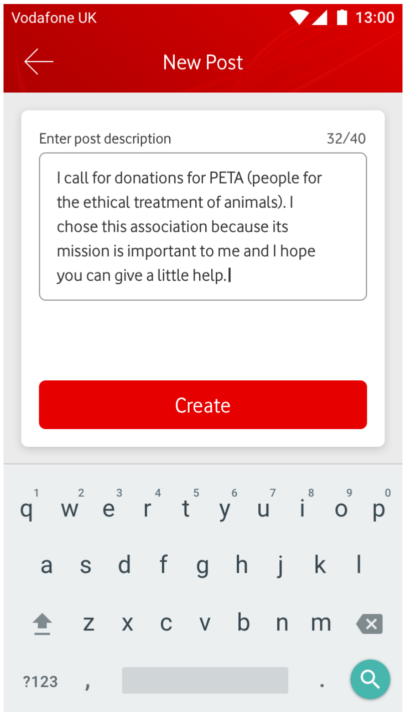
Figure 46: My Campaign - Options



About

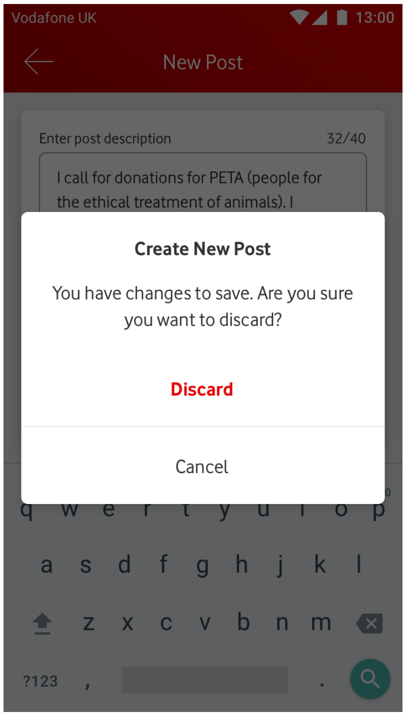
I call for donations for PETA (people for the ethical treatment of animals). I chose this association because its mission is important to me and I hope you can give it a little help to celebrate my birthday. Any donation, as small as it is... See more

Figure 47: My Campaign - Share



I call for donations for PETA (people for the ethical treatment of animals). I chose this association because its mission is important to me and I hope you can give a little help.

Figure 48: My Campaign - Post



I call for donations for PETA (people for the ethical treatment of animals). I

You have changes to save. Are you sure you want to discard?

Figure 49: My Campaign - Post confirmation

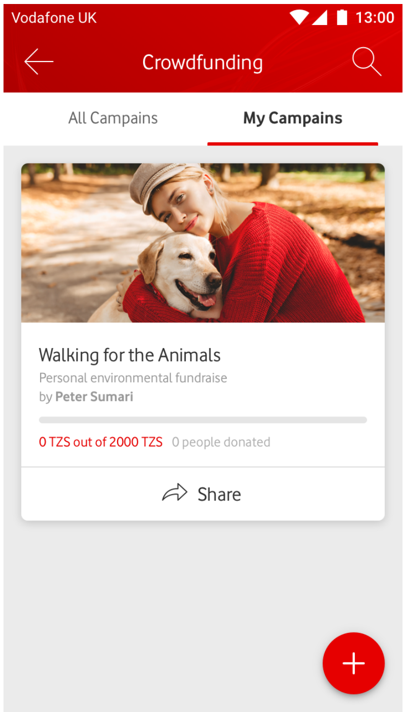
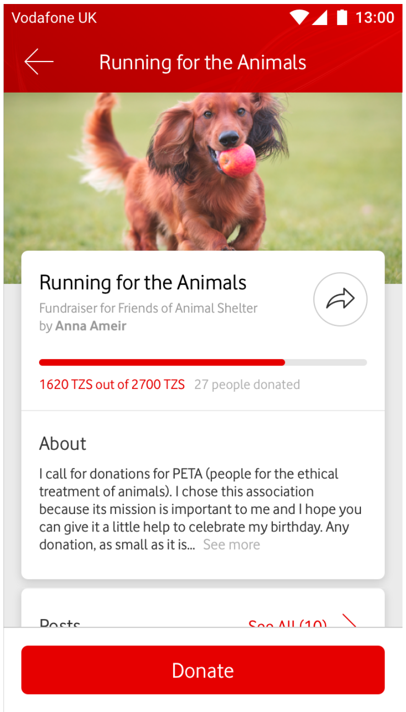
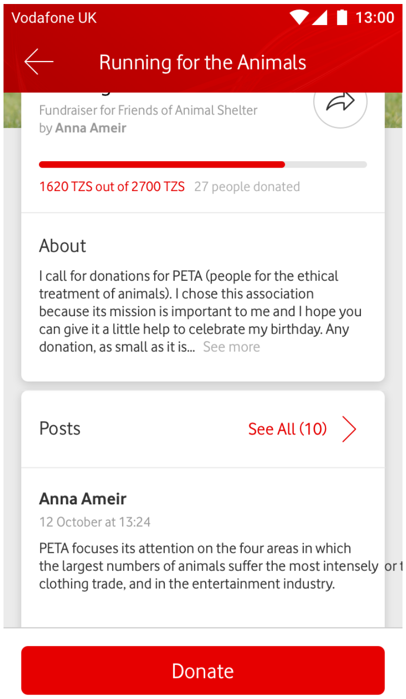


Figure 50: New campaign added



I call for donations for PETA (people for the ethical treatment of animals). I chose this association because its mission is important to me and I hope you can give it a little help to celebrate my birthday. Any donation, as small as it is...

Figure 51: Campaign details 1/2 - visitor view



Fundraiser for Friends of Animal Shelter
by **Anna Ameir**

1620 TZS out of 2700 TZS 27 people donated

About

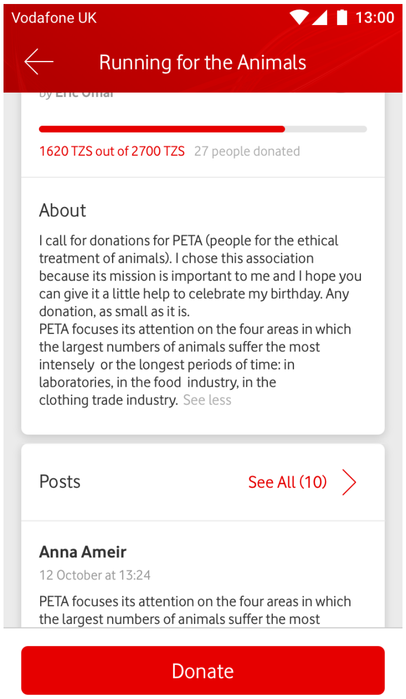
I call for donations for PETA (people for the ethical treatment of animals). I chose this association because its mission is important to me and I hope you can give it a little help to celebrate my birthday. Any donation, as small as it is... See more

Posts See All (10)

Anna Ameir
12 October at 13:24

PETA focuses its attention on the four areas in which the largest numbers of animals suffer the most intensely or t
clothing trade, and in the entertainment industry.

Figure 52: Campaign details 2/2 - visitor view



by Eric Omar

1620 TZS out of 2700 TZS 27 people donated

About

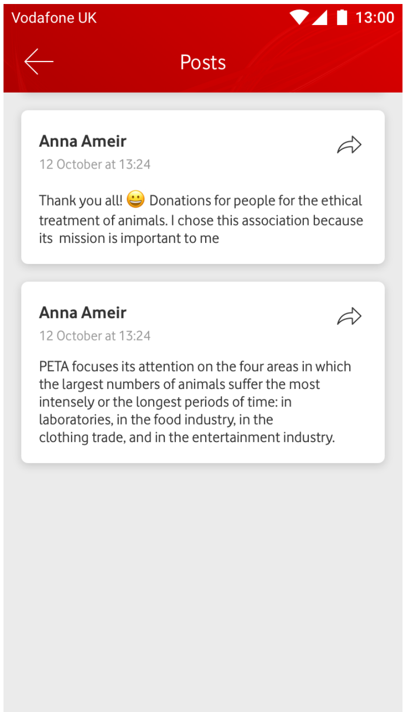
I call for donations for PETA (people for the ethical treatment of animals). I chose this association because its mission is important to me and I hope you can give it a little help to celebrate my birthday. Any donation, as small as it is.
PETA focuses its attention on the four areas in which the largest numbers of animals suffer the most intensely or the longest periods of time: in laboratories, in the food industry, in the clothing trade industry. See less

Posts See All (10)

Anna Ameir
12 October at 13:24

PETA focuses its attention on the four areas in which the largest numbers of animals suffer the most

Figure 53: Campaign details - expanded description



Anna Ameir
12 October at 13:24

Thank you all! 😀 Donations for people for the ethical treatment of animals. I chose this association because its mission is important to me

Anna Ameir
12 October at 13:24

PETA focuses its attention on the four areas in which the largest numbers of animals suffer the most intensely or the longest periods of time: in laboratories, in the food industry, in the clothing trade, and in the entertainment industry.

Figure 54: Campaign details - listing posts

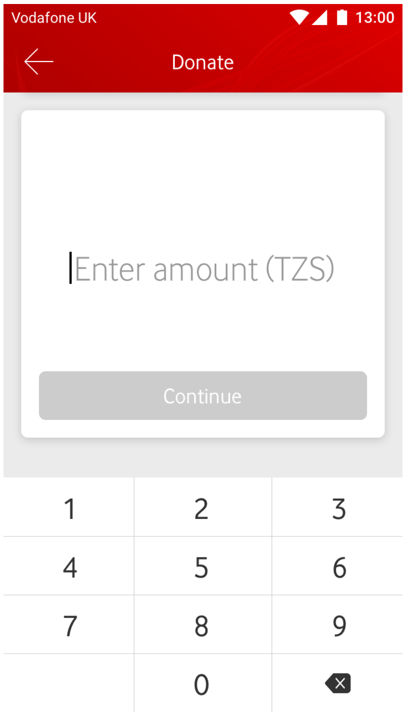
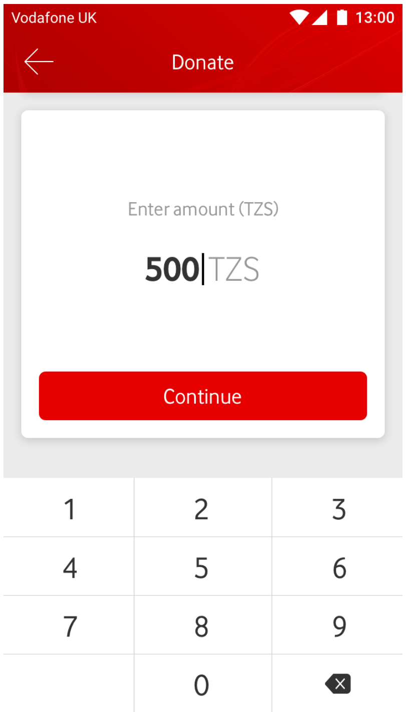


Figure 55: Donation- empty amount



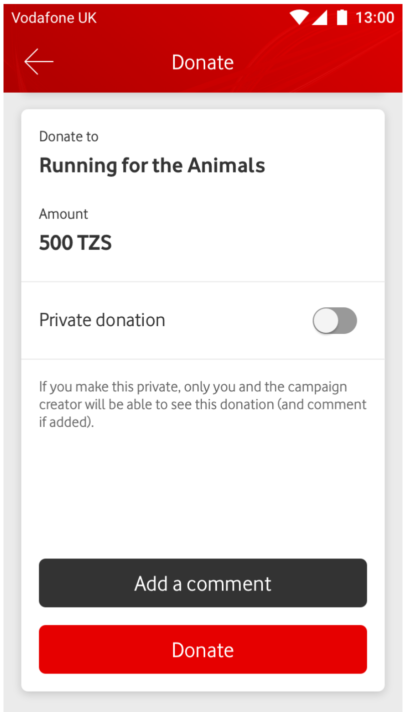
Vodafone UK 13:00

Donate

Enter amount (TZS)

500|TZS

Figure 56: Donate - amount inserted



Vodafone UK 13:00

Donate

Donate to

Running for the Animals

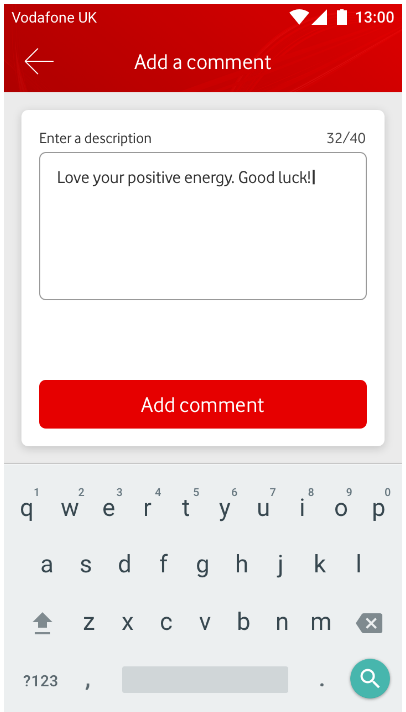
Amount

500 TZS

Private donation

If you make this private, only you and the campaign creator will be able to see this donation (and comment if added).

Figure 57: Donation options



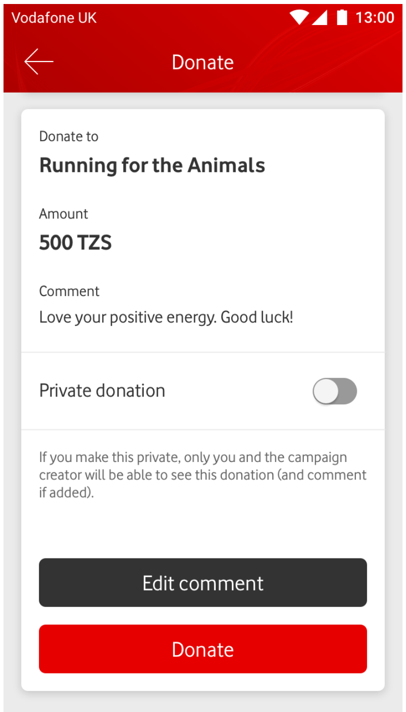
Vodafone UK 13:00

Add a comment

Enter a description 32/40

Love your positive energy. Good luck!|

Figure 58: Donation options - add a comment



Vodafone UK 13:00

Donate

Donate to

Running for the Animals

Amount

500 TZS

Comment

Love your positive energy. Good luck!

Private donation

If you make this private, only you and the campaign creator will be able to see this donation (and comment if added).

Figure 59: Donation options - added comment

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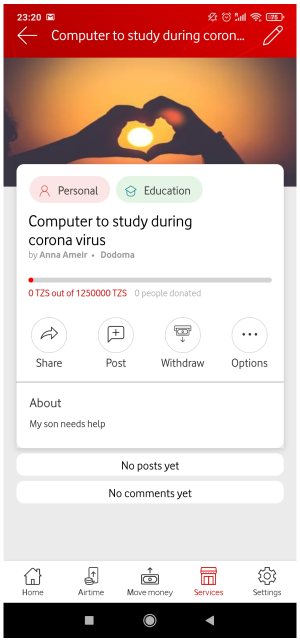
Annex B - Implemented Screens



Computer to study during corona virus

by Anna Ameir • Dodoma

0 TZS out of 1250000 TZS 0 people donated

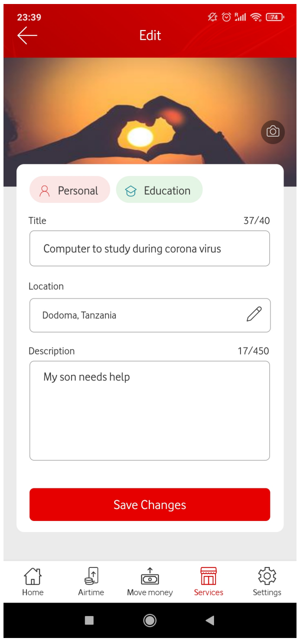
About

My son needs help

No posts yet

No comments yet

Figure 60: Campaign details - Creator view



Title 37/40

Computer to study during corona virus

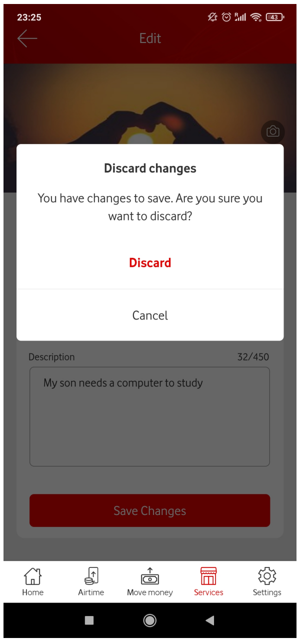
Location

Dodoma, Tanzania

Description 17/450

My son needs help

Figure 61: Campaign edit



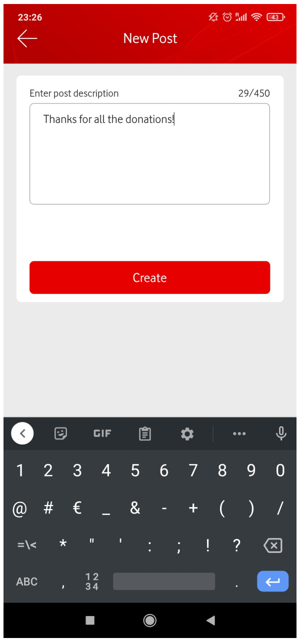
Discard changes

You have changes to save. Are you sure you want to discard?

Description 32/450

My son needs a computer to study

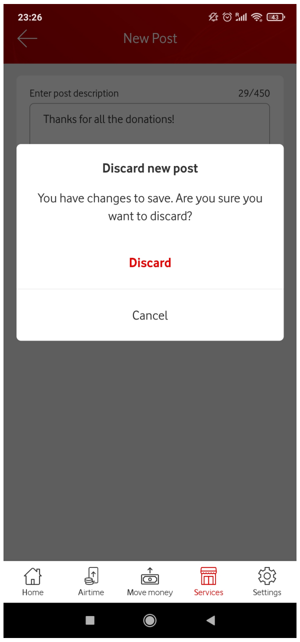
Figure 62: Campaign edit - discard changes



Enter post description 29/450

Thanks for all the donations!

Figure 63: Campaign post creation



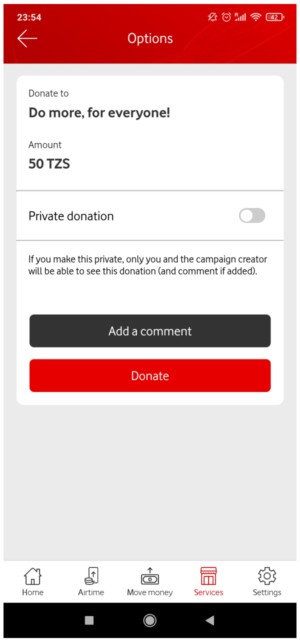
Enter post description 29/450

Thanks for all the donations!

Discard new post

You have changes to save. Are you sure you want to discard?

Figure 64: Campaign post creation - discard new post



Donate to

Do more, for everyone!

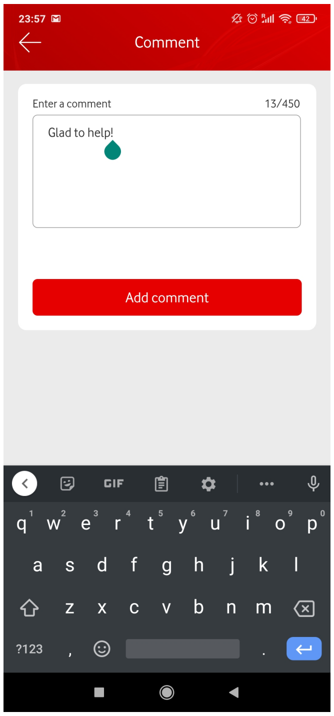
Amount

50 TZS

Private donation

If you make this private, only you and the campaign creator will be able to see this donation (and comment if added).

Figure 65: Donation options



23:57

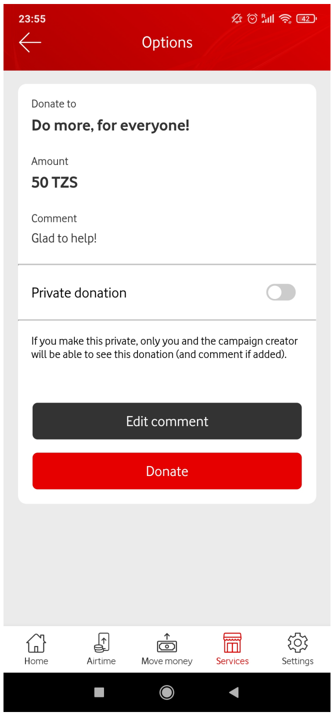
Comment

Enter a comment 13/450

Glad to help!

Add comment

Figure 66: Donation - add comment



23:55

Options

Donate to

Do more, for everyone!

Amount

50 TZS

Comment

Glad to help!

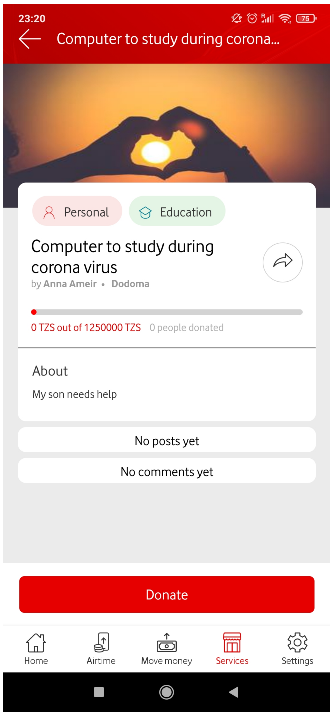
Private donation

If you make this private, only you and the campaign creator will be able to see this donation (and comment if added).

Edit comment

Donate

Figure 67: Donation options after comment



23:20

Computer to study during corona...

Personal Education

Computer to study during corona virus

by Anna Ameir • Dodoma

0 TZS out of 1250000 TZS 0 people donated

About

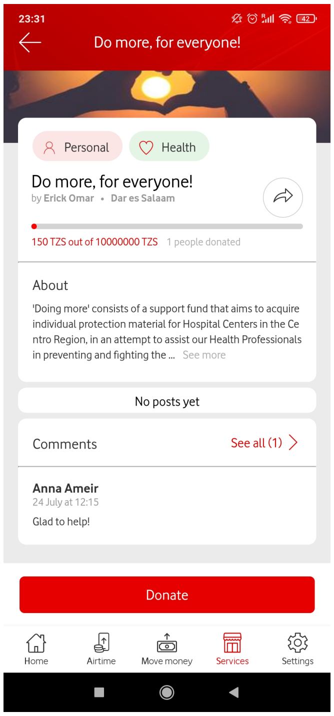
My son needs help

No posts yet

No comments yet

Donate

Figure 68: Campaign details 1/2



23:31

Do more, for everyone!

Personal Health

Do more, for everyone!

by Erick Omar • Dar es Salaam

150 TZS out of 10000000 TZS 1 people donated

About

'Doing more' consists of a support fund that aims to acquire individual protection material for Hospital Centers in the Ce ntro Region, in an attempt to assist our Health Professionals in preventing and fighting the ... See more

No posts yet

Comments See all (1)

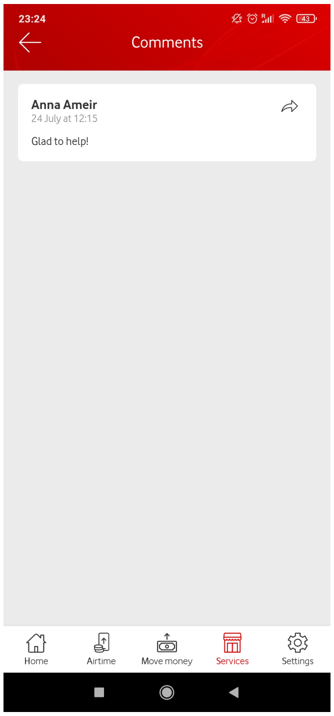
Anna Ameir

24 July at 12:15

Glad to help!

Donate

Figure 69: Campaign details 2/2



23:24

Comments

Anna Ameir

24 July at 12:15

Glad to help!

Figure 70: Campaign details - listing comments

Annex C - Testing

ID	FT01
User Story ID	US01
User Story	As a user, I want to search for campaigns by keyword.
User Story Priority	Must Have
Scenario	At least one campaign created that fits the search
Pass/Fail	PASS

ID	FT02
User Story ID	US01
User Story	As a user, I want to search for campaigns by keyword.
User Story Priority	Must Have
Scenario	There are no campaigns that contain the keyword inserted
Pass/Fail	PASS

ID	FT03
User Story ID	US02
User Story	As a user, I want to search for campaigns by category.
User Story Priority	Must Have
Scenario	At least one campaign created that fits the search
Pass/Fail	PASS

ID	FT04
User Story ID	US02
User Story	As a user, I want to search for campaigns by keyword.
User Story Priority	Must Have
Scenario	There are no campaigns that contain the category chosen
Pass/Fail	PASS

ID	FT05
User Story ID	US03
User Story	As a user, I want to search for campaigns by category and key word.
User Story Priority	Must Have
Scenario	At least one campaign created that fits the search
Pass/Fail	PASS

ID	FT06
User Story ID	US03
User Story	As a user, I want to search for campaigns by category and key word.
User Story Priority	Must Have
Scenario	There are no campaigns that contain the keyword and category chosen
Pass/Fail	PASS

ID	FT07
User Story ID	US04
User Story	As a user, I want to see the details of a campaign.
User Story Priority	Must Have
Scenario	Client chooses one campaign from ”All Campaigns” tab
Pass/Fail	PASS

ID	FT08
User Story ID	US04
User Story	As a user, I want to see the details of a campaign.
User Story Priority	Must Have
Scenario	Client chooses one campaign after using the search feature
Pass/Fail	PASS

ID	FT09
User Story ID	US04
User Story	As a user, I want to see the details of a campaign.
User Story Priority	Must Have
Scenario	Client chooses one campaign by opening a link shared by other users
Pass/Fail	FAIL - NOT IMPLEMENTED

ID	FT10
User Story ID	US05
User Story	As a user, I want to create a campaign
User Story Priority	Must Have
Scenario	User follows through all steps of campaign creation
Pass/Fail	PASS

ID	FT11
User Story ID	US06
User Story	As a user, I want to donate to campaigns
User Story Priority	Must Have
Scenario	User has money in his M-Pesa account
Pass/Fail	PASS

ID	FT12
User Story ID	US07
User Story	As a user, I want to edit the title of my campaign.
User Story Priority	Must Have
Scenario	User changes the title of his campaign
Pass/Fail	PASS

ID	FT13
User Story ID	US08
User Story	As a user, I want to edit the description of my campaign.
User Story Priority	Must Have
Scenario	User changes the description of his campaign
Pass/Fail	PASS

ID	FT14
User Story ID	US09
User Story	As a user, I want to edit the amount goal of my campaign.
User Story Priority	Must Have
Scenario	User changes the amount goal of his campaign
Pass/Fail	PASS

ID	FT15
User Story ID	US010
User Story	As a user, I want to change the image of my campaign.
User Story Priority	Should Have
Scenario	User changes the image of his campaign
Pass/Fail	PASS

ID	FT16
User Story ID	US011
User Story	As a user, I want to post an update to my campaign
User Story Priority	Should Have
Scenario	User posts an update to his campaign
Pass/Fail	PASS

ID	FT17
User Story ID	US012
User Story	As a user, I want to disable comments to my campaign
User Story Priority	Should Have
Scenario	User disables comments to his campaign
Pass/Fail	PASS

ID	FT18
User Story ID	US013
User Story	As a user, I want to withdraw money from my campaign.
User Story Priority	Nice to have
Scenario	User withdraws money from his campaign to his M-Pesa account
Pass/Fail	FAIL - Not implemented

ID	FT19
User Story ID	US014
User Story	As a user, I want to share my campaign.
User Story Priority	Should Have
Scenario	User shares his campaign to social media
Pass/Fail	Pass

ID	FT20
User Story ID	US015
User Story	As a user, I want to share a campaign
User Story Priority	Should Have
Scenario	User shares a campaign to social media
Pass/Fail	Pass

ID	FT21
User Story ID	US016
User Story	As a user, I want to see all update posts of a campaign
User Story Priority	Should Have
Scenario	User chooses a campaign that has update posts
Pass/Fail	Pass

ID	FT22
User Story ID	US016
User Story	As a user, I want to see all update posts of a campaign
User Story Priority	Should Have
Scenario	User chooses a campaign that has no update posts
Pass/Fail	Pass

ID	FT23
User Story ID	US016
User Story	As a user, I want to see all comments of a campaign.
User Story Priority	Should Have
Scenario	User chooses a campaign that has comments
Pass/Fail	Pass

ID	FT24
User Story ID	US016
User Story	As a user, I want to see all comments of a campaign.
User Story Priority	Should Have
Scenario	User chooses a campaign that has no comments
Pass/Fail	Pass

ID	FT25
User Story ID	US017
User Story	As a user, I want to select my location.
User Story Priority	Should Have
Scenario	User chooses his location from the list
Pass/Fail	Pass

ID	FT26
User Story ID	US017
User Story	As a user, I want to select my location.
User Story Priority	Should Have
Scenario	User allows to share his mobile phone location
Pass/Fail	Pass

ID	FT27
User Story ID	US018
User Story	As a user, I want to change my location.
User Story Priority	Should Have
Scenario	User allows to share his mobile phone location
Pass/Fail	Pass

ID	FT28
User Story ID	US019
User Story	As a user, I want to see a list of popular campaigns.
User Story Priority	Should Have
Scenario	At least one campaign is created
Pass/Fail	Pass

ID	FT29
User Story ID	US019
User Story	As a user, I want to see a list of popular campaigns.
User Story Priority	Should Have
Scenario	No campaigns have been created
Pass/Fail	Pass