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**DIGITAL CONTACTLESS PAYMENT  
DONATION POINTS  
ANALYSIS AND PROROTYPE**

Bachelor's thesis

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MSc

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TALLINNA TEHNIKAÜLIKOOL  
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# **DIGITAALSETE VIPEMAKSE ANNETUSE PUNKTIDE ANALÜÜS JA PROTOTÜÜP**

Bakalaureusetöö

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MSc

Tallinn 2017

## **Author's declaration of originality**

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

Author: Rein-Oliver Alasoo

16.05.2017

## **Abstract**

The main objective of the current study is to review and analyse current solutions in sphere of charity in Estonia and other Western countries, as well as to come up with a new solution that would include beneficial sides of contactless payment systems and computerised information flow collection, analysis and management.

During the study, I review current donation collection tools of Estonian charity organisations as well as other chosen country organisations with further analysis of applying advanced donation methods that are utilizing contactless payment systems within the framework of Estonia to consolidate and improve current donation statistics.

If the review and analysis results will be successful and accepted to be potentially useful in the current charity field, the non-operational prototype will be developed, utilizing analysis results and contactless payment system usage proposition.

This thesis is written in English and is 43 pages long, including 3 chapters and 19 figures.

## **Annotatsioon**

### **DIGITAALSETE VIIPEMAKSE ANNETUSE PUNKTIDE ANALÜÜS JA PROTOTÜÜP**

Antud uuringu põhieesmärk on vaadata läbi ja analüüsida olemasolevaid lahendusi heategevuse valdkonnas Eestis ja teistes riikides ning samuti koostada uus lahendus mis sisaldaks viipemakse tehnoloogia kasulikke külge ja arvutipõhine infovoogu kogumist, analüüsi ja haldamist.

Uuringu käigus vaatan ma läbi praegused Eesti ja samuti teise valitud riigi heategevusorganisatsioonide annetuste kogumise vahendeid koos edasise kauglearenenud viipemakse tehnoloogia kasutatava annetamise meetodi rakendamise analüüsimisega praeguse annetuse statistika konsolideerimiseks ja parandamiseks Eesti raamistikus.

Kui ülevaade ja analüüsi tulemused on edukad ja tunnustatud potentsiaalselt kasulikuna antud heategevuse valdkonnas, luuakse mittetöötav prototüüp mis utiliseeriks analüüsi tulemusi ja viipemakse tehnoloogia kasutamise pakkumist.

Lõputöö on kirjutatud inglise keeles ning sisaldab teksti 43 leheküljel, 3 peatükki ja 19 joonist.

## **List of abbreviations and terms**

|     |                                |
|-----|--------------------------------|
| NFC | Near Field Communication       |
| PIN | Personal identification number |
| UC  | Use Case                       |
| SD  | Sequence Diagram               |

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# **1 Introduction**

Historically there were two main ways to make a donation to charity organization. Interested party, should it be a private person or an organization, could either donate it's time, or it's welfare. And while the first one is absolutely respectful, the second way remains the most useful and effective one to make this world a better place to live in. This research project centres on the second way, specifically on financial donations by a private person to charity organizations.

## **1.1 Research Problem**

The problem of given research and the whole donation objective is to convince a donating party to financially participate in a gratuitous initiative organized by a charity party. Mentioned problematics can be represented in a form of a process consisting of 3 main steps: Finding donating party, making them notice and pay attention to a proposed charity initiative and finally convincing them in expediency of approving requested financial transaction thereby creating an entrusted and non-beneficial relationship with a mentioned party for potential future donations. It is worth mentioning that by a non-beneficial relationship is meant a relationship with no direct financial benefit, although non-direct and non-financial benefits are possible and, most likely, obligatory.

## **1.2 Objective**

In this thesis, I will analyse the current status of Estonian charity organizations, including their methods of finding a donation party and raising donation funds, specifically in private sector.

The main objectives are:

- to find a sociotechnical solution for optimizing and advancing current donation points that would include contactless payment system utilization

- in case of successful analysis results to create a non-operational prototype that would contain a contactless payment system as well as related digitalized information flow management system for charity organization and, if implemented, donating parties with society.

## **2 Theoretical part**

Given research focuses primarily on donation situation in Estonia. However, to give a more wide and complete overview a comparison country has been chosen, United Kingdom. The decision was made due to relatively prominent position of UK in world charity rankings, including personal donations. United Kingdom is also a way ahead of other European countries in terms of technological advancements level in everyday payments.

### **2.1 Current donation situation in Estonia and United Kingdom**

In Estonia, 31.4 million of euros has been donated in 2015, which is 20% more than in 2014, with 26.5 million of euros accordingly. It is worth mentioning that following numbers are presumably greater due to difficulties in measuring direct bank transaction donations as well as anonymous ones, which take over 40% of overall donation traffic. These anonymous payments mostly originate from charity boxes and phone donations. Remaining percentage is divided equally between 2700 business organizations and 65 000 registered individual donators. The rise of donation statistics in Estonia mostly caused by the rise of number of small donation individuals, who in the year 2015 have donated an average of 129 euros, according to income tax returns statistics. Overall 21% of Estonian residents have donated to charity in 2015, according to World Giving Index. [1]

On the other hand, in United Kingdom 67% of population have donated to charity in 2015, with the mean donation of 14 pounds (16.39 euro on 10.04.17). Older people and women are more likely to participate in financial charity initiative and majority of donators give to charity from time to time or monthly. Financial donations remain the most popular way to donate in UK (compared to other methods such as volunteering, giving goods, signing a petition etc.). Total amount of money given to charities in United Kingdom is 9.6 billion pounds (11 243 520 000 euro on 10.04.17). The most popular ways to give to charity in United Kingdom are cash, direct debit and buying lottery tickets with 55%, 31% and 26%

respectively, while debit card and credit card donations account for 14% and 3% respectively. [2]

## **2.2 Bank card payment statistics in Estonia and United Kingdom**

In this thesis, problem-solving proposal is based on bankcard payment system, which makes it necessary to describe current situation status of previously mentioned system in Estonia.

According to statistics provided by Bank of Estonia, the number of payments made by bank cards in Estonia has risen from 11 090 payments per quarter in 2007 to 22 062 payments per quarter, almost in twice in 10 years. On the average 740 000 card payments was made in 2015 during third quarter period with total sum of 12.6 million of euros, which is 6.5% more than in the same quarter of 2014. Transaction amounts per persona in Estonia are one of the smallest ones in Estonia, only 17 euros, which shows that citizens are using their cards even for small money transactions. For now, there are over 35 754 card payment terminals in Estonia and over 1 506 646 active debit and credit cards. [3]

The number of debit bank cards in United Kingdom has increased by 2.5%, while the number of credit cards remains the same at 1.94 credit cards per holder. In 2015, the number of bank cards transactions has increased by 9.2% with the total number of point-of-sale terminals rising by 10%. According to The UK Cards Association forecast card payments in the UK are to increase from 34.7 million in 2015 to 57.2 million in 2025. [4]

## **2.3 Contactless payment technology overview**

Contactless payments technology is based on NFC (Near Field Communication) technology with compliant chip integrated in bank card, in addition to regular chip technology. This allows card holder to make “tap-to-pay” payments by bringing up card to terminal without being required to insert PIN code.

United Kingdom is one of the leading European countries in the field of contactless payments, with more than 1 billion purchases in 2015. Thanks to growing awareness of technology and availability of point-of-sale terminals supporting technology consumers spending increased by 233% over the year, which is more than double than during the

2007 to 2015 period combined. In London, over half of all transaction up to 30 pounds were made using contactless technology. [5]

In Estonia, contactless payment system was implemented in 2016, with 4% of all issued cards supporting technology. Technology is backed up by Swedbank, LHV Bank, Nordea Bank and SEB Bank. There are over 35 000 terminals supporting technology in Estonia, and according to banks forecasts by 2020 all terminals will be supporting contactless payments. [6]

Contactless payments technology is relevant within the framework of current thesis due to important benefits this technology provides, including ease of use, time-savings, ability to digitally accept, proceed and analyse incoming payments and other data as well as making donation initiative more desired for donating party.

### 3 Practical part

#### 3.1 Analysis of current popular donation methods

There are two main sides in charity initiative: initiative organizer (Charity Organisation) and initiative participant (Donator). Charity Organisation's goal is to find donator, make him notice and pay attention to a proposed charity initiative and finally convince him to donate. Donator's goal is to fulfil his personal intentions by providing part of his financial wealth to charity organisation.

Following diagram (Figure 1) demonstrates basic relationship between Donator and Charity Organisation:

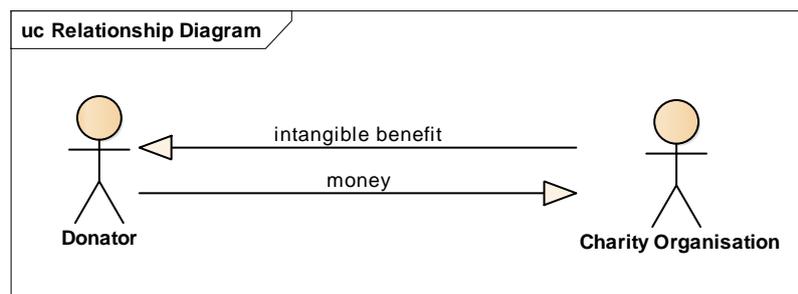


Figure 1. Relationship diagram

As it was mentioned earlier, given thesis focuses on personal donations. After analysing most popular charity organisations (Toetusfond, SOS Lasteküla, Heategu.ee, Laste fond and others) in Estonia it was possible to conclude that amongst the most popular donation methods are *charity boxes*, *donation phone numbers* and *direct bank transactions*. The first two methods were chosen to be compared against proposed alternative method for personal donations.

### **3.1.1 Charity boxes analysis**

Charity boxes were used by organisations for a long time, and there is obviously a reason for that – it works. Charity boxes are oriented towards mostly small cash donations, either by coins or banknotes. The minimum (or maximum) donation amount is not limited, which allows donating person to choose one according to his current financial situation. Charity boxes are usually made of transparent material to attract people’s attention, demonstrate initiative’s current financial status as well as donated banknotes values. Posters, which are usually placed on or near charity box play similar role: drawing attention and providing information on initiative.

Following diagram (Figure 2) describes receipt of funds by charity organisation using charity boxes:

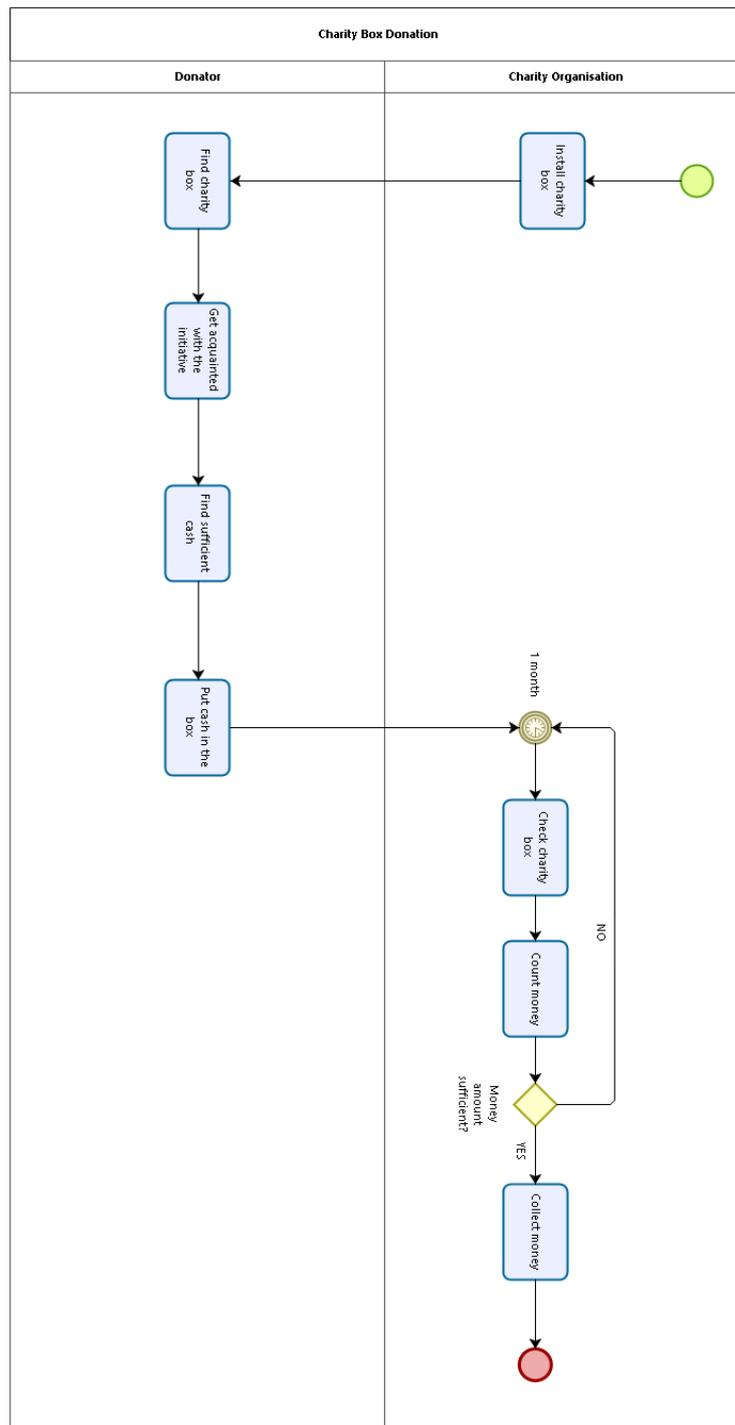


Figure 2. Charity box donation business model

Advantages of Charity Boxes are:

- Visually-physical representation of initiative – donator can see and, in theory, touch charity box
- Accepts banknotes and coins – cash remains the most popular method for accomplishing financial transactions, especially small ones
- Anonymity – not all people want to disclose their charitable intentions
- Price – installation of charity boxes is relatively cheaper when compared to other similar methods of donations collection

Disadvantages of Charity boxes are:

- Lack of interactivity
- Lack of card or mobile payment option – cards are the easiest and fastest way for accomplishing payments, especially for the younger generations
- Unsecure – the only obstacles are chain and morality
- Money reaches charity organisation in periods – should wait until charity box is filled up and physically withdraw banknotes
- Lack of ability to obtain precise statistical data and analyse it – information allows organisations to improve their results

To conclude, charity boxes remain one of the most popular and proven by time methods for charity organisations to collect donations, although obsolescence and lack of innovation motivates to find another way donations collection.

### **3.1.2 Donation phone numbers**

Donation phone number is another popular in Estonia donation method. The concept of the method is next: Usually a total number of 3 phone numbers with different endings is presented on a poster or another carrier of information. Calling on mentioned above numbers allows even cashless donator to transfer donation in the amount tied to phone number. The amount will be deducted from the donator's next mobile phone bill.

Following diagram (Figure 3) describes receipt of funds by charity organisation using charity boxes:

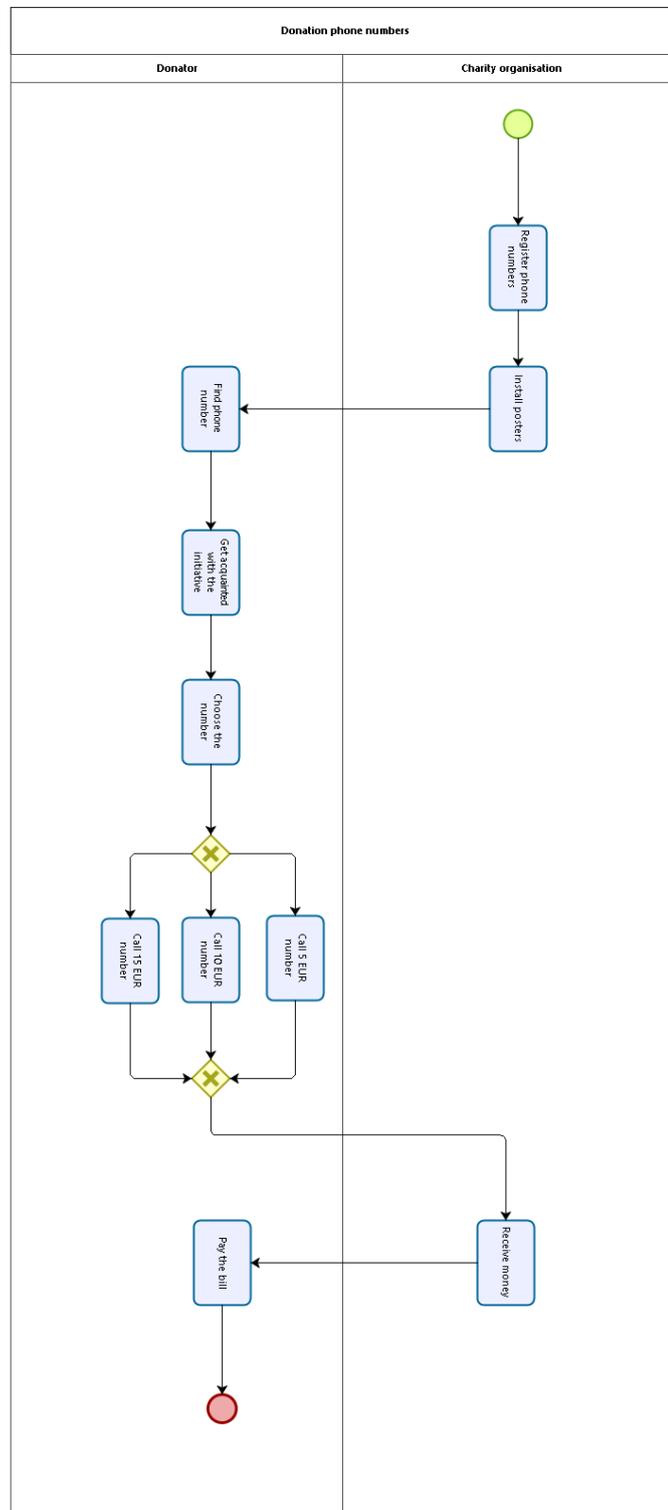


Figure 3. Donation phone numbers business model

Advantages of Donation phone numbers are:

- Cashless donation method – no cash needed, only phone number
- Security – transaction cannot be stolen
- Instant transaction – charity organisation receives money instantly
- Maintenance is not required – posters are notably autonomous
- Control of minimum donation amount – charity organisation can control the minimum required donation amount (example: 5 euro) which can boost total amount

Disadvantages of Donation phone numbers are:

- Complexity – taking out mobile phone and typing number is a relatively complex process, especially when compared to cash donation
- Lack of specific donation amount choice – donation amount depends on charity organisation policy
- Lack of statistical data – although mentioned donation process is mostly digital, the only trusted data organisation receives is amount donated per day
- Overall lack of interactivity

### **3.2 Design and analysis of alternative donation method**

The main goal of this section is to formulate, design and analyse practical alternative to mentioned above methods for donating parties to participate in charity initiatives. The following concept must meet next requirements:

- Concept must include contactless payment technology due to benefits listed in paragraph 2.3 of current thesis
- Concept must be notable enough to make potential donors notice an initiative and encourage to donate

- Concept must be effective, natural and time-saving enough to convince donators to make donations in the future
- Concept must provide relevant statistical data to charity organisation allowing the last one to improve their donator approach

In the role of customer for developed system was chosen charity organisation Tallinn Children's Hospital Foundation and its head Inna Kramer, who has expressed her interest in the idea and mercifully agreed to provide advice on this project.

### **3.2.1 System brief description**

Given business system is Digital Contactless Donation, more exactly a number of business services that Charity Organisation provides to Donating Party.

Given software is a Digital Contactless Donation system created for both Charity Organisation and Donating Party in mind which allows donations transfer as well as statistical data collection and analysis.

The developed system will consist of two main subsystems: Donating Party Subsystem and Charity Organisation Subsystem.

Donating Party Subsystem will be represented in a form of a more advanced version of a charity box. It will consist of two main customer interaction elements: Display and Payment Terminal.

Display is going to be used for several purposes, which are:

- Attracting attention of potential customers – showing audio-visual series of informative materials introducing the problem as well as an initiative designated to fight it
- Showing relevant statistical data – for further attention attraction and as an attempt to establish a more personal connection with donating party by showing relevant statistical data, for example:
  - Ratio of funds received to target amount

- Overall number of donations
- Daily number of donations
- Real-time statistics related to charity campaign
- Providing more interactivity to donators – if combined with touch interface, potential donators could learn more about the problem, the way initiative is going to solve it as well as choose donation transfer recipient and donation amount

Payment terminal will be used directly for payments, more specifically “pin code-free tap-to-pay” contactless payments transfer.

Charity Organisation Subsystem will be represented in a form of a website interface which would allow Charity Organisation to receive relevant statistical data, for example:

- Ratio of funds received to target amount
- Overall number of donations
- Daily number of donations
- Real-time statistics related to charity campaign
- Donations peak time
- Identify individual donators (by unique bank account) and provide statistics on when, where, how often and how much they donate to charity as well as, if possible, allow donators to receive financial benefits from governmental tax refund policies (bank transfers allow declaration of payments as charity)

The values for Donating Party and Charity Organisation can be represented in a following transaction model (Figure 4).

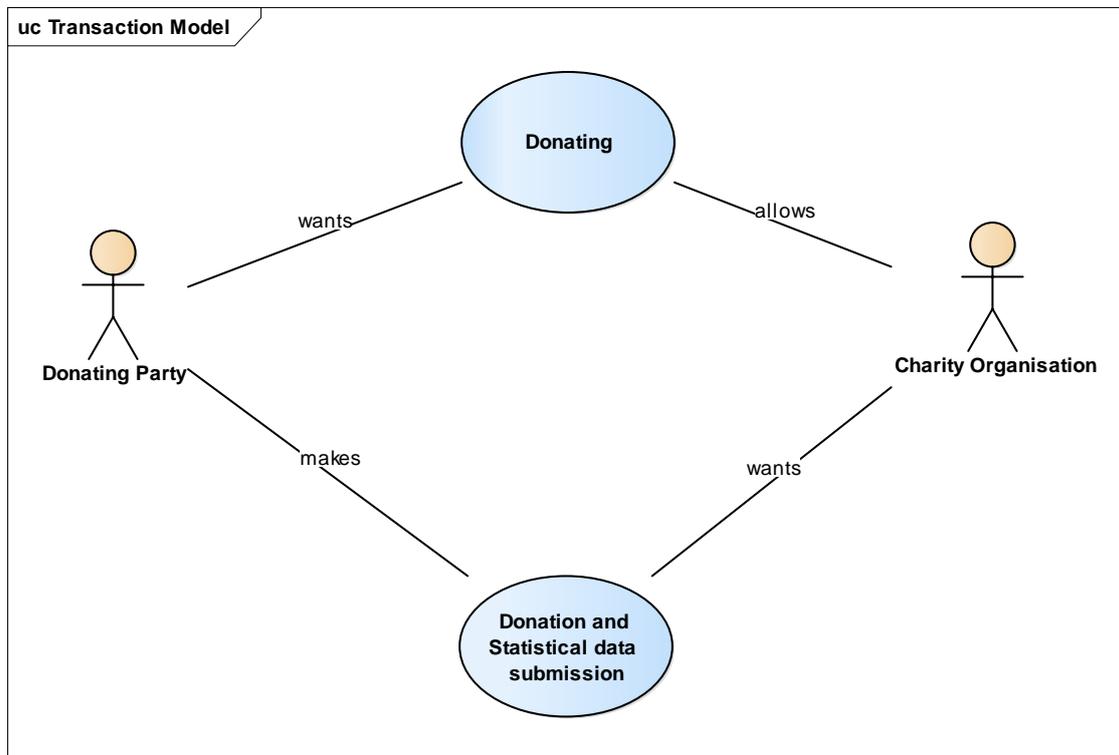


Figure 4. Transaction Model

Donating Party main goal is to quickly and easily make cashless donations to Charity Organisation. Contactless technology combined with informative display with interactive user interface must allow that.

Charity Organisation main goal is fulfilling Donating Party needs which includes providing moral satisfaction through financial donations as well as collecting donations and relevant statistical data with its further analysis.

Software main goal is to satisfy Donating Party – Charity Organisation needs and maintaining communication between them.

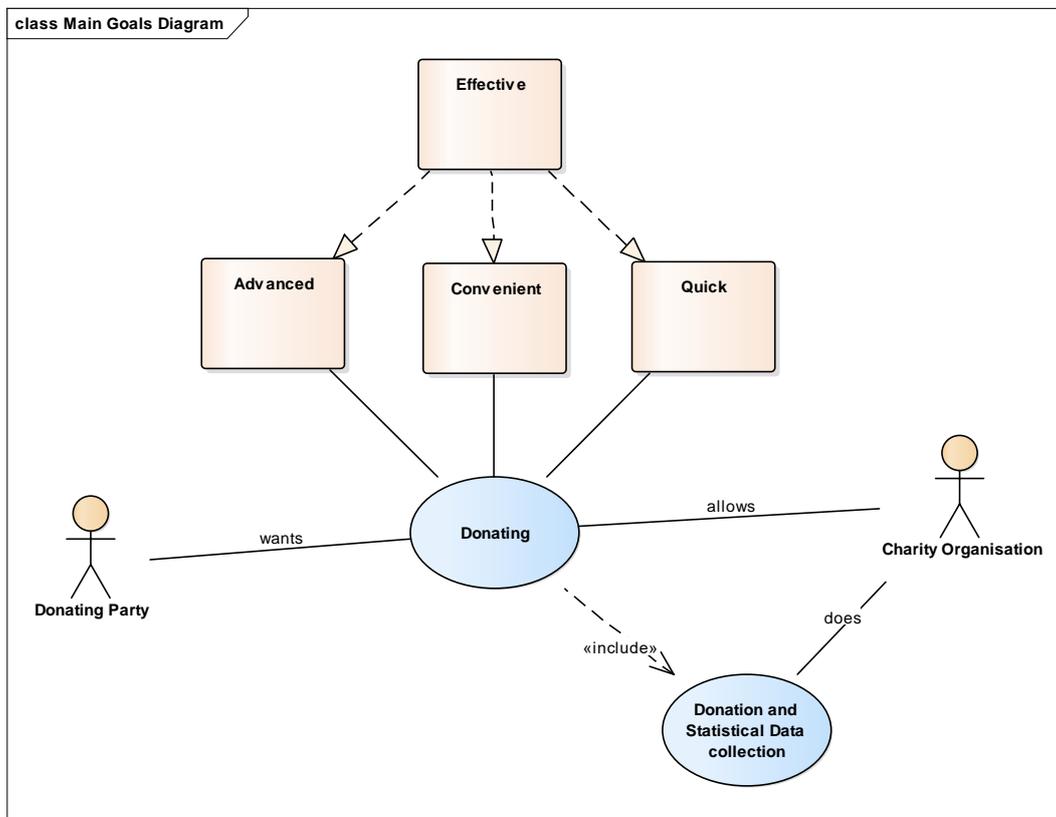


Figure 5. Main goals diagram

Next quality goals classes are placed on a separate class diagram (Figure 6), structured and supplemented with more detailed quality goals.

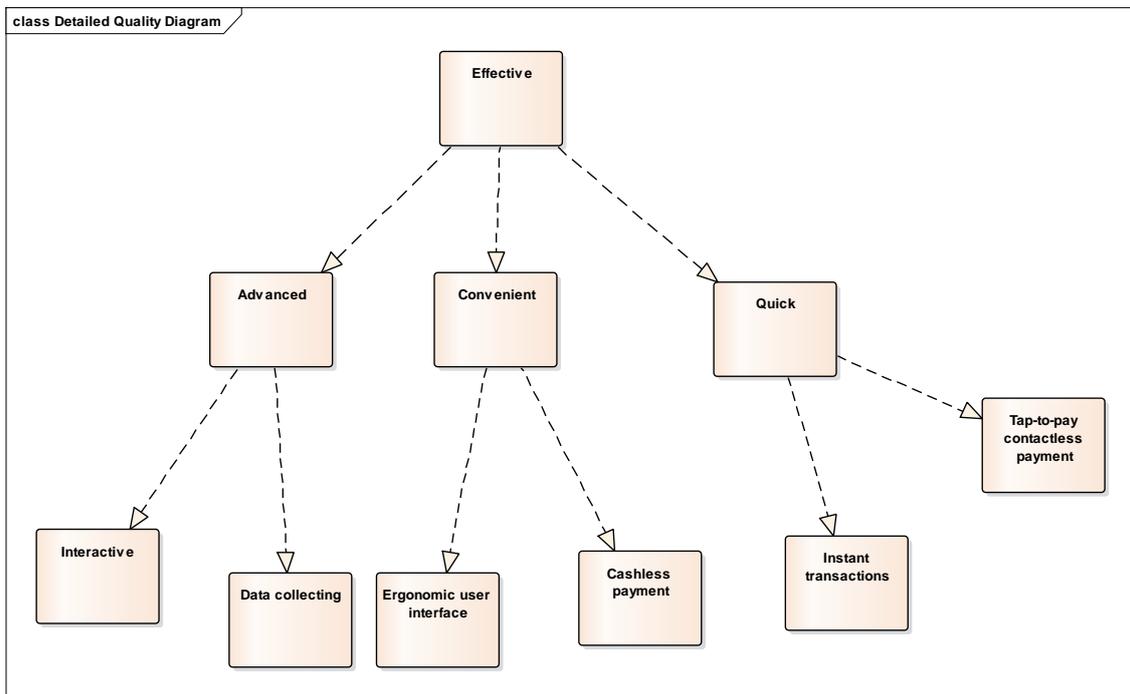


Figure 6. Detailed quality diagram

Next use case diagram (Figure 7) illustrates business processes structure. Given business processes are also functional goals and can be associated with quality goals but for the sake of diagram quality this step was skipped.

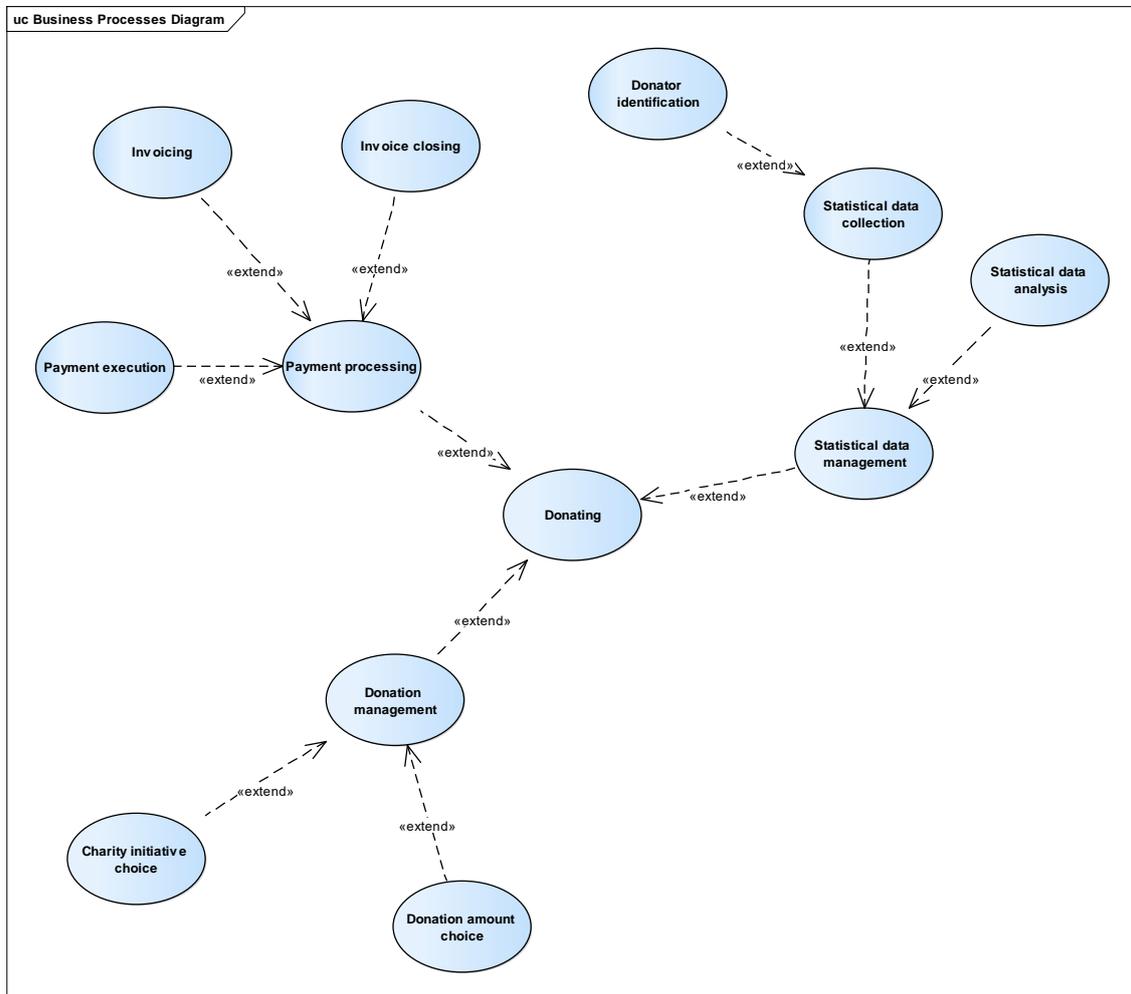


Figure 7. Business processes diagram

Based on compiled business processes structure following list of functional subsystems can be created:

- Donation management subsystem
- Payment processing subsystem
- Statistical data management subsystem

Following diagram (Figure 8) illustrates the main process (business service usage) workflow.

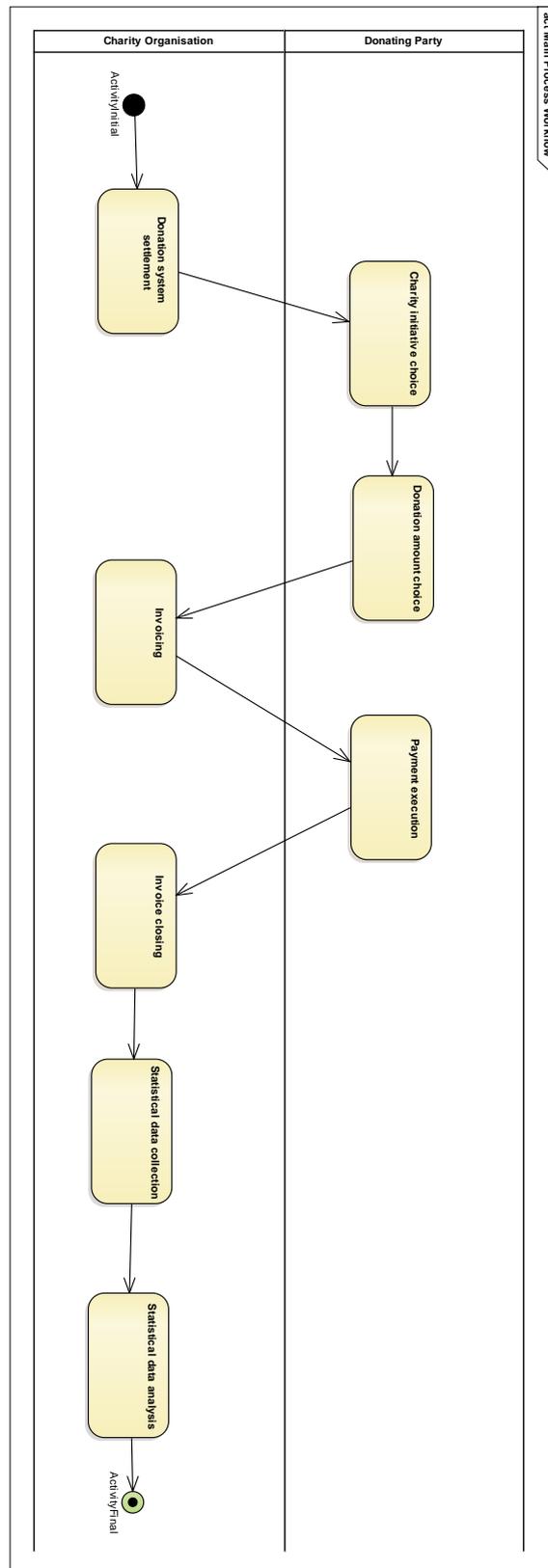


Figure 8. Main process workflow

General conceptual class diagram (Figure 9), its preliminary distribution to registries (data-driven subsystems)

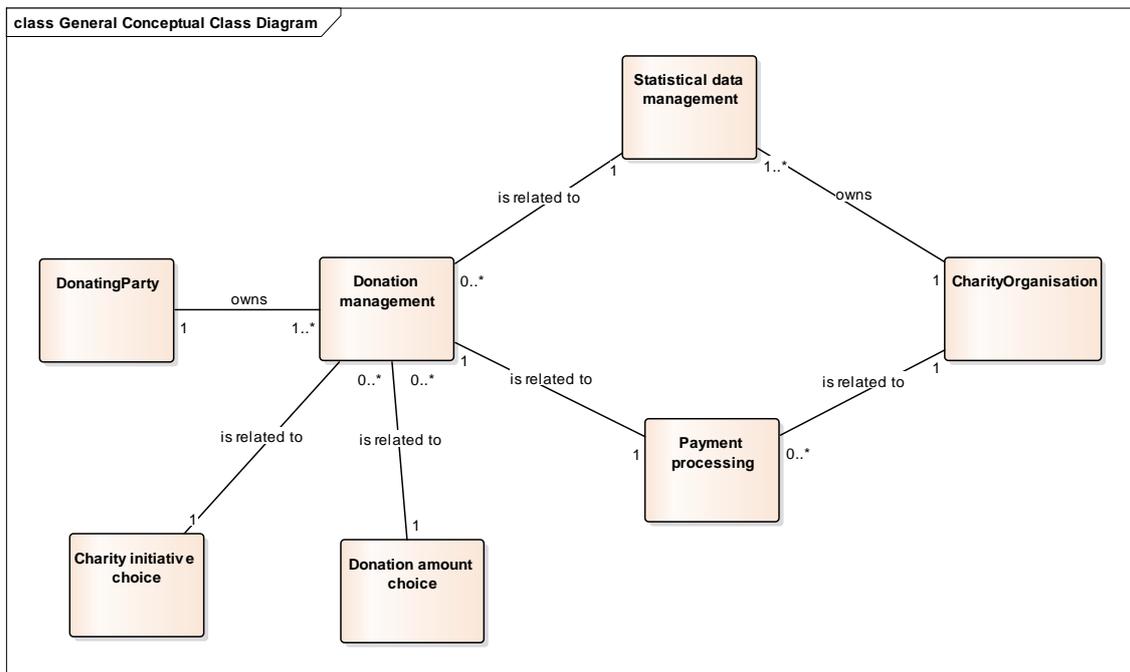


Figure 9. General conceptual class diagram

Using conceptual class diagram and business processes structure preliminary registries list was composed:

- Donations registry
- Charity initiatives registry
- Donation amounts registry
- Payments registry
- Statistical data registry

### 3.2.2 Software requirements analysis results

Use cases preliminary list is next:

- Donation management
  - Charity initiative choice
  - Donation amount choice
  - Payment processing
  
- Statistical data management

Use case diagram below (Figure 10) illustrates presented by Donation management sub use cases Charity initiative choice, Donation amount choice and Payment processing actions that are being analysed in this thesis in detail.

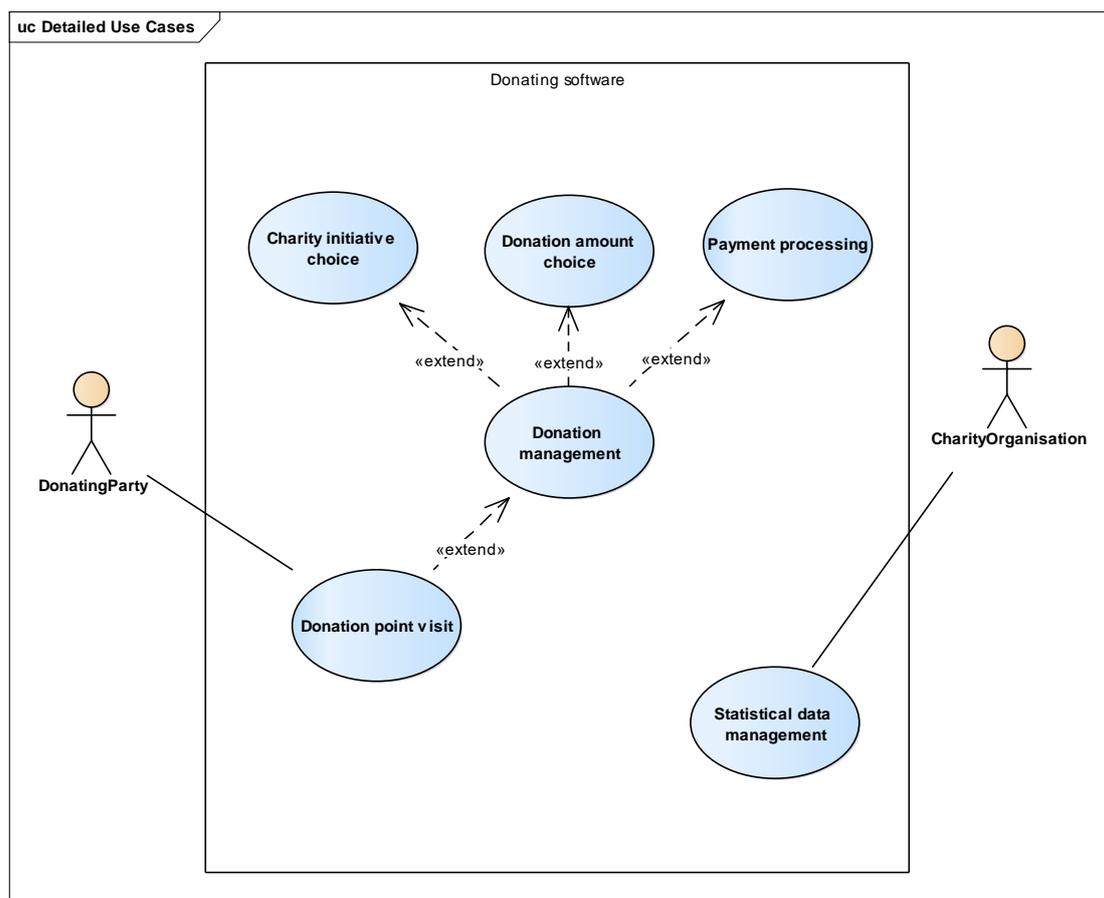


Figure 10. Detailed use cases

## **Use cases preliminary separation to functional subsystems**

Charity initiative choice belongs to Charity initiative choice functional subsystem.

Donation amount choice belongs to Donation amount choice functional subsystem.

Payment processing belongs to Payment processing functional subsystem.

Mentioned above subsystems can be grouped into larger Donation Portal Usage subsystem.

Statistical data management belongs to Donations management functional subsystem.

## **Most relevant functional and non-functional requirements**

Functional requirements:

- As a DonatingParty, I want to be able to donate so that I fulfil my donation requirements
- As a DonatingParty, I want to be able to choose charity initiative so that my donation would be received by those whom I think fit
- As a DonatingParty, I want to be able to choose donation amount so that it would match by preferences and possibilities
- As a CharityOrganisation, I want to be able to manage donations statistical data so that my current and future charity campaigns could be improved

Non-functional requirements:

- User interface must be ergonomic
- Payment processing must be fast and utilize contactless technology
- Donation portal screen must be touch-sensitive
- CharityOrganisation software must be web-based

### 3.2.3 Iterations planning

The planned focus of detailing phase is use case “Donation management”.

Other use cases mentioned in current thesis were skipped for the sake of keeping required page amount.

### 3.2.4 Detailing phase

#### 3.2.4.1 Business modelling results

Detailing phase’s focus is software use case “Donation Management”. This use is also business process. Next action diagram (Figure 11) describes mentioned process workflow.

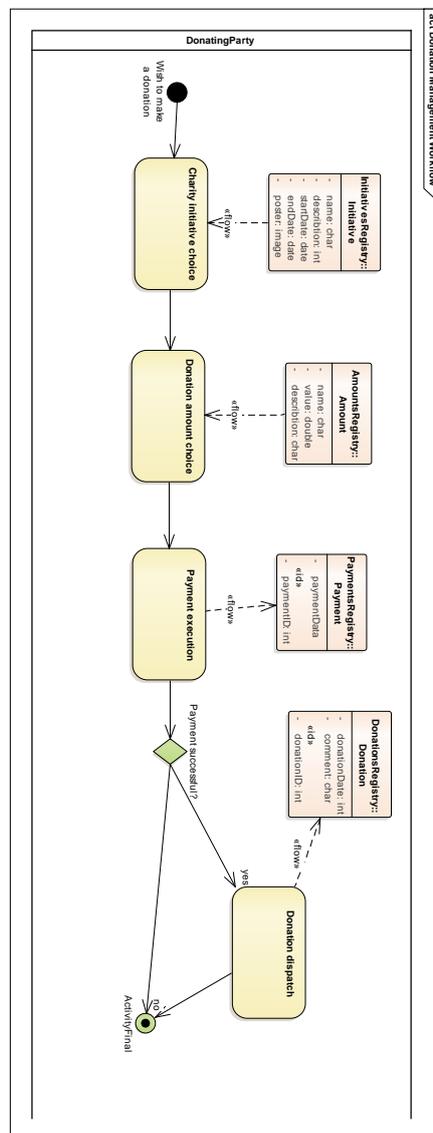


Figure 11. Donation management workflow

Following action diagram (Figure 12) shows workflow as well as information flow.

*Refined conceptual class diagram*

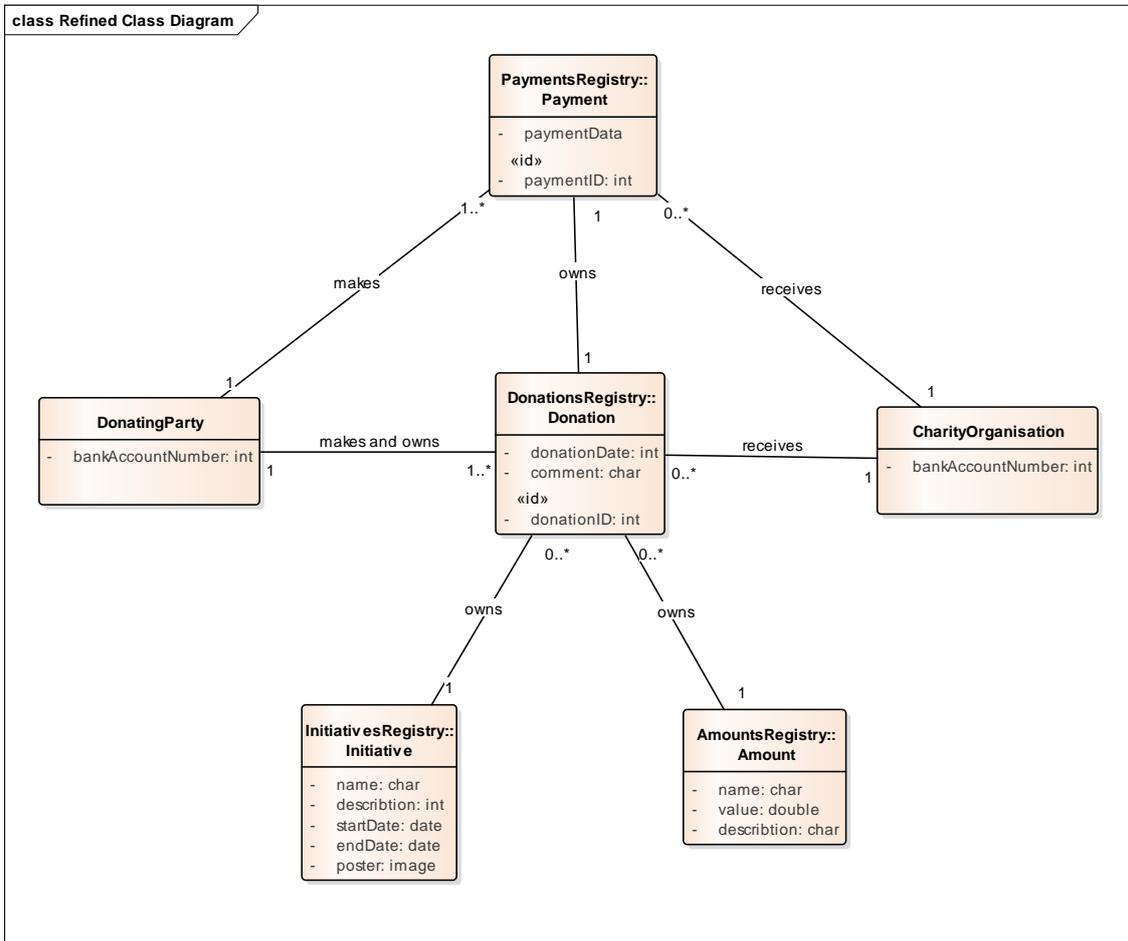


Figure 12. Refined class diagram

This iteration main object class is Donation.

Donation owns (donation) Initiative and (donation) Amount.

DonatingParty can make one or multiple Donation.

DonatingParty can make one or multiple Payment.

Donation owns Payment. Each Payment is related to Donation 1:1 using ID.

CharityOrganisation receives Payment and Donation.

Following state diagram (Figure 13) shows Donation execution states including one sub state.

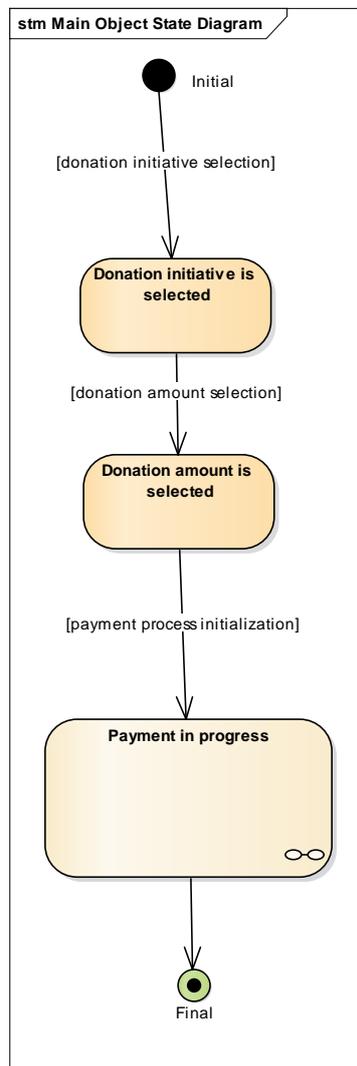


Figure 13. Main object state diagram

Following state diagram (Figure 14) shows Donation state “Payment in progress”.

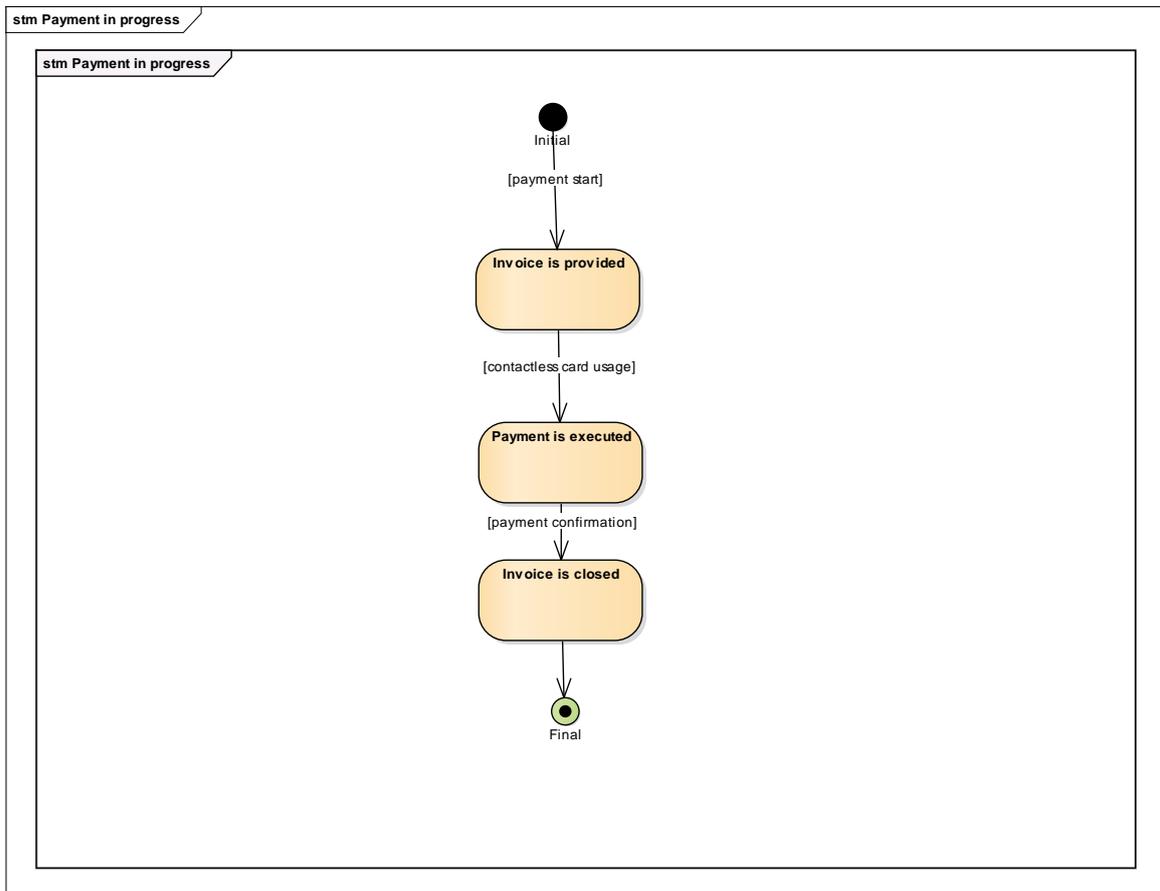


Figure 14. Payment in progress state diagram

### 3.2.5 Software analysis requirements result

#### Use Case UC1: Donation management

**MainParticipant:** DonatingParty

#### **Parties and Interests:**

- DonatingParty: Wishes attention attracting, simple to use, quick and convenient donation management which includes donation initiative, donation amount choice and payment proceeding.
- CharityOrganisation: Wishes DonatingParty to successfully accomplish donation.

**Prerequisites:** DonatingParty wishes to make a donation and approaches CharityOrganisation donation point.

**Follow Conditions:** Charity initiative and donation amount is chosen. Payment proceeded. (to CharityOrganisation)

**Main successful scenario:**

1. Potential DonatingParty wishes to make a donation
2. System shows donation initiatives to potential DonatingParty
3. DonatingParty chooses suitable donation initiative
4. System shows donation amounts to DonatingParty
5. DonatingParty chooses suitable donation amount
6. DonatingParty makes payment
7. System creates Donation and Payment, sends them to CharityOrganisation

**Extensions:**

5a. DonatingParty wishes to choose donation amount manually:

DonatingParty taps “Other Amount” option and enters desired amount manually

Corresponding donation management user interface sketches:



Figure 15. Initiative choice UI prototype in Estonian



Figure 16. Initiative choice UI prototype in English



Figure 17. Donation amount choice and statistics UI prototype in Estonian



Figure 18. Donation amount choice and statistics UI prototype in English

Prototypes were made in an application prototyping software [marvelapp.com](https://marvelapp.com)

## System sequence diagram

Following sequence diagram (Figure 19) shows Donation management use case for the main successful scenario.

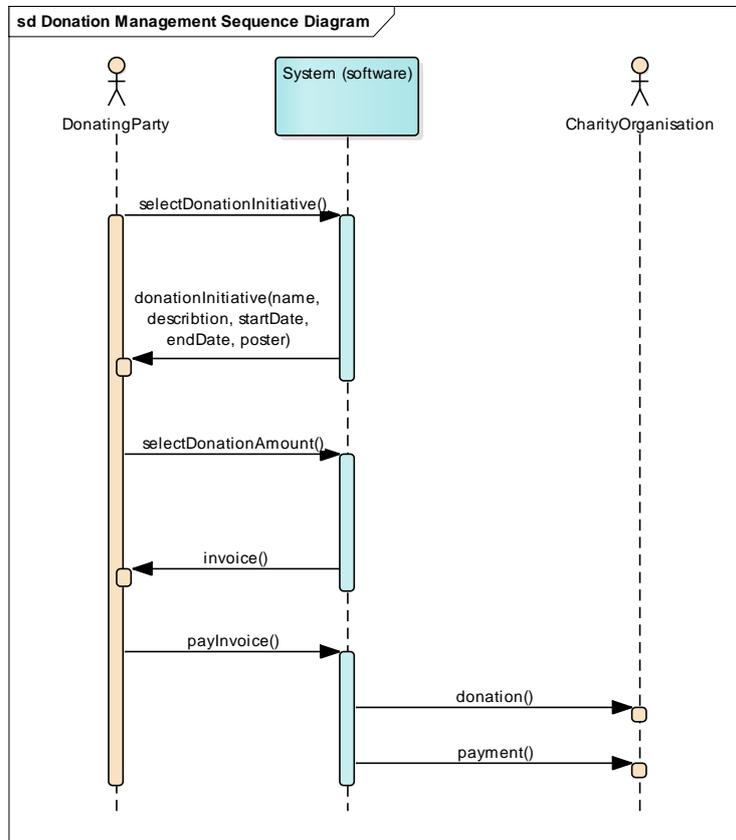
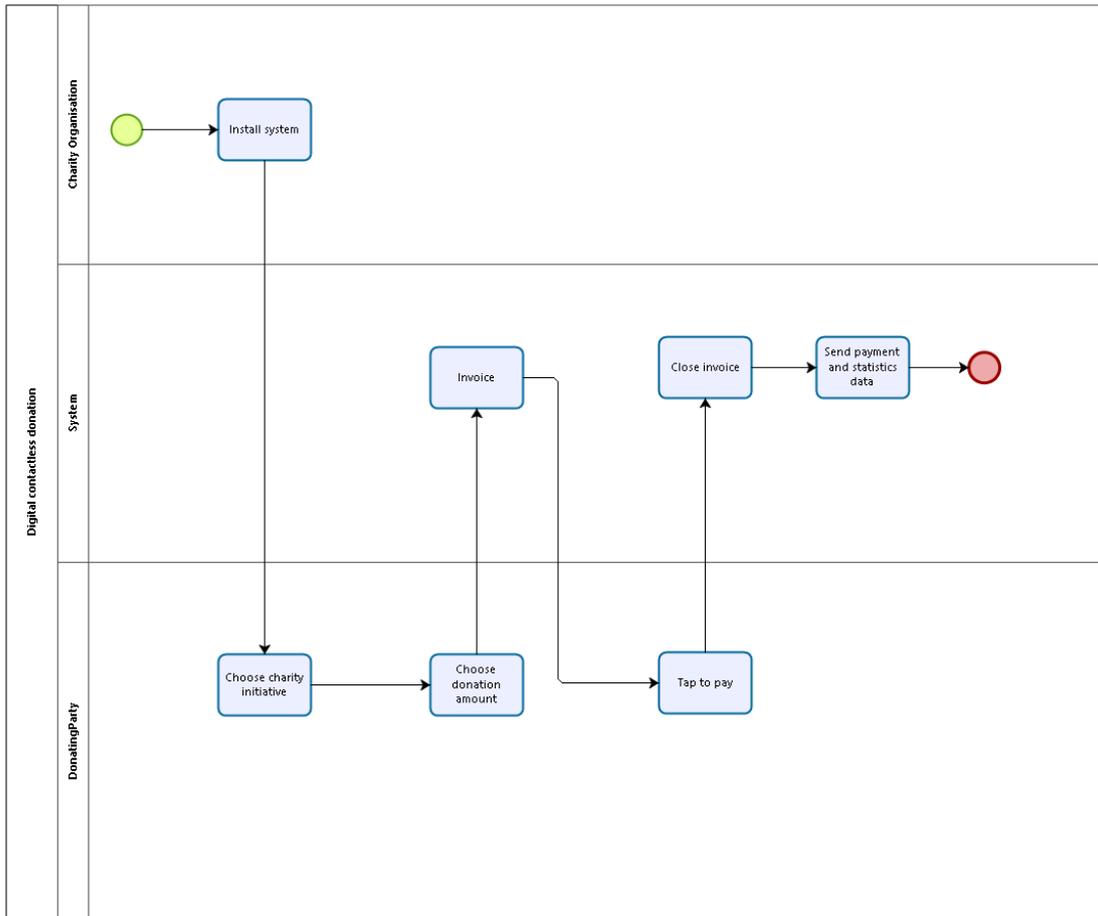


Figure 19. Donation management sequence diagram

Donation management system representation in the form of business model (Figure 20):



Powered by  
bizagi  
Modeler

Figure 20. Digital contactless donation business model

### 3.2.6 Results of the analysis

Current donation methods were analyzed. Alternative donation method was designed, analyzed and visually prototyped. Mistakes and inaccuracy remain possible in current analysis.

### **3.3 Confirmation of value by potential customer**

During analysis, planning and design stages of current donation solutions as well as proposed “Digital Contactless Payment Donation Points” solution the head of Tallinn Children’s Hospital Foundation Inna Kramer was consulted. After alternative solution proposal, the following comments were made:

- From the donations collector, entire process is very interesting and appealing
- For donating party, it (proposed system) makes donation very simple and at the same time interactive and for charity organization it is very beneficial to receive information/statistics on donations
- Wish to have a more detailed talk on proposed system realization after current thesis submission

The copy of mentioned letter is available in appendix (in Estonian).

From the given comments on proposed system the following conclusions can be made:

- “Digital Contactless Payment Donation Points” system design and prototype can be considered as successful
- Working prototype with future fully operating system is desired

I would like to express my gratitude to the head of Tallinn Children’s Hospital Foundation Inna Kramer for providing consultation and relevant opinions throughout the writing of current thesis as well as reviewing an alternative proposed method for donations collection.

## 4 Summary

The aim of this thesis was to review and analyse current solutions in sphere of charity in Estonia and other Western countries (United Kingdom was chosen), as well as to come up with a new solution that would include beneficial sides of contactless payment systems and computerised information flow collection, analysis and management.

During the study, I have reviewed current donation situation in Estonia and United Kingdom coming up with up-to-date statistical data that have helped to understand sphere's overall state of affairs. This included mentioning collection tools used by Estonian and United Kingdom charity organisations. Given the fact that designed alternative donation system should include card payment system, bank card payment statistics in Estonia and United Kingdom were shown. Contactless payment technology overview was aimed at familiarity with the technology and related statistics.

Practical part consists of current popular donation methods detailed analysis, which includes charity boxes and donation phone numbers. The advantages and disadvantages of both methods were listed leading to alternative donation method formulation, design and analysis.

A non-operational graphical prototype was designed based on a previous design and analysis of alternative donation method that includes initiative and donation amount choice steps as well as required UI elements.

After the main part of alternative donation method design and analysis was completed, a confirmation of value by potential customer was received from Inna Kramer, the head of Tallinn Children's Hospital Foundation, including rather positive feedback.

Although charity is a long-established sphere of human society, innovations and non-standard solutions brought by information technology open a wide, if not infinite, variety of possibilities for charity organization, making donation process simple, quick and attractive as never before, besides giving the last one an opportunity to collect one of the most powerful resources available to us – information.

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## Appendix 1 – Letter 1 from head of charity organisation

*Tere Oliver!*

*Vaatasin töö üle- väga põnev. Ega ma ju ei oska IT poole pealt midagi lisada, aga annetuste koguja poolelt on kogu protsess hästi huvitav ning ahvatlev. Ja seda mitmel põhjusel- annetajale teeb see annetuse tegemise väga kergeks ja samas ka interaktiivseks ning toetuse saajal on jälle hea saada igasugust infot/statistikat annetuste kohta. Kas ma saan õigesti aru, et ühe sellise punkti juures saab ikkagi toetada ainult ühte organisatsiooni; ja kas läbi mitme panga või ikkagi tuleb eelistada ühte pankat?*

*Kui töö ära kaitsed, siis tahaks ikkagi pikemalt rääkida kes ja kuidas võiks sellise töötava punkti teha meile.*

*Heade soovidega*

*Inna Kramer*

## Appendix 1 – Letter 2 from head of charity organisation

*Tere, Oliver!*

*Jah, midagi sellist nagu sa kirjeldad, meil tõesti kasutuses pole. Ja ei tea ma ka, et Eestis üldse oleks. Aga see oleks äärmiselt huvitav. Oleksime sellise süsteemi rakendamisest vägagi huvitatud. Kas sa saaksid ja sooviksid meid sellesse projekti kaasata?*

*Ehk on parema ülevaate saamiseks mõttekas mkohtuda- olen selleks igati valmis,*

*Heade soovidega*

*Inna Kramer*