FACULTY
OF INFORMATION
TECHNOLOGY
CTU IN PRAGUE

ASSIGNMENT OF BACHELOR'S THESIS

Title:	Feasibility Study of Student Account Information System
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Study Programme:	Informatics
Study Branch:	Information Systems and Management
Department:	Department of Software Engineering
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Instructions

The goal of Bachelor thesis is to investigate feasibility of design, implementation and deployment of the Student Account information system.
- Analyze economic aspect of cashback systems, its benefits towards customers and banking organizations.
- Describe the current version of the Student Account information system and identificate its weak points.
- Determine user requirements in order to improve the Student Account information system.
- Model the most crucial business processes with the help of BPMN method in order to convey improvements upon the Student Account information system.
- Design and develop web application which allows user to follow the state of his account, transfer money to other users accounts and get cashback after certain payments.
- Convey economic evaluation of costs which are caused by implementation of the Student Account information system.
- Assess economic impact of the Student Account information system (CTU, CTU students, banking organizations).

References

Will be provided by the supervisor.

Ing. Michal Valenta, Ph.D.
Head of Department

doc. RNDr. Ing. Marcel Jiřina, Ph.D.
Dean

Prague December 12, 2018

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Bachelor's thesis

Feasibility Study of Student Account Information System

Department of Software Engineering
Supervisor: Ing. Dana Vynikarova, Ph.D

January 9, 2020

Acknowledgements

Thanks to all for all.

Declaration

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In V Praze on January 9, 2020 . . . . . .

Czech Technical University in Prague
Faculty of Information Technology

Citation of this thesis

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Abstrakt

Hlavním cílem mé bakalářské práce je studie proveditelnosti návrhu, implementace a nasazení informačního systému pro studentské konto. Jako výsledek jsem analyzoval současný stav IS Studentské Konto, zjistil jeho silné a slabé stránky, vytvářil BPMN modely nejdůležitějších business procesů, navrhnul aktualizaci tohoto informačního systému. Aktualizace zahrnuje vrácení peněz - cashback. Abych předvedl, jak by to mohlo fungovat, vyvinul jsem webovou aplikaci, která může působit jako prototyp. Nakonec, provedl jsem business hodnocení projektu, aby zjistil, zda je možné aktualizovat IS Studentské Konto.

Klíčová slova Závěrečná práce, studentské konto, menza, business process, integrace, informační systém, LaTeX.

Abstract

The main goal of my Bachelor thesis is an investigation of feasibility of design, implementation and deployment of the Student Account information system. As a result, I analyzed current state of Student Account information system, detected its strong and weak points, created BPMN models of most important business processes and proposed an update of this information system. An

update involves cashback refunds. In order to showcase how it could work I developed web application, which can function as a prototype. Finally, I conducted project evaluation in order to investigate if an update of Student Account IS is achievable.

Keywords Thesis, student account, canteen, business process, integration, information system, LaTeX.

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Introduction

In modern economy Information system as a concept has a crucial value, since it has a potential to scale up economic processes to the next level. The key element is a possibillity of cashless payment, which increases the amount of payment transactions per second dramatically. So called Student Account is an information system whithin CTU in Prague and UCT, which includes information about payment transactions, amount of money stored in the account and etc..

Although Student Account is being used on a constant basis, it rarely gets updates and definetely has certain weak points, for instance there is no way of putting money on your account whithout cash.

Author of this thesis has chosen this particular topic by reason of opportunity to improve Student Account information system, adding new features, such as cashback, and possibly transcend it to the next generation of information systems.

The main goal of this Bachelor thesis is to investigate feasibility of design, implementation and deployment of the Student Account information system.

Chapter 1

Main tasks

In order to achieve this goal, several tasks must be completed. First of all, we have to analyze economic aspect of cashback systems, its benefits towards customers and banking organizations.

Secondly, it has to be described what the current state of the Student Account information system is, then we need to indicate its strong and weak points.

After that, model the most crucial business processes with the help of BPMN method in order to convey improvements upon the Student Account information system.

After that, we have to determine user requirements in order to improve the Student Account information system. On a basis of user requirements it is possible to design and develop web application which allows user to follow the state of his account and get cashback after certain payments.

Finally, we could convey economic evaluation of costs which are caused by implementation of the Student Account information system, and assess economic impact of the Student Account information system (CTU, CTU students, banking organizations).

Chapter 2

Cashback anylysis

2.1 The definition of cashback

Firstly, the definition of financial transaction needs to be given. Financial transaction is an operation, which is being carried out between two parties, most commonly a buyer and a seller. Financial transaction includes a shift in the state of these two parties finances, i.e. subtraction on the side of the buyer and addition on the side of the seller.

Secondly, it is needed to point out what cashback is. Cashback is a financial transaction towards customer after he executes a certain payment operation. It functions as an incentive, which is given to customer, therefore he would purchase more products and get a certain percentage of his spendings back. Usually cashback is released as a form of creditdebit card, or as a customer loyalty system.

If the attentive reader may have noticed, the shift in the state of finances as a result of financial transaction, when cashback is implemented, consists of two parts. First step is similar to the usual financial transaction, meanwhile second step is carried out from seller to customer. Product marketing, which uses cashback as a primary tool to market the products, is called cashback marketing.

2.2 Cashback advantages for banks and commercial organizations

In this section cashback advantages for banks and commercial organizations are going to be explored. Cashback marketing strategy is based on the idea that product is cheaper due to the refund. That fact could encourage more demand from customer, therefore increase brand loyalty. In addition to that, cashback marketing has a potential to extend the product lifecycle, where product lifecycle is the period from product entering a market and product

removed from market. Finally, it simply could attract more customers. It can be seen, that banks and companies have plenty of benefits to implement cashback marketing as an increase in sales can be achieved.

2.3 Cashback advantages for customer

Cashback advantages for customer are going to be studied in this section. The main one is obviously cash refund. Subsequently, it positively affects customer savings. Cashback in its core is a discount, however it has a crucial distinction. Discounts are usually based on a sense of urgency, lasting for a specific period of time. Cashback, on the other hand, is stable and systematic, allowing customer to save money on a regular basis.

2.4 Student financial affairs

This section deals with student finances and how it affects student engagement. Initially, it needs to clear out what is student engagement. Student engagement is basically a measure of how much focus and attention students are able to devote to education process, to simplify even more, student engagement is the degree of participation in learning activity. In order to qualify the level of education given at the university, the level of student engagement should be taken into account. As a result, high reputation and high educational standards are not key factors in enabling great learning experience, since they are not a guarantee of high level of student engagement.

Student's financial situation must be taken into account, when investigating student engagement. According to the study, that was conveyed in Australia, more than 72 percent of students in 2006 are in paid employment, usually working long hours during semester. In addition, study also indicates, that student are working mostly to cover basic needs, those are food, rent and household expenses. Psychological aspect is also involved, i.e. many students are asking friends to borrow them some money for food, which is quite a humiliating experience. Similar study, which was conveyed in UK, indicates, that keeping up with finances while studying may be a struggle for students. As a matter of fact, the study suggests, that it is difficult for students to manage their priorities between working and studying.

Correlation between student employment and student engagement has been presented in the study. A great proporion of students have missed classes or assignements due to their employment commitments. In fact, the time, students are able to dedicate to studying, has been shortened. Subsequently, it results in decline in level of student engagement. Many students have addmitted, that disengagement from studies could happen uncontrollably, since they are focusing on covering basic needs.[3]

As one of the improvements of Student Account, cashback could be inserted. Considering the fact, that there are sufficient amount of discounts for students, such as books, food, travel tickets, cashback is a logical step forward. The main idea is that student instead of discount would get refund on his Student Account, that he could spend on food in canteen, beverages and snacks. The main advantage of cashback is that it lessen the pressure of managing finances in some way, allowing students to focus more on learning experience. Cashback system will also provide students with psychological support, showing them, that universities are caring about them. Overall, it is possible to conlude that implementation of cashback in Student Account information system has a potential to increase the level of student engagement.[1]

Chapter 3

Current state of Student Account IS

3.1 General characteristics of Student Account IS

Overall description of Student Account system will be presented in this section. Within CTU in Prague there are several so-called Account systems, which are used as payment gate for services provided by CTU. Each structural service of CTU has its own account system, for instance, ISKAM, accomodation management system, or [name], account for copying and printing services. This bachelor thesis deals with account system, which is used for catering within CTU in Prague. Later in this thesis mentioned account system for catering will be called Student account management sysem.

Student Account information system consists of several parts, which are mainly application 'Stravnik' a 'Jidelnik'. Web pages, which was developed in 2013, uses php as a main language. 'Stravnik' represents itself to be an account management application, which shows the state of student account and financial transaction carried out within several months. 'Jidelnik' is an application, that shows current menu list and canteen working hours. There are 'Jidelnik' mobile applications for Android and iOS, which have the same functionality with few additional changes. In order to obtain data, iOS application uses API calls, Android applications use parsing of php pages. Those applications don't have information about state of student account though. Currently there is only one mobile application, that shows state of student account. However, this application doesn't use authorization gateway and considered to be a scam.[5]

3.2 Strong and weak points of Student Account IS

The main problem of Student Account information system is its isolated stucture. There is only one way to update data in database, which is through terminals on workstations in canteens. Although such structure definetely solves security problem, isolated information systems is considered to uneffective for business and obsolete. This isolation architecture is bassically have to be solved by implementing middleware, that functions as an integration system.

Following strong points of Student Account IS have been detected:

- it has information about state of account
- it has transaction history

Following weak points of Student Account IS have been detected:

- web application is generally old-fashioned
- there is no possibility to put money on your account whithout cash
- non-intuitive interface
- there is no API for external use

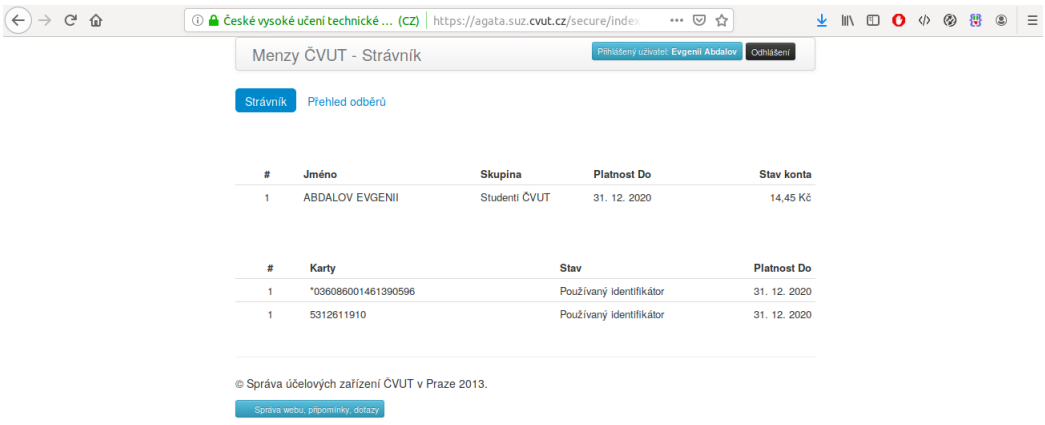

Figure 3.1: Current state of Student Account web app

3.3 AS-IS business processes

This section showcases business processes, that take place in Student Account IS. BPMN model language is used to demonstrate bussiness processes.[4]

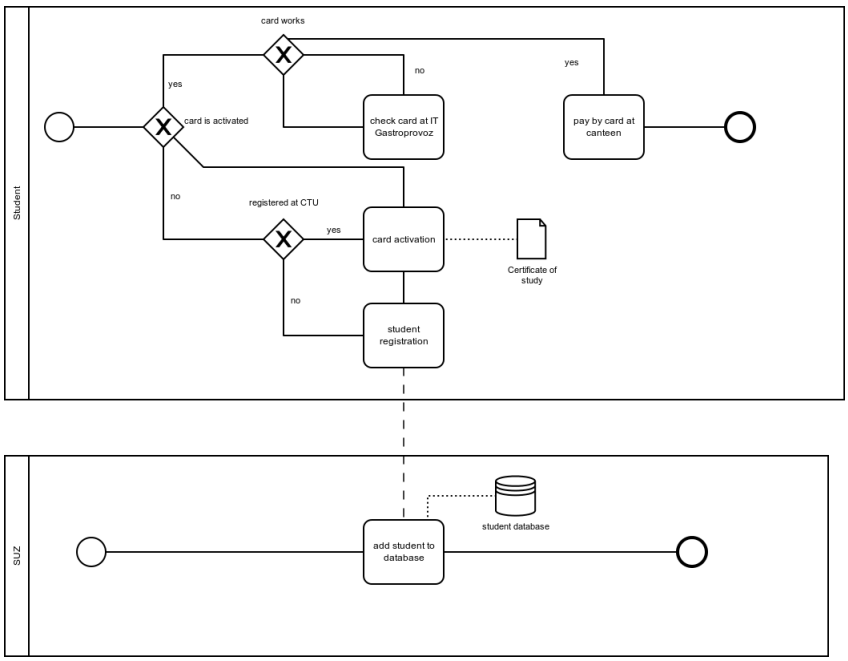

Figure 3.2: ISIC registration process for internal CTU students and for external students

Card should be activated/updated every year. In order to activate card, student has to show valid certificate of study for current academic year. For CTU students there is 'Vypocetni centrum CVUT', where it is possible to update your card. For external students it is needed to register at SUZ first. If student doesn't have ISIC card, OpenCard or Litacka card could be used as a substitute. In case card, that has been already activated, doesn't function properly, student could use help at 'IT Gastroprovoz'.

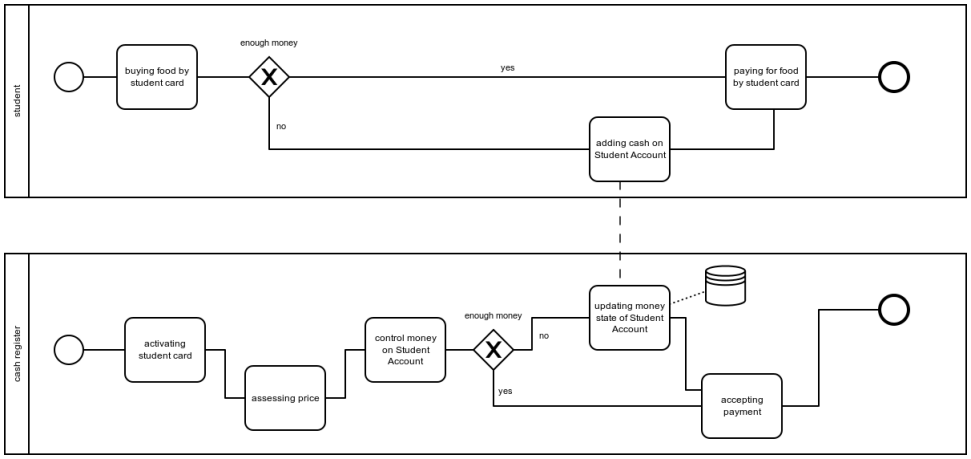

Figure 3.3: Payment control process

In case there is no enough money on the Student Account, canteen worker requests student to put money on account, when money has been added, there is change in database.

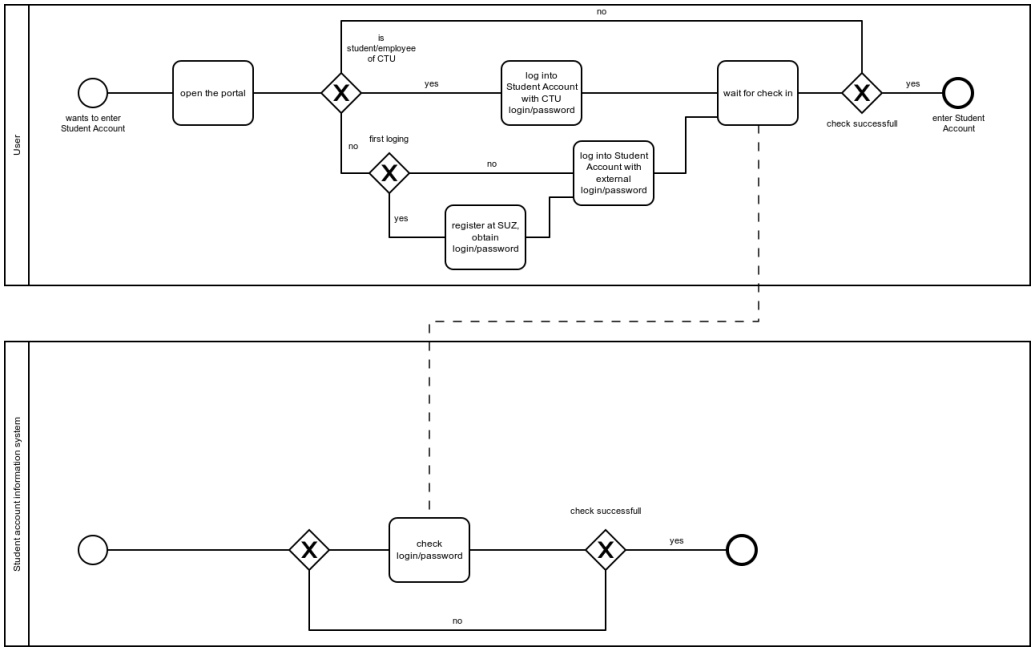

Figure 3.4: Check balance in student account information system

In order to check balance in Student Account information system, student has to enter web portal. If student is CTU student, CTU login/password

could be used. In case student is not from CTU, then during registration at SUZ external student is given his own login/password for web portal.

Chapter 4

TO-BE, Analysis

This chapter is dedicated to design of a better version of Student Account IS, that includes cashback refunds. New version of Student Account IS will be referred as a New Student Account IS.

4.1 User requirements

In order to understand better, what should be implemented in the New Student Account IS, User requirements should be defined. In our case the main users are students. User requirements have to be defined as a student requirements.

Primarly, the main requirement is to have a possibility to check your Student Account balance fast and convenient. Possibility to check money balance would allow student to get more clear picture about his financial state, thus allowing him to control his finances more properly.

Secondly, as it has been mentioned before, there is no possibility to transfer money from your bank account to Student Account. Therefore next requirement is to have a possibility to transfer money online from user's bank account to Student account, which has a potential to shorten time spent in queue in the canteen. Shorten time in queue would allow student to gain more time for studying and resting.

Finally, there is cashback in order to support student financially. User should have a possibility to monitor his cashback transactions, including information about amount of money transfered, transaction timestamp, etc..[2]

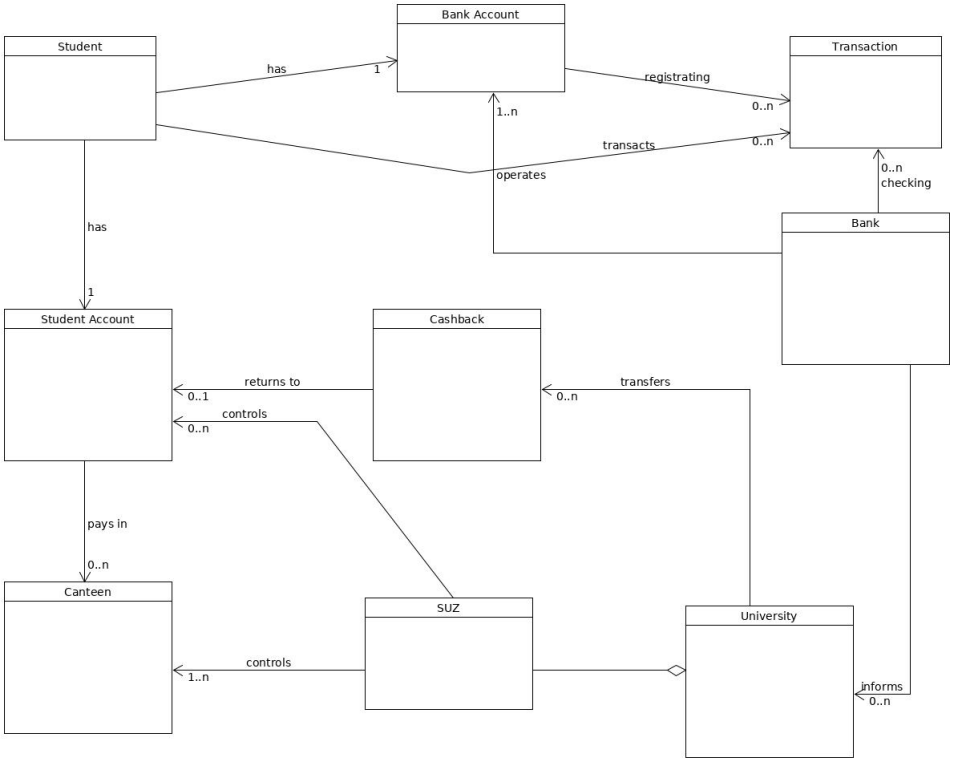

Figure 4.1: Domain model

To specify domain and interconnections of its parts, domain model has been created.

4.2 Cashback mechanism

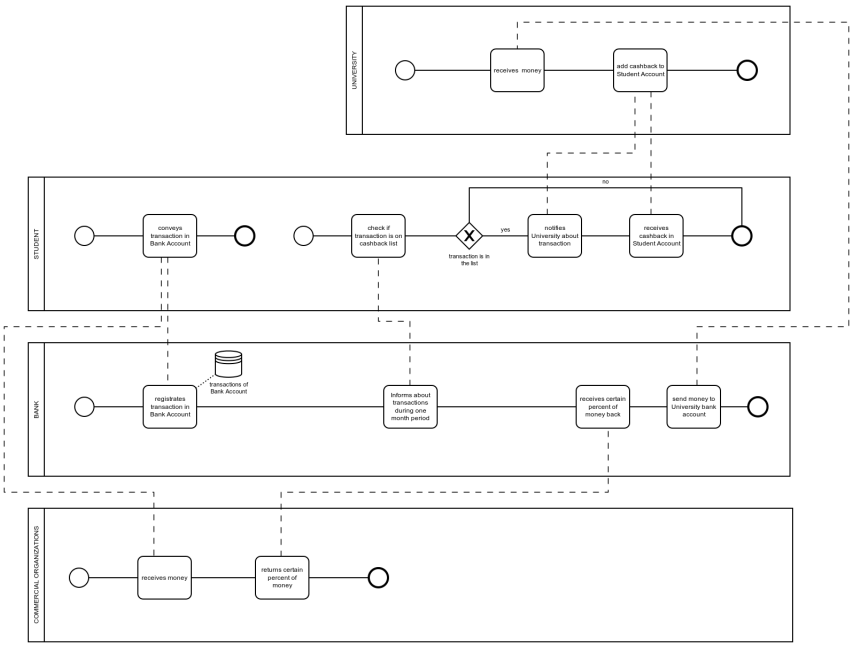

Figure 4.2: Cashback processing

When Student pays for something by bank card, transaction is being registrated in Bank system. Commercial organizations should return a certain percent back to Bank as a student discount, afterwards those money will transfer to University bank account. Once a month Bank checks money transactions on student's bank account and send information about transactions to Student. When Student identifies transactions, which are in so-called Cashback list, he notifies University about that. University procceds that internally and refunds cashback on student account. As it can be seen, Student here serves as a buffer between Bank and University, so that University doesn't have access to student transactions information. It has to be mentioned though, that security issues are not an object of the study of this thesis. Therefore it may not be designed properly.

Chapter 5

TO-BE, Data

Based on domain model, following database model has been created:

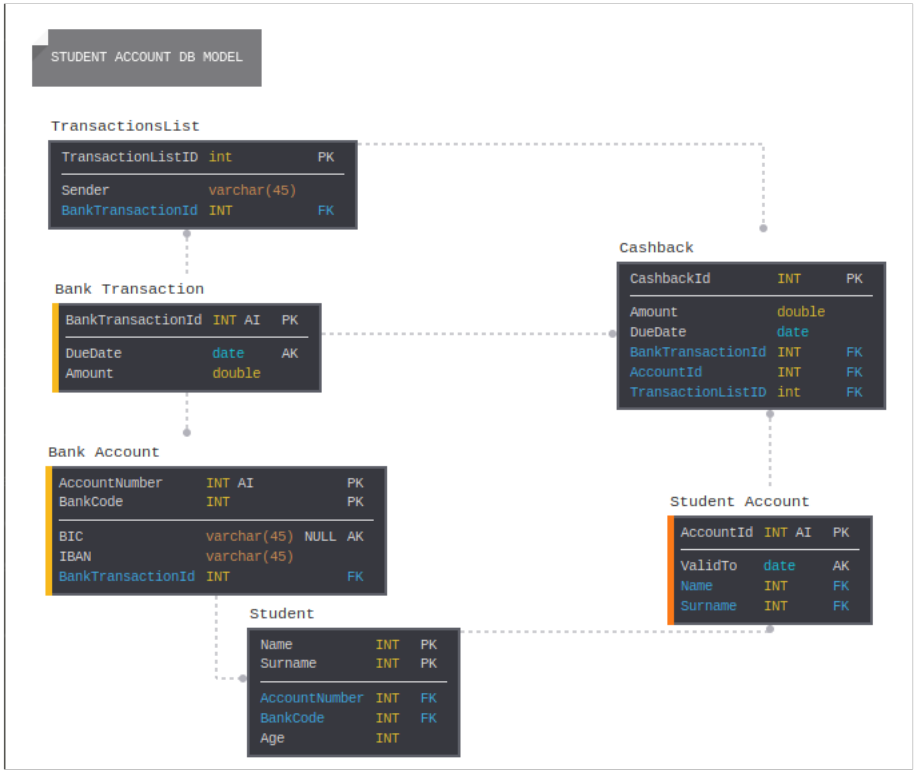

Figure 5.1: Student Account database model

Since bank account data is provided by Bank and student account data is provided by University, actual application has Cashback and TransactionList entities implemented in actual database.It is needed to be pointed out, that TransactionsList is a list of approved transactions, for which student could get cashback. It is basically an agreement between Bank and University that facilitates cashback payments to students.

5.1 Student Account data

Student Account has student personal data - name, surname, group id, and money balance state. Due to the fact that Student Account doesn't have API

to obtain data for external applications, there is only one way to get data - by parsing html page with mentioned data.

```
<table class="table table-condensed" style=" font-size: 13px;">
  <thead>
    <tr>
      <th style="width:30px; text-align:center">#</th>
      <th style="width:100px; text-align:left">Jmeno</th>
      <th style="width:60px; text-align:left">Skupina</th>
      <th style="width:60px; text-align:left">Platnost Do</th>
      <th style="width:60px; text-align:right">Stav konta</th>
    </tr>
  </thead>
  <tbody>


    <tr>
      <td style="width:30px; text-align:center">1</td>
      <td style="width:100px; text-align:left">ABDALOV EVGENII</td>
      <td style="width:60px; text-align:left">Studenti CVUT</td>
      <td style="width:60px; text-align:left">31. 12. 2019</td>
      <td style="width:60px; text-align:right">6,45 Kc</td>
    </tr>
</table>
```

5.2 Bank transactions data

Ceska Sporitelna API system has been chosen in order to implement main cashback functionality. In order to test API functionality, sandbox has been set with following parameters:

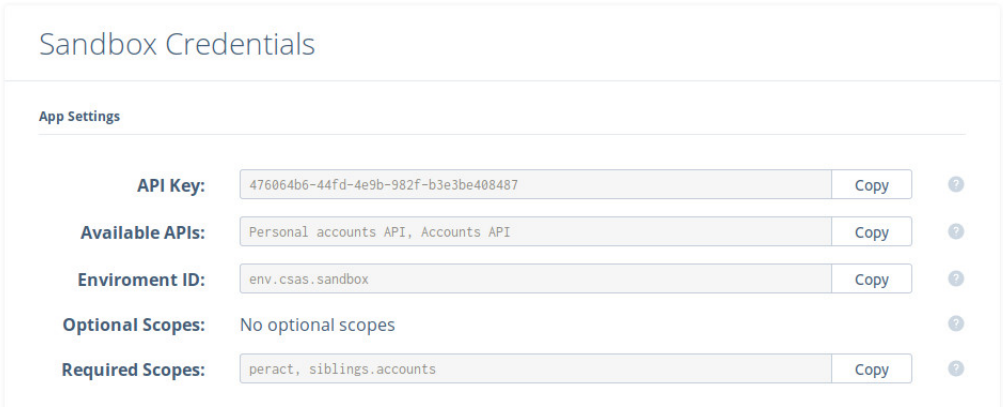

Figure 5.2: Student Account sandbox credentials

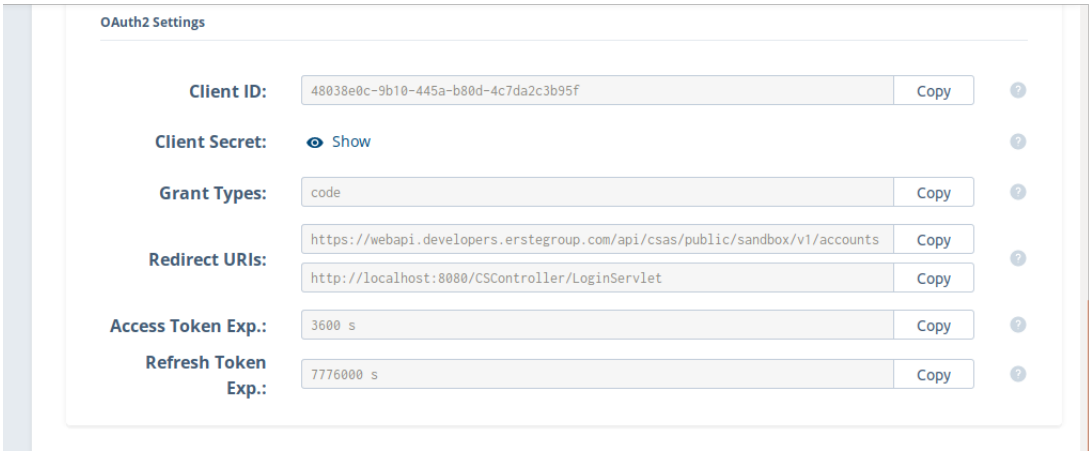

Figure 5.3: Student Account sandbox OAuth2 credentials

In order to obtain bank transactions data, user has to login into online banking portal first. Firstly, the following GET request should be sent to obtain CODE:

```
https://webapi.developers.erstegroup.com/api/csas/sandbox/v1/sandbox-idp/auth?
redirect_uri=http://localhost:8080/CSController/LoginServlet
&client_id=48038e0c-9b10-445a-b80d-4c7da2c3b95f&response_type=code
&access_type=offline&state=csas-auth
```

Figure 5.4: GET request to obtain CODE value

When this request has been processed, REDIRECT_URL has as a parameter CODE value. After user has acquired CODE value, the following POST request should be sent in order to obtain ACCESS_TOKEN which is needed for authentication:

```
curl -X POST https://webapi.developers.erstegroup.com/api/csas/sandbox/v1/sandbox-idp/token
-H 'Content-Type: application/x-www-form-urlencoded'
-d 'grant_type=authorization_code
&code=CODE
&client_id=48038e0c-9b10-445a-b80d-4c7da2c3b95f
&client_secret=8c91c128-e206-4614-b7be-cba5d7ddecd9
&redirect_uri=https://webapi.developers.erstegroup.com/api/csas/public/sandbox/v1/accounts'
```

Figure 5.5: POST request to obtain ACCESS_TOKEN value

When application has ACCESS_TOKEN, it is possible to authenticate other requests. Example of GET request to get transaction history:

```
https://webapi.developers.erstegroup.com/api/csas/public/sandbox/v1/accounts/my/accounts/id/
transactions?fromDate=2019-10-15&toDate=2019-10-30&size=100&page=0
```

Figure 5.6: GET request to obtain transaction history

Chapter 6

Project evaluation

6.1 Strategic Assessment

In this section we need to assess if proposed update of Student Account Information system fits into vision of future development of CTU, i.e. it corresponds with long-term goals of CTU. According to the official CTU documents, some of its main goals are:

- Quality assurance, which includes support of crucial processes(activities) in the information system of CTU for the needs of quality assurance.
- Diversity and accessibility, the main objective in this area is to attract a sufficient number of students studying at the University to ensure its continued development.
- Data-orientated decision making.

In 2020 CTU will mainly focus on developing and updating a modern competitive IT system. It will further develop the CTU information system, which comprehensively supports the main processes of the university, managerial desicion-making(MIS) and administrative support of the university operation. It will focus on latest trends, international standards and recommendations. It will further develop in the direction of extending functionalities, ensuring reliability of services and system integration.[6]

It can be seen, that proposed update of Student Acount IS is relevant within the framework of CTU main goals.

6.2 Cost Benefit Analysis

Cost/benefit analysis will be conducted in this section, i.e. comparison between expexted cost and expected benefits. Cost will be estimated in time effort. When estimating time effort following factors was taken into account.

Personnel factors, which are characteristics of people, working on the project. Main advantage, that CTU has, is that, all its information system components are supported and developed by people, that work at CTU, which allows them to understand CTU needs and problems better, than outside developers would. For instance, VIC, that is working on KOS development, partly consists of FEL professors. They are experienced, well-educated people, who can be sometimes old-fashioned as far as development approach is concerned. To sum this up, it can be concluded, that as far as personnel factors are concerned, there should not be a problem with those.

Project factors, which are connected to project management and organization management, working conditions and employees turnover. It should be taken into account, that CTU is financed by different organizations, among which are both commercial and state-controlled organizations. Potential problem, that could CTU face, is a conflict of interests between these organizations, which could postpone financing transactions. It would definetely cause increase in time effort.[7]

Estimation of required activities will include

- data storage integration
- integration module development
- Bank-University cashback agreement
- Cashback app development

Data storage integration is a structural change, that requires high level of management coordination. As a result, it is influenced by Project factores, which means it demands more time effort.

Integration module development, which is integrating Student Account with other information systems. CTU has its own 'Transakční zúčtovací systém'(Transaction clearing system), which manages all other accounts and transactions within those accounts. Therefore it makes sense to integrate Student Account with Transaction clearing system. It will be influenced by personnel factores, which means it requires optimal time-effort.

Bank-University cashback agreement once again requires management control over the whole process. It is a complex business process change, that would be most crucial part of Student Account IS update. In addition Bank-University negotiatons would require managemental desicions from both sides, which means time-effort will be doubled. Cashback app development could be developed by a group of CTU student with some professionals as a team leader. Once again, it is mostly influenced by personnel factores, so time-effort is estimated to be optimal.

As far as benefits are concerned, following:

- Data will be stored in one data storage, which makes data management much more effective, costs for data storage will be reduced.

- Student Account will be integrated with other accounts at CTU, which makes business logic more coprehensive, therefore business processes of CTU IS will be more effective.
- Bank-University cashback agreement would attract more attention from the side of private organizations, which could potentially lead to increase in level of private investments to CTU.
- Cashback app has a potential to make a positive effect on PR, which will attract more students to CTU, this bring more investments to CTU.

6.3 Risk Evaluation

Possible risks will be considered in this section. Since main profit source is sales at the canteen, we should examine possible risks that caused by problems with canteens. Canteen reconstruction could lower amount of sales, and considering the fact, that canteens mostly are placed in post-soviet buildings, chances for reconstruction are quite high. However, since new canteen at CIIRC has been opened, reconstruction should not infuence sales that much.

Food poisoning has a possibility to stop sales immediately until further inspection. However, quality and high standards may reassure, that chances for food poisoning are low.

One of the main technical risks is data storage failure. It will make application usage irrelevant, as Student Account data is unaccessible. In order to prevent data storage failure, it needs to convey data storage check procedure every semester.

6.4 Cash Flow Forecasting

According to financial plan, CTU has planned in 2020 to invest 1 million czech crones into development od IS/IT for faculties and its components. We will take it as a total investment into the Student Account project.

Profit from Student Account will be considered as a profit from sales at canteens and cafes, as Student Account is connected to this financial activity. Sales data is provided by SUZ and it can be found in SUZ annual reports:

	2014	2015	2016	2017	2018
CTU students	952,041	899,965	874,543	849,996	869,107
Other students	160,266	157,735	157,440	150,410	148,844
CTU employees	103,685	93,172	85,737	82,719	88,701
Others	565,058	522,896	496,985	524,664	612,531
Total	1,781,050	1,673,768	1,614,705	1,607,789	1,719,183

Figure 6.1: Food sales 2014-2018 by visitors groups

Data in table above represents amount of food units sold to a certain group of visitors during the year. Considering the fact Student Account is designed for CTU students, CTU students data should be taken into account.

In order to make future predictions about food sales, it needs to assess average number of sales during the period between 2014-2018.[9]

$$(952,04100 + 899,96500 + 874,54300 + 849,99600 + 869,10700) = 889,1304$$

Figure 6.2: average sum for CTU students

Assuming the level of consumption would not decrease, it is possible to make annual profits predictions by multiplying average sum for students and average check at the canteen.

The low bound for check is at approximately 50 czk. , when the high bound is around 110 czk.. Therefore average check is

$$(50 + 110)/2 = 80$$

Figure 6.3: average check at the canteen

$$889,1304 * 80 = 71130,432$$

Figure 6.4: Annual profits

With this data, ROI(Return On Investment) could be estimated. ROI demonstrates investment's profitability. The formula for estimating ROI is following - (average annual profit/total investment) X 100. [8]

$$(71130432/1000000) * 100 = 7113.0432$$

Figure 6.5: ROI

ROI value demonstrates, that investment is extremely profitable.

Conclusion

The main goal of this Bachelor thesis was an investigation of feasibility of design, implementation and deployment of the Student Account information system.

During the course of this Bachelor thesis, I have conducted research upon current state of Student Account IS, detected its weak and strong points, modelled most crucial business processes of Student Account IS and developed web application, which can function as a prototype.

In addition, I proposed my own vision of how an update of Student Account IS could be done. It includes integration with other main accounts at CTU, which creates main CTU information system. I proposed an addition of cashback refund as a possible endeavour to increase the level of student engagement.

In the conclusion, it needs to say, that Student Account IS is an extremely crucial component of overall CTU information system and imortant part of CTU business processes. It leads to the fact, that integration and update of Student Account is inevitable.

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Appendix A

Seznam použitých zkratek

UI User interface

CTU Czech Technical University

IS Information system

CZK Czech crone

BPMN Business Process Model and Notation

Appendix B

BPMN

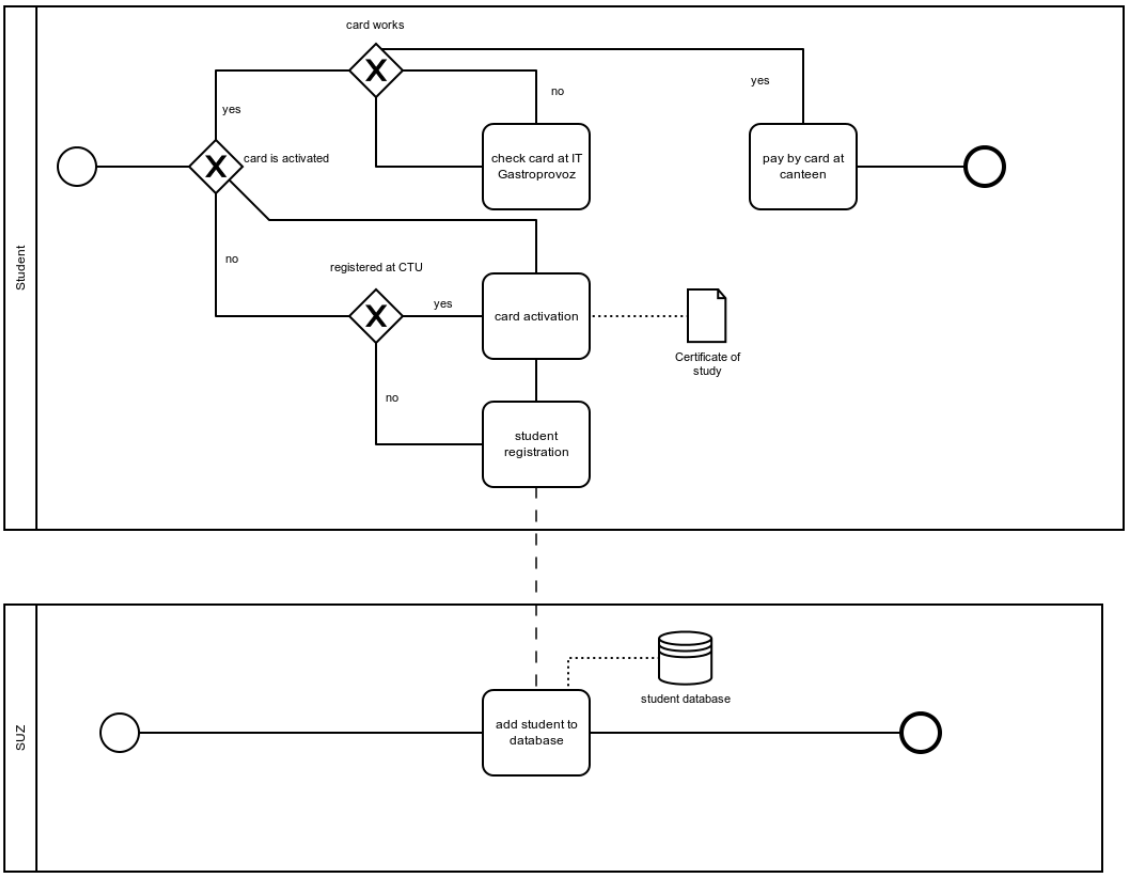

Figure B.1: ISIC registration process for internal CTU students and for external students

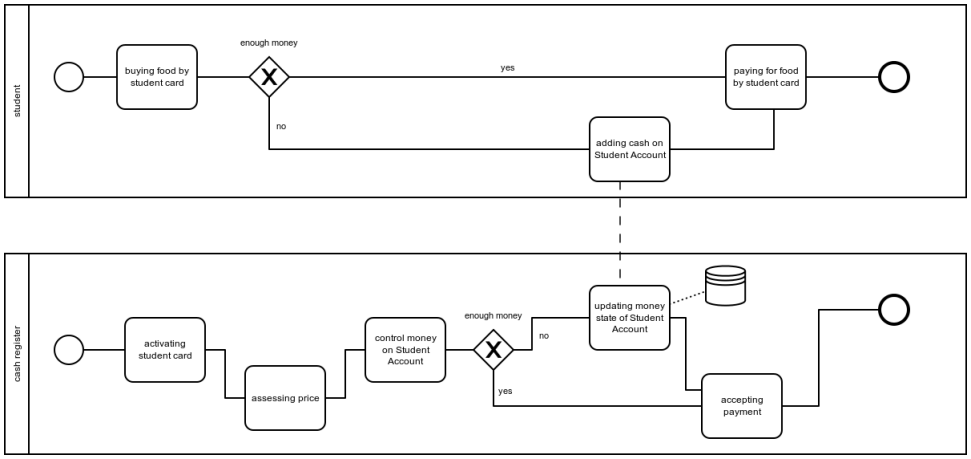

Figure B.2: Payment control process

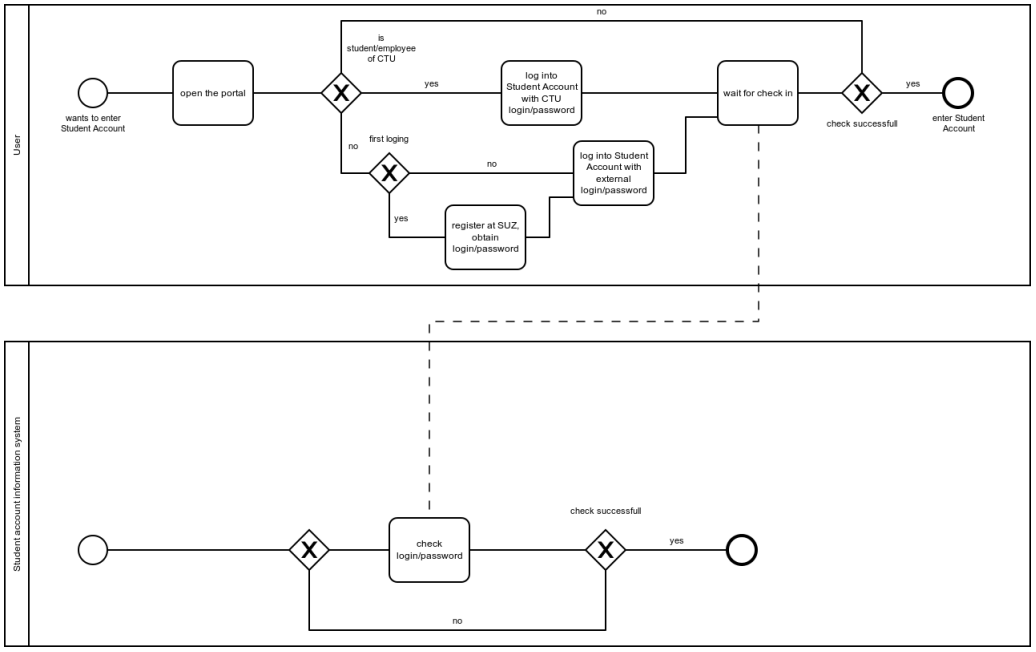

Figure B.3: Check balance in student account information system

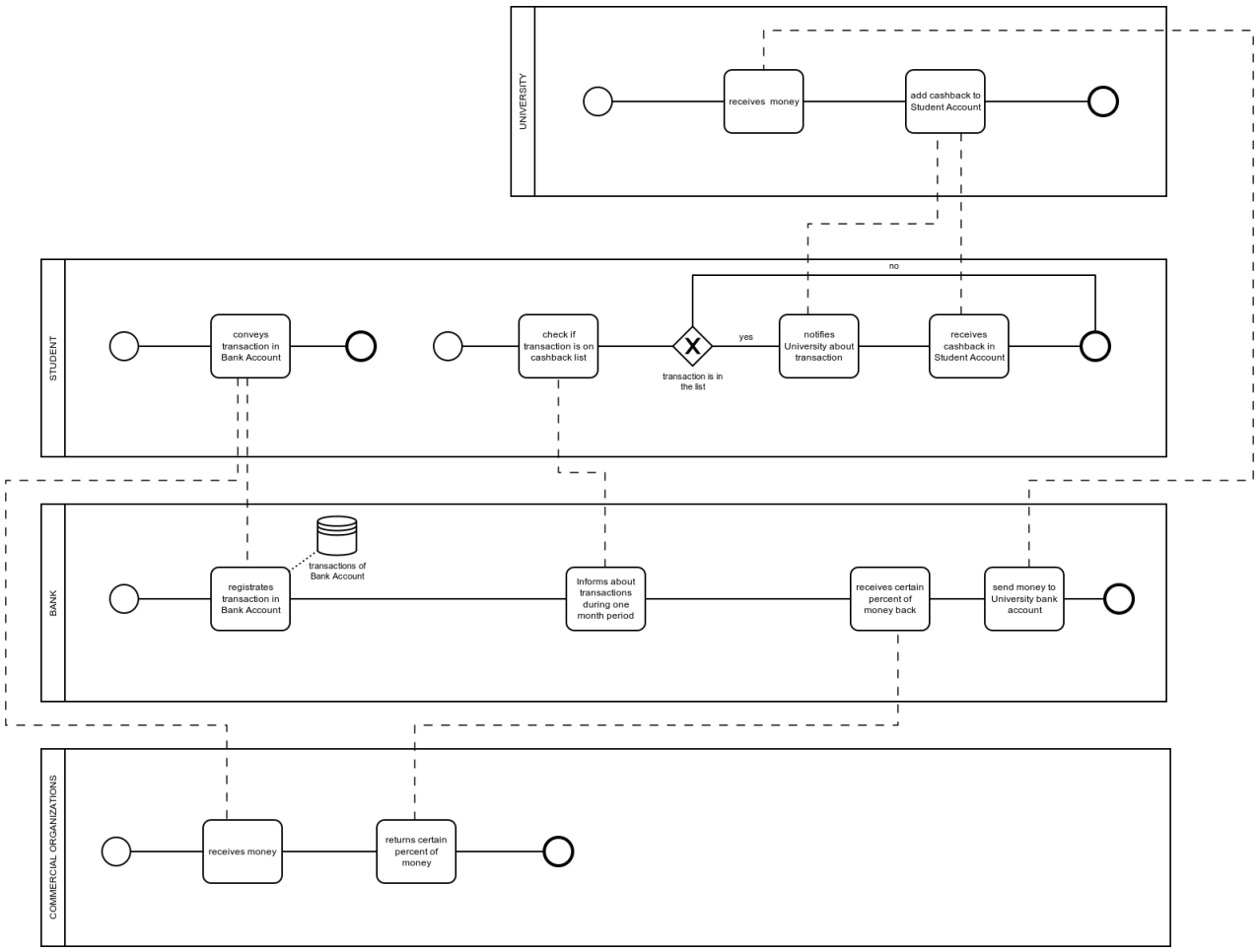

Figure B.4: Cashback processing

Appendix C

Student Account web application

C.1 Student Account frontend

UI is implemented with help of Java Servlets. First, user has to login to his bank account, then Student Account application gets access token. In order to check bank transations, button CHECK_TRANSACTIONS has to be pushed. It evokes method, that sends GET request to Ceska Sporitelna API. If access_token is not valid, user has to login again. If access_token is valid the response is a JSON array of bank transactions. This array later is being converted into string and sent to Student Account backend as a body of POST request.

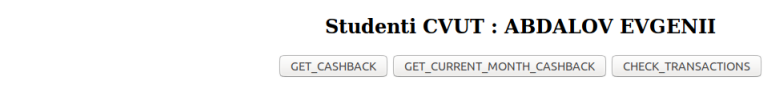

Figure C.1: Main menu

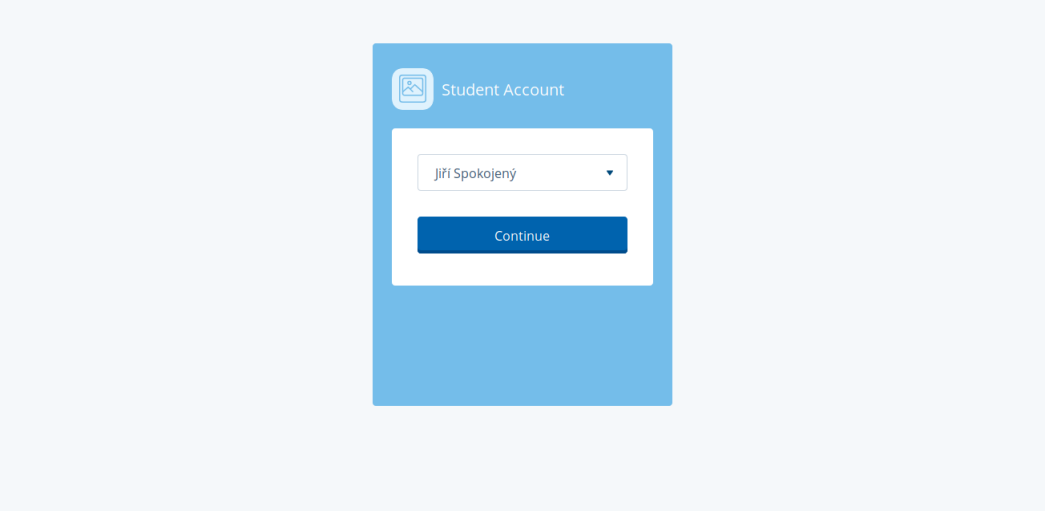

Figure C.2: Login to Bank account

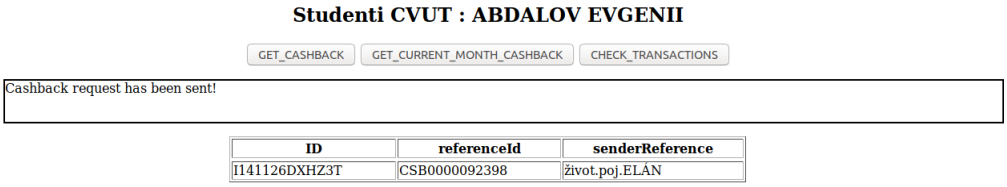

Figure C.3: Checking Bank transactions

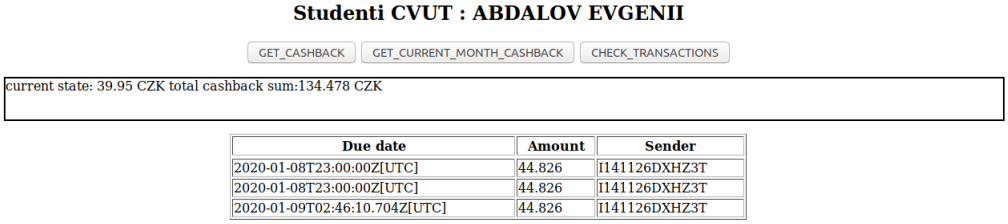

Figure C.4: Obtained Cashback

GET_CASHBACK returns all cashback, that student has got.

GET_CURRENT_MONTH_CASHBACK returns all cashback that has been got for the time period of current month.

C.2 Student Account backend

Cashback REST services:

GET http://localhost:8080/StudentAccountApp/services/Cashback
Graphical returns all cashback payments, that student has received

GET http://localhost:8080/StudentAccountApp/services/Cashback/id
returns cashback payment, that has id parameter value

GET http://localhost:8080/StudentAccountApp/services/Cashback/month
returns all cashback payments, that student has received during current month

GET http://localhost:8080/StudentAccountApp/services/Cashback/total
returns sum of all cashback payments, that student has received

GET http://localhost:8080/StudentAccountApp/services/Cashback/month/total
returns sum of cashback payments, that student has received during current month

DELETE http://localhost:8080/StudentAccountApp/services/Cashback/id
deletes cashback payment, that has id parameter value

POST http://localhost:8080/StudentAccountApp/services/Cashback
as BODY of request it has json object of transactions, that student has conveyed during a certain time period. Backend application checks if those transactions are in TransactionsList. In case transaction is in the list, 5% of this transaction value is added as a cashback

TransactionList REST services:

GET http://localhost:8080/StudentAccountApp/services/TransactionList
returns current transactions list, for which student will get cashback

PUT http://localhost:8080/StudentAccountApp/services/TransactionList
adds new transaction to transactions list, which means that student will get cashback for this transaction in the future

DELETE http://localhost:8080/StudentAccountApp/services/TransactionList/id
deletes transaction from transactions list, which means that student will not get cashback for this transaction in the future

C.3 Bank API transaction history

JSON example of positive response:


```
{
    "pageNumber": 0,
    "nextPage": 1,
    "pageCount": 2,
    "pageSize": 1,
    "transactions": [
        {
            "id": "I141126DXHZ3T",
            "referenceId": "CSB0000092398",
            "type": "MANUAL",
            "description": "Tuzemska prichozi uhrada",
            "additionalDescription": "pol.: 2 / 5.00 Kc",
            "accountParty": {
                "prefix": "000000",
                "number": "259459101",
                "bankCode": "0800",
                "iban": "CZ1208000000000259459101",
                "bic": "GIBACZPX",
                "name": "Jiri Sporitelny",
                "address": "Lapes    AU",
                "location": "CS, METRO I. P. Pavlova"
            },
            "amount": {
                "value": 8965200,
                "precision": 2,
                "currency": "CZK"
            },
            "amountSender": {
                "value": 8965200,
                "precision": 2,
                "currency": "CZK"
            },
            "exchangeDate": "2018-12-06",
            "exchangeRate": "26.6",
            "symbols": {
                "variableSymbol": "0000000009",
                "constantSymbol": "0558",
                "specificSymbol": "55"
            },
            "senderReference": "zivot.poj.ELAN",
```

```
                "receiverReference": "ELAN",
                "sepaEndToEndIdentification": "143270808",
                "note": "Poznamka",
                "cardNumber": "123456XXXXXX1234",
                "bookingDate": "2018-09-30",
                "dueDate": "2018-10-01",
                "inputDate": "2018-09-30",
                "transactionDate": "2018-09-28",
                "transactionDirection": "INCOMING",
                "flags": [
                            "IS_FAILED"
                 ]
            }
        ]
}
```


JSON example of negative response:


```
{
 "status":403,
 "errors":[
   {
     "error":"OAUTH2 failed to TOKEN_INFO with response:
           {
            "error":"invalid_request",
            "error_description":"Token or Scope not found or invalid"
           }"
   }
           ]
}
```

Appendix D

Obsah přiloženého FD

- `readme.txt` ..... Flash disk manual
- `src`
  - `impl` ..... implementation source codes
    - `StudentAccountBackend` ..... backend part of web application
    - `StudentAccountFrontend` ..... frontend part of web application
  - `BP.tex` ..... Source code of Bachelor thesis in format of LaTeX
- `text` ..... Bachelor thesis
  - `thesis.pdf` ..... Bachelor thesis in PDF format