School of Electronic Engineering and Computer Science

MSc Software Engineering

Project Report 2018

Intelligent Expense Manager

Natalia Govor

August 2018



Acknowledgements

Abstract

Table of contents

[Introduction 4](#_Toc520637084)

[1. Background research 5](#_Toc520637085)

[1.1 Analysis of flagships’ accountancy solutions 5](#_Toc520637086)

[1.1.1 Oracle accountancy solutions 5](#_Toc520637087)

[1.1.2 SAP accountancy solutions 6](#_Toc520637088)

[1.1.3 Microsoft accountancy solutions 7](#_Toc520637089)

[1.1.4 Sage accountancy solutions 9](#_Toc520637090)

[1.2 Overspending issues and microloans system in the UK 10](#_Toc520637091)

[1.3 Analysis of existing budgeting solutions for individuals 10](#_Toc520637092)

[1.4 Identifying the gap? 10](#_Toc520637093)

[2. Requirements for Intelligent Expense Manager 10](#_Toc520637094)

[3. Design 12](#_Toc520637095)

[3.1 Monetization strategies of mobile applications 13](#_Toc520637096)

[3.2 UI design 13](#_Toc520637097)

[3.3 Architecture design 13](#_Toc520637098)

[4. Implementation 13](#_Toc520637099)

[5. Testing and evaluation 13](#_Toc520637100)

[6. Conclusions 13](#_Toc520637101)

[7. Further work 13](#_Toc520637102)

[References 13](#_Toc520637103)

[Appendices 13](#_Toc520637104)

# Introduction

Finance management is one of the most common problem different subjects encounter daily. Companies manage their finances, analyse their incomes and outcomes in order to distribute their assets better and gain more profit from their business. Ordinary people also have to control their money. Algorithm is similar, but they operate with smaller amounts and have less rules and risks in their mundane life. However, inefficient control of money can lead individuals to dramatic consequences. High overspendings and approaching mandatory bills, such as rent, can force individuals to seek for credit. For instance, it can be overdrafts, personal loans, payday loans. Some types of credit have very high interest rate and if they are not paid in full at the end of the term additional fees can be charged from the debtors. It results to further expenditures and in the worst case it may bring individuals into loan cycle; this is the situation when person takes new loan just to pay the previous one. Loan cycles are very dangerous and can lead to severe financial problems.

Добавить абзац про разделение трат?

Taking everything into account, expense management is a very important aspect of welfare and people should be able to deal with it easily and efficiently. This project investigates the existing accounting solutions and focuses on building the prototype which attempts to improve the competitors’ applications to provide better experience and results for individuals in money management. The report contains seven chapters and is organized as follows. Chapter one contains an overview of existing solutions and presents the necessary background information. Chapter two introduces the requirements for the building application. Chapter three and four discuss design and implementation issues and challenges. In chapter five the implemented software is evaluated. Finally, chapters six and seven conclude the paper and describe the future improvements of the project.

# 1. Background research

Test

## 1.1 Analysis of flagships’ accountancy solutions

The problem of finance management is not new, and plenty solutions have been already developed to address it. To learn more about important issues and aspects of accounting, the large business solutions from flagship corporations have been investigated and analysed. These solutions are oriented on mainly large and medium-sized businesses and are quite expensive. Companies which can afford those solutions have many complex processes to maintain; therefore, by buying accounting solutions they can gain greater control of their finances, automate routine tasks and as a result make better decisions over time. Many experts and developers have been working on the flagships’ solutions for years, so their analysis might help to discover essential capabilities and give an idea of vital features which can be inherited to help ordinal individuals with tighter budgets.

Solutions of four corporations have been investigated: SAP, Oracle, Microsoft and Sage. The products of the first two companies (SAP, Oracle) are mainly intended for large and medium-sized enterprises, whereas the last two company (Microsoft, Sage) focuses on small and medium-sized. These companies do not provide free trial versions to individuals, so the analysis was done only by examining the information from their websites and official handbooks.

### 1.1.1 SAP accountancy solutions

SAP SE (Systems Application & Products in Data Processing) is a multinational software corporation that makes enterprise software to manage business operations and customer relations. SAP website is very good structured and contains videos which describe the main features and benefits of their solutions. Some videos show parts of the workflow of mobile and/or desktop applications; this gives quite accurate representation of the products.

SAP Business Network Group includes Concur Technologies which offer three interesting products:

1. Concur Expense;
2. Concur Travel;
3. Concur Invoice.

All these solutions integrate with the world most popular finance systems. Moreover, SAP provides a combination of their two products: Concur Travel & Expense.

Concur Expense presents automated, fast and accurate expense management. It captures data from credit card transactions, e-receipts and receipt photos, automatically categorises and maps expenses and enforces policy compliance. Concur expense helps to get accurate and on-time expense reports which can be easily reviewed and approved by managers.

Concur Travel focuses on corporate travels and helps to simplify their bookings and control company costs. The system provides searching and booking of flight, hotel, rental car and rail using multiple global distribution systems. Employees can attach receipt photos of their trip expenses; additionally, trip expenses are automatically imported from e-receipts and credit cards charges. These data collection methods help to create practically complete report which employees just need to submit after they return home.

The last product, Concur Invoice, aims to automate the invoice processing which helps company to reduce costs and achieve larger control over accounts payable. The solution manages requests, requires validating of purchase requests before spending and matches invoices to received goods and services, saving companies time and money. Intelligence monitoring tools give organization complete visibility of employees’ expenditures and help better forecast cash, time payments and identify additional vendor savings and discounts.

### 1.1.2 Oracle accountancy solutions

Oracle Corporation is an American multinational computer technology corporation which specializes primarily in developing and marketing database software, cloud engineering systems and enterprise software products. Oracle website has a complex structure which leads to difficulties in finding necessary solutions. It does not provide videos of specific products demonstration; only abstract description of benefits and main features is available. Consequently, it was hard to form concrete opinion about Oracle products and imagine how they should work. If the company is interested in purchasing Oracle products, they should contact Oracle and request a demo version.

One of the major Oracle application is Oracle E-Business Suite which contains applications that enable organisations to make better decisions, reduce costs and increase performance. The Oracle E-Business Suite provides a set of financial applications: Asset Lifecycle Management; Cash & Treasury Management; Credit-To-Cash; Financial Control & Reporting; Lease and Finance Management; Procure-To-Pay; Travel & Expense Management.

Each of Oracle Financial application is devoted to some specific area of interest in business world. For instance, Asset Lifecycle Management helps companies to manage different types of their assets and check their states during their lifecycle to intelligently manage budget; Cash & Treasury Management supports core treasury operations and offers functionality to manage liquidity, interest rate and foreign exchange risk. Only Financial Control & Reporting and Travel & Expense Management are closely related to the area of the project interest, so will be described in more detail.

Financial Control & Reporting is a fully automated solution which offers range of possibilities from creating and managing transaction to consolidating and reporting results. Built-in best practices facilitate robust planning and budgeting, help to save time and money and deliver more reliable, accurate data.

Travel & Expense Management solution aims to automate and streamline travel spend management. It offers credit card import functionality, robust workflow approval which help to reduce the amount of time and effort require to submit, approve, process and pay expense reports. Moreover, the system promises user-friendly interface with flexible user preferences which should increase employee productivity and satisfaction.

### 1.1.3 Microsoft accountancy solutions

Microsoft has a line of enterprise resource planning (ERP) and customer relationship management (CRM) software applications which is called Microsoft Dynamics. There are six separate products that make up the Microsoft Dynamics family:

1. Microsoft Dynamics AX;
2. Microsoft Dynamics GP;
3. Microsoft Dynamics NAV;
4. Microsoft Dynamics SL;
5. Microsoft Dynamics CRM;
6. Microsoft Dynamics RMS.

Microsoft has a quite difficult structure of the website, it was problematic to find and understand the differences between various products. There are no videos or screenshots of applications; however, each product is followed by detailed handbook with extended description of capabilities and available packages and guides how to buy them.

The interest of the research are only ERP solutions which are first four products. Microsoft Dynamics AX is best suited for large enterprises whereas GP, NAV and SL are intended for small and medium; and so are described in detail below.

Microsoft Dynamics GP introduces management tools for various business parts, such as financial management and accounting, stock management and operations, sales and service, human resources and payroll. Dynamics GP product is accompanied by lightweight mobile applications to provide access to some specific tasks from everywhere. Financial management capabilities include such useful features as tracking multiple budgets in multiple currencies, keeping and audit trail of who modifies a budget and when, quick transferring information between customer and vendor. Moreover, task and reminders capability helps to proactively inform users when specific incidents occur, such as customers going over their credit limit or payables due.

Microsoft Dynamics NAV is designed for growing businesses and contains more capabilities than Dynamics GP. It is a multi-language multi-currency business management solution which can adapt for specific business needs of a company when they change. It has the same basic financial capabilities as Dynamics GP such as working with budgets, logging of users’ modifications to the data and powerful reporting tools. Additionally, it provides prediction of a company’s liquidity, bank account management and international currency support in full compliance with euro legislation.

Microsoft Dynamics SL solution is more focused on business management (project planning, material management, people management). It also supports financial management of the business, but the major part of the system is not devoted to accounting.

### 1.1.4 Sage accountancy solutions

Sage is a British multinational enterprise software company which began as a startup in 1981. They help businesses of small and medium sizes to manage accounting and finances, payments, people and payroll. The Sage website is a bit intricate, it contains a few videos with products’ descriptions, but they are too abstract and do not give clear picture of the software. Nevertheless, the website contains plain description of products and in addition Google Play and App Store have screenshots of mobile applications to obtain the better impression about the granted solutions. Only products related to accounting and financials have been investigated.

Sage Business Cloud Accounting works with invoices, records transactions, displays performance statistics and syncs information across all devices using cloud storage. Invoices for done work can be created in the system and sent to customers. It is possible to track and manage overdue payments, send quotes for review and agreements by a customer. Accounting solution also allows to enter money in and money out transactions, as well as attach photos of receipts; a category, description and reference can be applied to transactions. The great focus of Sage product is on the facilitation of managing transaction and invoices which helps companies to run their business more professionally.

Sage Business Cloud Financials focused on growing and medium-sized businesses and allows more additional and professional possibilities for accounting than Sage Business Accounting. Since the developing software is not going to focus on invoice managing it was decided not to analyse Sage Financials in details.

Sage solutions are not very expensive, it is just £10 for simple account each month, but the solution is not oriented on finance managing of ordinary individuals.

Add summary table

## 1.2 Overspending issues and microloans system in the UK

As any business, ordinal people also should maintain their budgets and ensure that their outcomes do not exceed incomes. Moreover, it is very important to keep enough money in a savings account to be prepared for unforeseen circumstances.

Some events in life require to spend more money as people usually do, such as holidays. According to debt advice charity National Debtline, millions of Britons (16% which equivalent to around 7.9 million people) start 2018 with huge overspending after Christmas season; this is 11% more than the last year. The poll has shown that more than half of the participants had not started to save money for Christmas before December arrived. In a separate report, National Debtline published that 37% of Britons bought Christmas presents on credit, whereas the last year the number was 33%.

Another research by the Money Advice Service revealed that two thirds (60%) of UK adults exceed the planned budget during their holidays, with the average £220 overspending. One of the most common reason for unexpected costs is unrealistic budget; for instance, more expensive food and drinks (32%) and more expensive activities (22%) than expected. Also, many people do not take into account pre-holiday purchases when planning for a holiday. The research demonstrated that 68% of respondents save enough money for their holiday while 24% of UK adults have been on a holiday which they could not afford which caused the average debt of £421.

These reports highlight the growing problem of reliance by consumers on credit. According to research from Compare the Market, the personal debt level is now the highest in recent history, with the average person owing over £8,000. Credit unions across the country promote thrift and encourage their members to save money regularly to help them overcome financial difficulties.

A number of reasons influence such high levels of personal debts in the UK, including the more positive attitude towards borrowing in the country. This more relaxed attitude is impacted by media and advertising. According to research, there are “more loans advertisements than savings advertisements” in the UK newspapers. Moreover, mostly positive emotional appeals are used in these advertisements which focuses only on the positive credit aspect and leads to “normalizing debt”.

The form of short-term credit known as a payday loan increased significantly in the UK from 2006-2012, resulting to media and public concern regarding their extremely high cost. The original goal of payday loan was to lend a small amount to someone before their payday. When person receive his/her salary, the loan must be repaid. Technological developments have simplified the access to payday loans; modern online platforms allow to get the credit the same day the application being accepted. Some people also enjoy the anonymity of the online process.

Due to the availability of payday loans, people have started to use it for casual spending such as groceries, bills and car costs when they are out of cash. Almost 3 in 5 (59%) stated their payday loan was for something urgent and essential. However, 1 in 4 (24%) of these people reported that they would have managed without the buy if a payday loan had not been accessible.

A payday loan is a short-term and high-cost loan. The debtor provides a small-amount loan for a fee and expects it to be paid in full in a few weeks. Because the loans have such short terms, the interest rate is generally high, with some costing of nearly 400%. If a borrower cannot pay the debt in full at the end of the term, the debtor will charge additional fees.

Payday loans could be a good tool for quick money in the case of emergency, but they might trap consumers in spirals of debt from which it is hard to escape. People who usually borrow money using payday loans have variable wages or insecure work; they are self-employed or lost their job. When the few weeks expire, such categories of consumers can be unable to repay the loan. Instead, they take another loan to reimburse the old one and again pay fees and other administrative costs. If this cycle continues, it can bring individuals to severe financial problems. Therefore, it is always better to prepare for unexpected costs by careful planning of expenses and saving money each month.

## 1.3 Analysis of existing budgeting solutions for individuals

In the previous chapter 1.2 it was discussed how many people in the UK overspend and why it is important to manage your finances.

Nowadays, there are many budgeting applications which are available as desktop, web or mobile applications. Analysis of three popular applications (YNAB, Goodbudget, MoneyLover) has been conducted to get an overview of the available functionality of competitors on the market.

You need a budget (YNAB) is a paid application which costs £6.99 per month and has 34 days trial period. The mantra of the application is “give every dollar a job”, and it supports the concept of having virtual pots of money for different things. Users divide their income into independent pots, such as groceries or rent, and if they overspend in an area they should move money from one to another pot. Additionally, YNAB encourages users to save money for larger expenses. It offers both desktop and mobile interfaces, options to enter expenses manually or sync bank accounts automatically.

The next competitor, Goodbudget, offers free and plus versions. Plus version offers more capabilities and costs $6 per month. It also divides users’ cash into pots of money for different things; authors call it “envelope budgeting method”.

Finish description of Goodbudget and MoneyLover.

Talk about aspect of splitting expenses which individuals usually face.

Short overview of application for sharing expenses Splitwise.

## 1.4 Identifying the gap?

Talk about idea that there is no application which combines budget and sharing of expenses.

Talk about conducted interviews and what people think. Do they use budgeting apps, if yes what they like/dislike about them. Do they use Splitwise app? If they use both budgeting app and Splitwise, do they find it convenient?

# 2. Requirements for Intelligent Expense Manager

The specification of Intelligent Expense Manager requirements has been created based on the background research described in the previous chapters. The software will be developed iteratively. Дописать, сказать, что тут только core requirements, которые будут реализованы, а остальные в аппендиксе.

Basic requirements:

1. User should be able to register and authorize in the application.
2. All entered user’s data should be synchronized and fully accessible between different devices (if user uses several devices).

Requirements for the budgeting aspect:

1. User should be able to set a budget for a month.
2. User should be able to enter his/her everyday expenses.
3. While entering expense data, user should be able to set the following information: the date of expense, the category of expense, the amount of expense, whether the expense was done during travelling (by default it is false).
4. User should be able to edit and delete expenses.
5. **User should be notified if he/she is getting closer to the limit of the month.**
6. **User should be able to select important dates in the calendar and the app will send them a reminder to start saving money for this event in advance. The default reminder will send notification one month before, but it should be customisable by user.**

Requirements for the sharing expenses aspect:

1. User should be able to create or add a friend.
2. User should be able to create a group for sharing expenses. To create a group user should specify the name and add minimum one friend to it.
3. User should be able to change the group name.
4. While creating expense, user should be able to specify that it is shared expense, choose the group to which it belongs and select the splitting method within group members.
5. User should be able to modify any added expense and set/change/delete for it splitting options.
6. The app should support the following splitting rules:
   1. The expense can be paid by one or several group members.
   2. The amount of expense can be split not equally and not between all group members.
7. All shared expenses should be synchronised between group members.
8. User should be able to view balances between group members.
9. User should be able to view the list of friends with the debts.

Requirements for displaying statistics:

1. User should be able to view statistics of his/her expenses.
2. User can choose the period for which the statistics should be displayed.
3. User should be able to switch the statistics display between:
   1. All expenses.
   2. Only travelling expenses.
   3. Only everyday expenses without travelling expenses).

Say that the most functionality is quite trivial, but very useful for users. But the bold requirements related to notifications is not that trivial, it is smart functionality which requires to use some smart algorithms

# 3. Design

Test

## 3.1 Monetization strategies

Each project should not only help users to solve some problem, but also it should bring revenue to its creators. An application can be supplied as free or as one-time paid app. In the case of one-time paid apps, users pay only once to download the app, and all features and updates should be available for free. Free applications have several different strategies to make money which are described below in detail.

According to Statista, the amount of paid app downloads decreased remarkably in 2016. The paid app description should be convincing enough for users to pay for it without sampling. Moreover, this model requires continuous search for new customers to provide stable revenue stream. As a result, revenues generated from paid apps are expected to continue to decline in the upcoming years and it is more preferably to focus on free app monetization strategies.

## 3.2 UI design

Test

## 3.3 Architecture design

Test

# 4. Implementation

Test

1. Set limit, send notification if user is getting close to the limit based on the threshold. Very easy, not very smart.
2. Use machine learning, like linear regression to predict the future. Send notification if you predict that user is going to overspend
3. Calculate average expenditure. Calculate the remaining number of days. Calculate based on it if user has enough money
4. Use Item-based recommendation algorithm. You can ask user if notification was useful and adapt it.

# 5. Testing and evaluation

Test cases

Does your algorithm send the recommendation when it should

Is it annoying to user, is it helpful

Machine learning prediction

Item based is not recommendation system

# 6. Conclusions

Test

# 7. Further work

Test

# References

Test

# Appendices

Test