INVESTIGATING THE UCT MEAL VOUCHER SYSTEM TO IMPROVE THE EFFICIENCY AND RELIABILITY DURING PROTEST TIME

Prepared for: CSC3002F

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TERMS OF REFERENCE

On the 14th of February 2019, we were given an assignment in which we were required to conduct a feasibility study. In this feasibility study, a problem that UCT experiences, particularly during protest periods, is investigated and potential solutions are proposed.The UCT catering system experiences problems during protests as catering services are halted and students are unable to receive meals. The current emergency meal voucher system is not an efficient way to deal with the problem and we have decided to find a more effective alternative.

The following terms of reference were provided:

1. Create a set of criteria which will be used to assess the feasibility and likelihood of success of a technology-based solution under the social and technical challenges described in the background to this investigation.
2. Investigate a solution that the UCT catering system implemented to deal with the impact of protests.
3. Research alternatives to these using your expertise in computer science, or through examining the responses of other universities in comparable situations. Include costs are far as possible.
4. Draw conclusions by evaluating the departmental solution as well as solutions we have investigated.
5. Make recommendations to the department about what should be done to change, maintain, develop or enhance the approach that was or is being used.
6. Submit the report by 11 April 2019

EXECUTIVE SUMMARY

The aim of the report is to investigate a problem in the University of Cape Town and to propose solutions to those problems. This report is investigating the UCT meal voucher system, particularly during protest times. Meal vouchers are a piece of paper with a certain value assigned to it in which students can redeem at certain vendors. There are two types of meal vouchers: the lunch and emergency meal vouchers. A student requests a lunch meal voucher if they are unable to make it back to their residence in time for lunch. This meal voucher is currently at the value of R32. The emergency meal vouchers are issued when catering services on residences are suspended, usually due to protest action. Students are then required to use the emergency meal vouchers (which are currently worth R55) at third party vendors (such as Pick ‘n Pay) or at certain vendors on campus. In this report, alternatives to the paper meal vouchers will be investigated.

The objectives of this report is to look at the current meal voucher system and investigate its limitations, create alternative solutions based on criteria that follows UCT’s values and missions, takes into account cost limitations and should be technological. Students, third party vendors and a UCT staff member were interviewed, information about the UCT protests and the use of meal vouchers were researched using various articles found online, and a survey was issued to students to identify student experience with the current meal voucher system, the most popular payment methods and their opinions on our proposed solutions.

Two main solutions were investigated: A High Cost Card Payment system and a Low Cost Card Payment System.

High Cost Card Payment System

Students, vendors and UCT are the three users that use and drive system processes. UCT will adopt this new system as a replacement for the paper meal voucher system that is currently in use and will monitor growth of this new system. The students would be required to simply use this system as their new payment method when buying products from the relevant vendors. The vendors will use a card scanner to facilitate these payments. The software components of the High Cost Card Payment System include a web and mobile application and various backend services. The hardware components of this system include the student cards, card scanners and the computer hardware (i.e. UCT servers).

The UCT student card can store payment processing information. When a student scans their card on the relevant scanner, the encoded data in the card is send to the UCT database for verification which then returns the student’s account information. The vendor will enter the payment amount and the student will then enter their pin number. If the pin is valid, the student’s available balance will be updated and the card scanner will indicate that the transaction was a success. The update balance will be sent to the application server (which is responsible for the

mobile and web applications). Students will be able to add money to their student account and view their account balance. Extra functionality, such as selecting meal plans in residences, can be added. A web application for vendors will also be available. Vendors will be able to monitor transactions and view the total amount owed to them by UCT. Vendors will be pressure to adopt the new system as it would become the preferred method of payment amongst students. Vendors will be required to pay commission in order to adopt and use the new system.

A closed loop payment system will be used as it allows UCT to have an expiration date to online vouchers and the closed wallets allow UCT to capture and monitor data on customer transactions more easily.

Low Cost Card Payment System

This solution is essentially the same as the High Cost Card Payment system in which the fundamental system organisation, the mapping of system and hardware components and the top-level strategy and guide to implementation will be similar. The difference is that the mobile and web application will not be used. The Low Cost Card Payment System is simply a payment process. Student will use card top-up machines to put money on their card and to view their balance. When students redeem their meal vouchers to vendors, an EFT will be made.

The report found that the Low Cost Payment System was more feasible.

	Paper voucher system	High cost card system	Low cost card system
Cost	High	High	Medium
Security	Low	High	High
Delivery time	5 minutes	Instant	Instant
Environmental impact	High	Low	Low
Protest vulnerability	High	Low	Low

Table comparing the various payment systems

The High Cost Card Payment system would have a total yearly cost that falls between R590, 000 and R1, 028, 400, while the Low Cost Card Payment System would have a yearly total of around R338, 000 to R698, 400. This makes the Low Cost Card Payment System to be more feasible in the short-term and is easily scalable compared to the High Cost Card Payment System. Additionally, the only major difference between the two solutions is that the Low Cost solution doesn't have the convenient online platform.

Conclusions

The report concludes that the current meal voucher system is ineffective and a new paperless system is preferable and essential. The current meal voucher system is unreliable as paper vouchers can be damaged, lost and duplicated easily. The transportation of meal vouchers are error prone. Students lose money as the paper meal vouchers do not offer change. Student satisfaction will increase with the new payment system as the risk of losing money will be significantly lower compared to the current paper meal voucher system. Vendors will benefit from this system as they will be able to receive their money daily rather than weekly. The new mobile and web application could increase student and vendor satisfaction, but due to a higher cost and longer implementation time, the simpler, Low Cost Card Payment System is preferred.

Recommendations

The report recommends to adopt the Low Cost Card Payment System. The implementation of this system will start with a pilot project which uses a single vendor on upper campus and a slow integration of the new meal voucher system will be used to replace the current paper meal voucher system in residences. A single residence should be chosen and used to test out the new system.

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GLOSSARY

UCT - University of Cape Town

1. INTRODUCTION

1.1. Subject of the Report

This report is an investigation into the current meal voucher system at the University of Cape Town and an exploration of alternative methods which will be more reliable during protests.

1.2. Background to the Investigation

The University of Cape Town distributes about 500 000 meal replacement vouchers to its students annually. These paper vouchers can be redeemed at shops on campus for food. In late 2015, UCT had to deal with student protests which eventually affected the catering service in student residences. UCT had to deliver emergency meal vouchers to its students to buy food off campus at selected shops. Students have reported issues with the current system including lost, theft, damage and rejection of the meal vouchers. Additional issues inherent to paper vouchers are the negative environmental impact that they have and the waiting time for students to collect their vouchers at residences. These issues are accentuated during protests when every student living in residence are given up to 2 meal vouchers a day. UCT would like to implement a new system that will be modern, cleaner and can better handle emergency situations like protests.

1.3. Objectives

- Determine the flaws and limitations of the current system
- Understand the impact of protests on the current system
- Assess the needs of students regarding payment on and off campus
- Design new payment systems with respect to budget
- Evaluate the proposed solutions
- Conclude on which solution is preferred
- Recommend how to implement the new system

1.4. Method

1.4.1. Research

Information about protests in South Africa and the use of meal vouchers were found in articles over the internet.

1.4.2. Interviews

Various interviews were conducted with students, UCT staff and third party vendors off campus.

1.4.3. Surveys

A number of surveys were conducted on UCT upper campus to identify the most popular payment methods.

1.5. Scope and Limitations

1.5.1. Limitations

Due to time constraints, the head office of third party vendors could not be contacted to receive feedback about the proposed system. Students who lived in residences during protests are now no longer in University or could not clearly recall details about emergency meal vouchers.

1.5.2 Assumptions

It is assumed that third parties will be willing to implement the new system once UCT has approved the project.

1.6. Plan of Development

The report starts by describing the current situation at UCT regarding meal vouchers and how protests affect the functioning of this system. The criteria by which to assess new solutions is then investigated. With respect to the criteria, we will design alternative payment systems. The best system is then chosen after careful evaluation and recommendations are made on how to implement it.

2. CURRENT SITUATION OF PAYMENT METHODS ON CAMPUS

2.1. UCT Response

A student living at a UCT residence is required to indicate the type of meal plan that they would like for the year. There are four available meal plans:

- Plan 1 includes breakfast, lunch and dinner. This is the default meal plan if the student fails to indicate their choice in time.
- Plan 2 includes lunch and dinner.
- Plan 3 includes breakfast and dinner.
- Plan 4 includes breakfast, lunch and dinner on weekdays only.

Each plan has its own meal ticket colour which students collect when they sign into their residence. If a student is unavailable to get back to residence in time for their meal, a meal voucher can be taken and spent at vendors found on Upper, Middle and Health Science campuses and some other third-party vendors.

During protests, the catering staff are unable to work in the residences and students are issued meal vouchers every day. These meal vouchers are at the value of R55 and last up to 48 hours. They can be used by certain Pick ‘n Pay branches and fast-food outlets.

UCT is currently rolling out a cashless system with Pay&Connect powered by a base application called Slide. This system is currently only operating at Gracia Residence and more residences and functionalities will be added in the next term.

Students and Vendors use the Pay&Connect app to make payments. Student will have the ability to sign in at the residence dining hall during meal times, request food vouchers, which are only valid for one day, redeem their food voucher at various participating vendors on campus, and cancel meal vouchers. Vendors are required to have a unique QR code and a sticker (showing that the stand accepts this payment type) displayed at their stand. The student scans the QR code with their phone when making a payment. Vendors click the “withdraw” button in the app to redeem the money.

2.2. Limitations of Response

Students have claimed that the current paper meal voucher system is not safe as they can be damaged, lost and duplicated easily. Students are unable to receive change when using their meal vouchers. Students have complained that collecting meal vouchers are time consuming and can take up to 45 minutes to collect them during protest time. Paper meal vouchers are not environmentally friendly as the vouchers can only be used once and are then disposed of. Meal vouchers, during protest time, are only valid for 48 hours.

A questionnaire was created, in which 15 students were asked to rate their satisfaction with the current meal voucher system out of ten. As shown in the figure below, the students gave an average rating of 5.4/10 which is not satisfactory and shows that there is a large room for improvement in UCT’s meal voucher system.

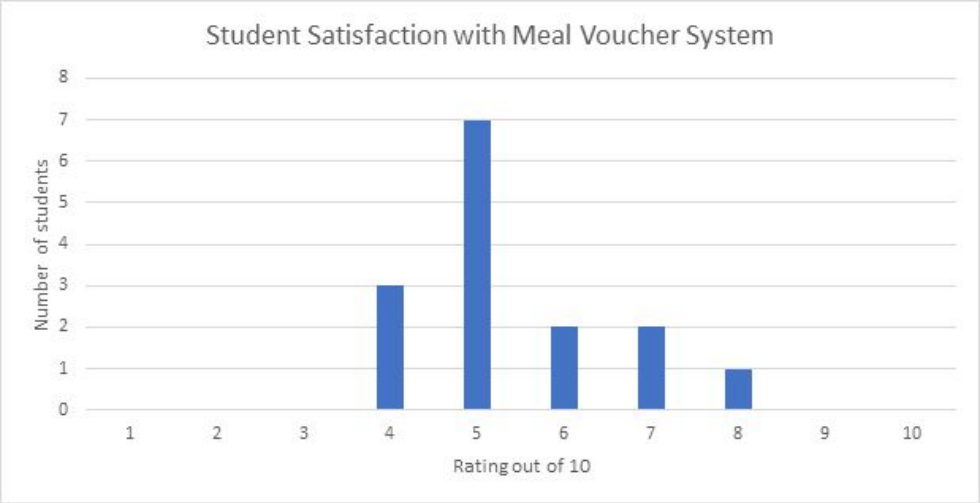

Figure 1. Bar Graph showing student satisfaction with the meal voucher system.

Students were also asked if they had ever been inconvenienced by the meal voucher system. 73% had said that they had been inconvenienced on some way, as shown in Figure 2 below.

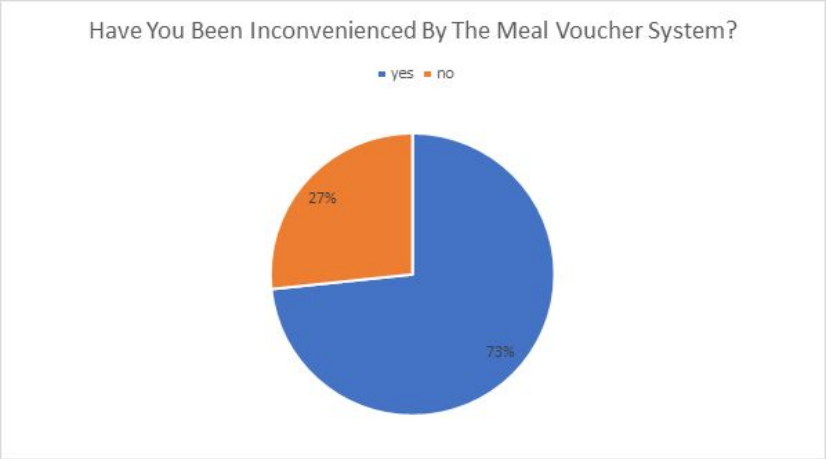

Figure 2. Pie chart showing if students have been inconvenienced by the meal voucher system.

2.3. Prefered Payment Methods on Campus

A survey was conducted on the 1st of April 2019 outside the Food&Connect on upper campus UCT, whereby a total of 112 students were asked what payment method they were most likely to use when purchasing food on upper campus. The students were grouped into residence students and non-residence students. The results of the survey are summarised in the following two figures.

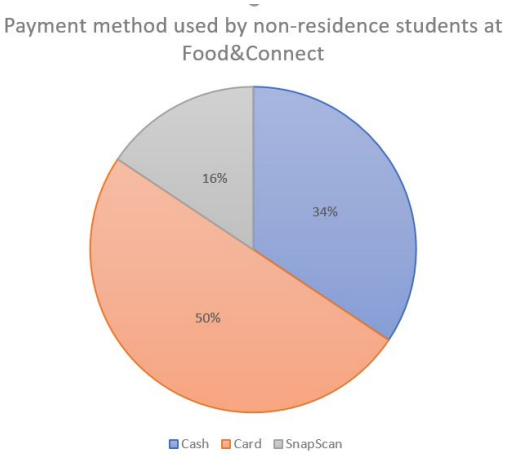

Figure 3. Pie chart showing the most popular payment methods used by non-residence students.

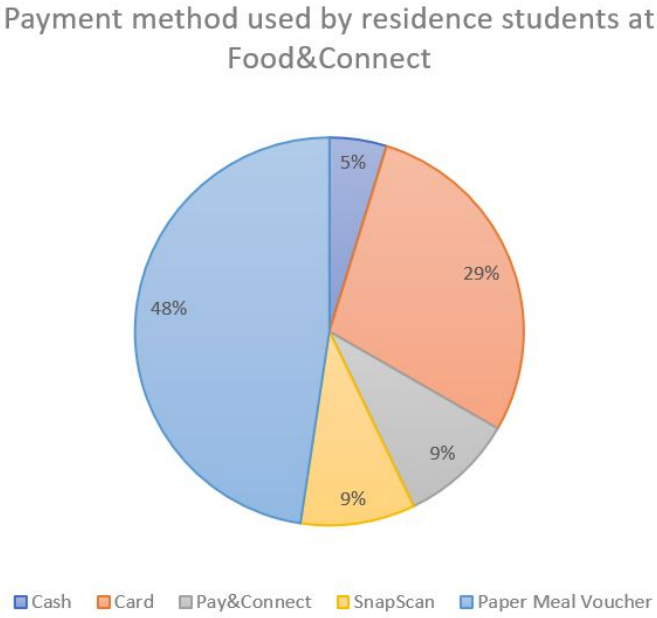

Figure 4. Pie chart showing the most popular payment methods used by residence students.

3. CRITERIA BY WHICH TO ASSESS PAYMENT SOLUTIONS ON UCT CAMPUSES

The criteria we have come up with can broadly be grouped into three subgroups, namely criteria relating to UCT's values and mission, criteria relating to cost limitations and finally, criteria relating to the technological aspects of the solution.

3.1. UCT Values and Mission

3.1.1. Payment solution should be accessible to all students regardless of background

Cultivating an inclusive institutional culture is a part of UCT's mission and so any payment solution introduced on campuses should be accessible to all students regardless of financial background.

3.1.2. Payment solution should enhance the lives of UCT students and staff

UCT's mission includes striving towards enhancing the lives of students and staff. And so, a new payment solution should reflect this by improving on the efficiency of transactions made on campus.

3.1.3. Payment solution should be environmentally sustainable

UCT strives towards being an environmentally conscious institution. And so, a new payment solution should reflect this by minimising the impact made on the environment in areas such as energy demands, paper and printing requirements etc.

3.2. Cost Limitations

3.2.1. The cost of implementing a new payment solution should be within a realistic budget for UCT.

UCT can only allocate so much of its funds to the development of a new payment method on campuses. A new solution should not exceed this budget.

3.2.2. Students should not incur any extra costs for using the new payment method

A new payment method should not have any fees attached to it. This would make the method appealing to most students and completely inaccessible to others.

3.2.3. Vendors on UCT campuses should incur minimal or no fees for using the new payment method

Vendors are unlikely to use the new method if high fees take away from their profit margins. The new solution should have fees less than alternative methods such as SnapScan and debit cards.

3.3. Technological Solution

3.3.1. The new payment solution should be innovative

The new payment method should leverage modern technological solutions so as to reflect UCT's mission to be a leader in influencing the global higher education landscape.

3.3.2. The new payment solution should take into account the technological limitations of many of UCT's students

Some of UCT's students might not have access to smartphones or bank accounts or a number of other technological limitations. The payment method should leverage technological solutions that are most accessible to all of UCT's students.

4. ALTERNATIVE SOLUTIONS

4.1. High Cost Card Payment System

4.1.1. System Architecture

Fundamental System Organisation. The three key pillars of the proposed architecture can be viewed as the three users that drive system processes and system growth. These users include the students, the vendors/clients and UCT as the corporate entity whom will take ownership of the project. The student's main role in the student card payment system is to simply adopt the new cashless means of payment when buying products from the relevant vendors/clients. The vendors will facilitate such payments using a card scanner. UCT will fulfil its role as a user by adopting the new payment framework as a replacement of the current meal voucher system. These roles and responsibilities form the backbone of the proposed architecture as they determine system evolution and motivate system design.

Principles that are integral to the fundamental system organisation can be deduced from the entity/component interactions necessitated by the system. These interactions include:

- The transfer of money from a student to UCT to be represented as a cash balance attached to the student's account.
- The transfer of money from UCT to the relevant vendors for the purchases made using the student card payment system.
- The payment interaction between students and vendors when a purchase is made through the cashless payment method.

These interactions have various ramifications on the relevant users. Well-founded and properly implemented procedures are needed to manage such ramifications. The core principles that will govern the outlined interactions are specified below:

- Participants should have a clear understanding of the financial risk involved with participation.
- Credit risk management procedures should dictate how UCT manages finances among participants.
- The system should implement the prompt payment discipline.
- Every student should be able to participate in the system.
- The system should have a well-grounded legal basis.
- The system should be transparent in its dealings.
- The system should be secure.

Mapping of Hardware and Software Components. The software components of the student card payment system include web applications, a mobile application and a variety of backend services such as data storage management and transaction processing. Hardware includes student cards, card scanners and computer hardware in the form of UCT servers. These servers can be functionally broken up to represent an application server, a database server and a database. The mapping of hardware and software components comprises of two separate subsystems. The first subsystem, as visualised below, describes the software and hardware components involved with processing a payment.

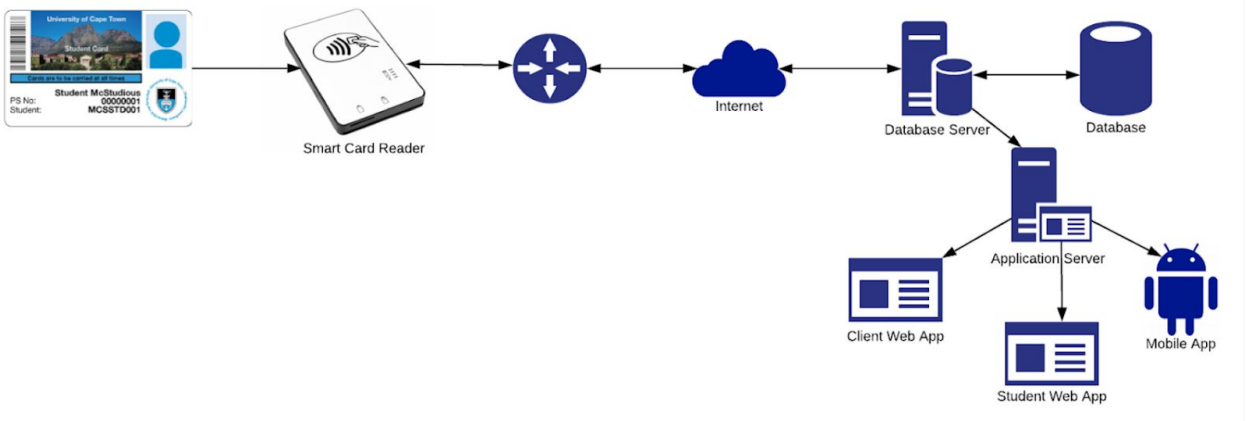

Figure 5: Hardware and Software Mapping for Payment Interaction. The mapping diagram depicts interactions and a simplified view of information flow between the relevant components.

The UCT student card uses a magnetic strip to store information. The magnetic strip is comprised of three to four bands. The first band is used for access control and the second and third store information relating to payment processing. When a student card is held near the proximity card scanner, the scanner detects and interprets encoded data. The encoded data contains identification information relating to the student's UCT account. This information is sent to the UCT database for verification. The database returns account information, such as available balance and pin number, to the card scanner.

The vendor will then enter in an amount and the student will enter their pin number. If the pin is valid and the UCT database server has successfully updated the student's available balance, the transaction will be indicated as a success on the card scanner.

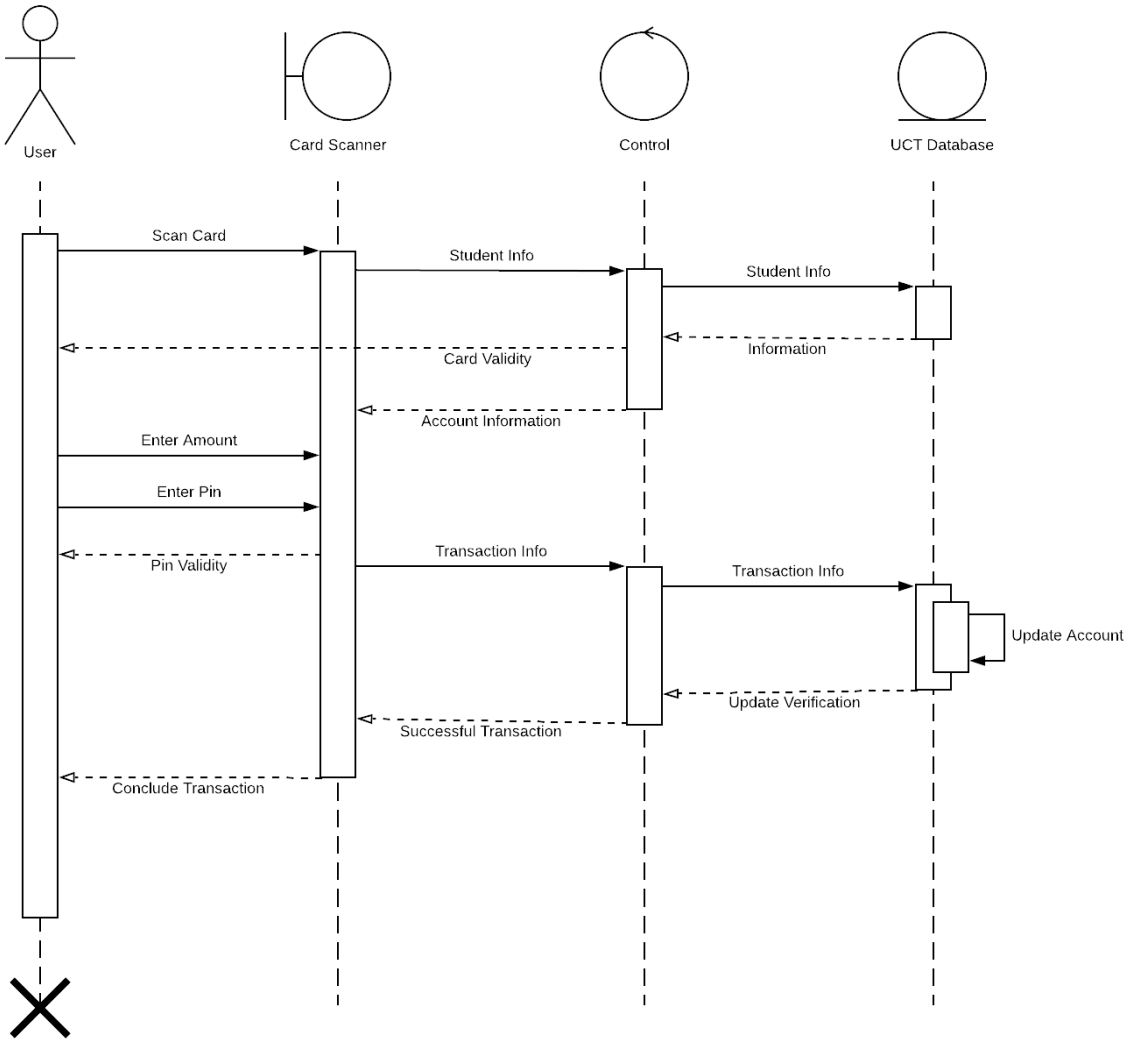

***Figure 6**: Sequence Diagram for Payment Interaction. Depicts the interactions between components in a sequential order. It shows lifelines of actors and entities along with the series of messages passed between them. The method-invocation boxes indicate that the entity is currently active or handling a message. The solid arrows indicate synchronous messages and the dotted arrows indicate asynchronous messages.*

Once the database server has updated the student's available balance, the updated information is sent to the application server. This server is responsible for managing the mobile and web applications.

The web application and mobile application provided to students will be functionally equivalent. The core functionality of both applications includes the ability to add money to the student's account and the ability view the available balance associated with that account. Further functionality can be added at a later stage after the initial deployment of both applications. Extra features may include the ability to view the current meal plan, opt for a different meal plan or view vendors that have adopted the card payment system.

There will also be a web application provided to the clients/vendors. This application will be used by vendors to monitor transactions and view amount owed to them by UCT. A built-in tool will allow a billing structure that adheres to the prompt billing principle outlined at the beginning of this section. This tool will also implement an automated credit settlement plan in which outstanding amounts are settled daily. This settlement plan aids the goal of credit-risk management as large accumulations of outstanding debt are prevented.

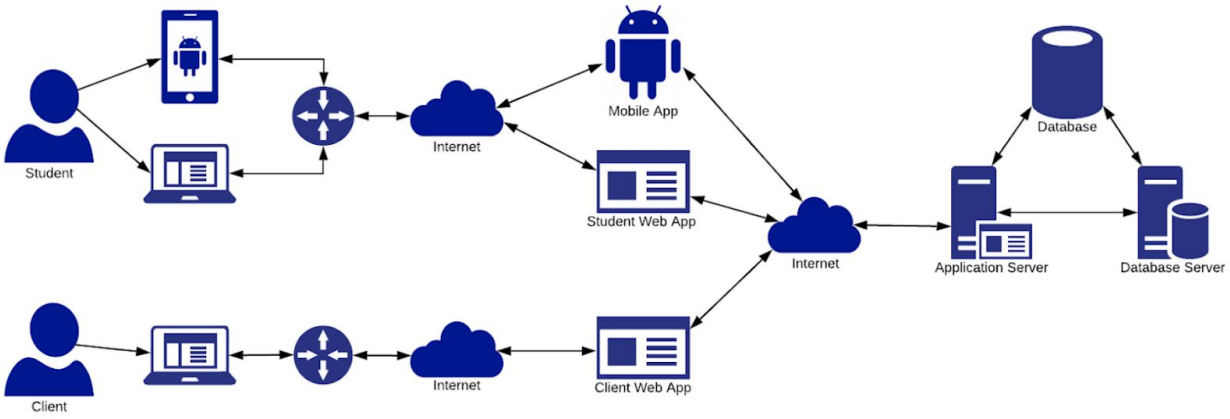

Figure 7: *Hardware and Software Mapping for Application Interactions. It can be noted that the application server serves as a management gateway between the applications and the other two servers.*

Each web application account will be associated with a specific card scanner. This one-to-one mapping allows for a more robust system that is difficult to exploit. The number of online accounts is fixed to the number of card scanners that are currently in circulation. This makes monitoring of cash flow to/from vendors easier and allows for simpler contingency plans should the system fail.

Top-level strategy. The proposed system aims to implement a closed loop payment system in which student's pre-load funds into a spending account that is linked to their student card. Student's will be able to top-up through a variety of mechanisms. The current method of

loading cash onto your student card will still be supported. This method utilises top-up machines to load cash. The new system will allow for student's to top-up using the mobile and web applications. Automatic top-up/reload will be implemented as a replacement of the current meal voucher system.

Opting for a closed loop structure lets UCT to derive the ancillary benefits that such a structure provides. Meal vouchers currently expire after a day or two; a closed loop structure allows UCT to attach an expiration date to online vouchers if they so desire. Closed wallets also give UCT a greater ability to capture and monitor data on customer transactions.

Commission could be taken on all transactions. Vendors will be pressured to adopt the new system as it becomes the preferred mode of payment amongst students. The cost, to the vendors, of adopting the new system will simply be the aforementioned commission.

Guide to implementation. A pilot project could be launched with a single vendor on upper campus. Initially, one additional mechanism of cash top-up would be used along with a single card scanner. If this small-scale project proves to be feasible, the system will start the scaling process. In terms of replacing the current meal voucher system, a slow integration is preferable to ensure a smooth transition. Eventually both means of payment will be available, current and new, after which the whole meal voucher system will fully integrate onto the online platform.

4.1.2. Costs

The main cost of proposed system will be in the form of human resources. Below are some of the needed positions that will comprise the most cost.

- Team of web app developers (2-3): until deployment.
- Team of mobile app developers (1-2): until deployment.
- Application maintenance/updates/upgrades (2): permanent
- Back-end systems expert (1-2): permanent

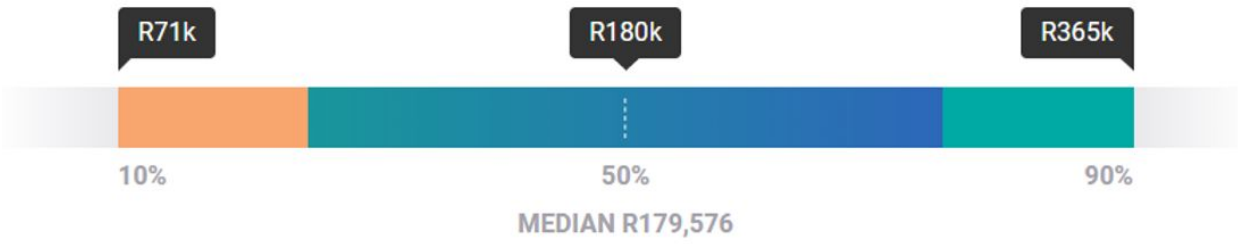

Figure 8: *Pay scale of website application developers in South Africa. ("PayScale - Salary Comparison, Salary Survey, Search Wages", n.d.)*

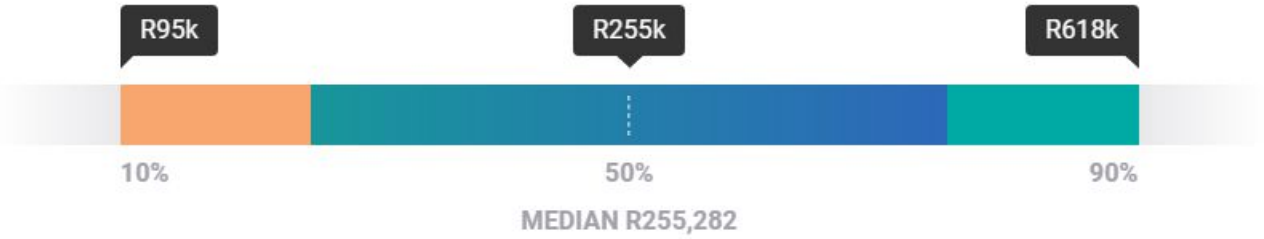

Figure 9: *Pay scale of mobile application developers in South Africa. ("PayScale - Salary Comparison, Salary Survey, Search Wages", n.d.)*

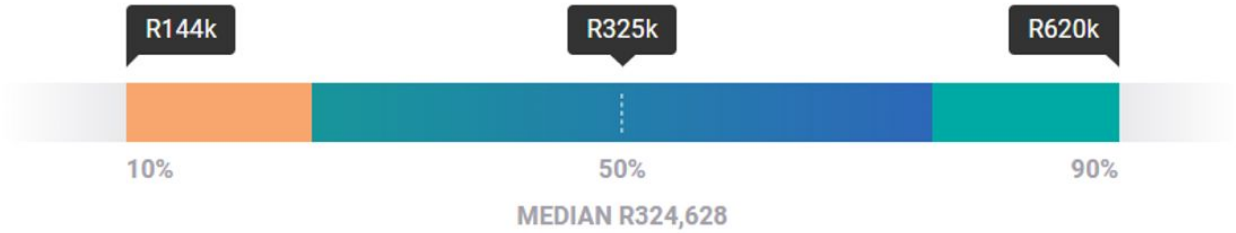

Figure 10: *Pay scale of mobile application developers in South Africa. ("PayScale - Salary Comparison, Salary Survey, Search Wages", n.d.)*

The estimated cost of hiring a full-stack team will be between R144,000 and R177,000 per month prior to application deployment.

Once the application is deployed, maintenance of applications and back-end systems is estimated to cost between R42,000 and R69,000 per month. It is important to note that these figures were taken as an average across the whole of South Africa and may not be representative of UCT's specific case. UCT could also explore alternative options such as hiring students to develop and maintain the relevant applications. This would result in a substantial decrease in cost estimates as students are typically willing to work for less.

The prices of card scanners vary greatly across the market. The six top rated card scanners were evaluated to get a price estimate of implementation. The cost of card scanners ranged from R400 to R1400. Assuming UCT implemented 35 card scanners across the relevant campuses, it would put the total cost between R14,000 and R50,400. Therefore, the total cost of fully implementing this system falls between R590,000 and R1,028,400 for the year.

4.2. Benefits

The proposed system is a cashless closed-loop payment system that provides an array of benefits to both students and UCT. Our solution goes to great lengths to prioritise user experience and solve issues that students have with the current system. Indeed, our research shows that many a nuisance would be solved by the proposed system. 73% of students indicated that they've been inconvenienced by the current meal voucher system in some way. These issues, among others, include lost vouchers, no change given for vouchers, inconvenient collection times and having to wait in a queue to collect a voucher. Our survey showed that, on average, a student had to wait 5 minutes every day to collect their meal vouchers. Not to mention the inconvenience of being constricted to a certain time and place for collection. The cashless payment system rids students of all of these issues.

The benefits experienced by UCT are far more extensive than the benefits experienced by students. Most of these benefits are derived from the fact that these vouchers will no longer be paper but will instead be online. The most apparent risk that arises from paper vouchers is that of fraud. This risk is mitigated entirely as paper vouchers will be replaced with their online counterpart. The logistics relating to the distribution and redemption of meal vouchers also poses a problem as such a process can be a tedious and somewhat risky prone. The physical transportation of paper meal vouchers is essentially the same as transporting real money. Losses and the cost of administrative clean-up could be devastating should these vouchers be lost or stolen during the transportation from a vendor to UCT. The online payment system will be automatic and redemption of meal vouchers to the relevant vendors will happen daily, thus circumventing any risk associated with the logistics of paper meal vouchers. A problem UCT experienced during protests was that meal franchises turned down the paper meal voucher as a means of payment. They didn't adopt this system due to the credit risk associated with the possibility of failed voucher redemption. This new system is far more secure and built-in tools manage credit risk, thus making it far preferable for vendors to adopt.

4.3. Low Cost Card Payment System

4.3.1. System Architecture

The system architecture of the low-cost card payment system is essentially a perfect subset of the solution outlined in section 2.1 and as such, the fundamental system organisation, mapping of software and hardware components, the top-level strategy and guide to implementation will be very similar. This solution implements only the core functionality needed for the system to be operational. There will, therefore, no longer be a web app or mobile app for either students or vendors. There will simply be the payment process. Students will only be able to check their balance at the card top-up machines and the redemption of meal vouchers to vendors will simply be an EFT. Each student will be allocated their daily stipend a day, which would either be spent or become expired.

4.3.2. Costs

The cost of human resources would now fall between R27,000 to R54,000 a month for one or two system experts to oversee implementation. The cost of the card scanner would be the same, i.e. between 14,000 and 50,400 for 35 card scanners. Thus, bringing our yearly total to be from R338,000 to R698,400. This cost-effective solution is far more feasible in the short-term and can be easily scaled to provide the functionality provided by the cost ineffective solution.

4.3.3. Benefits

During or research we found only a minor difference in preference between the cost-effective and cost-ineffective solutions. In fact, the cost-effective solution was preferred over the cost ineffective solution. Much of the benefits of the previous solution are the same for this solution, the only difference being that this system doesn't provide the convenience of having an online platform.

5. CONCLUSIONS

5.1. The current paper meal voucher system is unreliable and inconvenient

Meal vouchers can be easily damaged, lost and duplicated as they are simply printed pieces of paper. As the investigations and survey showed, 73% of the students who answered the survey had been inconvenienced by the current system. This is an unacceptable number as the system should be a convenient and efficient system for students and vendors alike. Students may be unable to eat due to the unreliability of the paper meal vouchers which could affect their performance in their studies and daily life. Students are paying for their meals to be provided for them and if their meal voucher cannot be used for any reason, then they are not receiving the meals that they had paid for. The manufacture of paper vouchers also have a heavy toll environmentally which makes it an undesirable option for the future.

5.2. Vendors do not issue change which leads to students losing out on money

When a student redeems their meal voucher, the full amount must be used, or the student loses out on the amount that they haven't used. Students should not have to lose out on money simply because change is not issued when a meal voucher is used.

The new payment system will eradicate this problem as the student will have an account which simply deducts the payment amount. The rest of the money in the "voucher" will still be in the account, which can be used at a later date.

5.3. Vendors can only redeem their vouchers weekly and may struggle to make payments

Vendors currently redeem the vouchers once a week, which takes a couple days before the money is properly transferred into the appropriate account. This is not convenient for the vendors as it means that they cannot access the income that they receive fast enough and may have to wait before being able to pay expenses.

5.4. Logistics relating to the transportation of paper meal vouchers is error prone.

The distribution and collection processes under the current meal voucher framework have a massive administrative cost. The manual administrative labour involved with these processes will often lead to the miscounting of meal vouchers. This may lead to vendors/clients being short-changed by UCT for the unaccounted payments made through the paper vouchers. The new system mitigates this problem entirely as all transactions are immediate, automatic and online.

5.5. The new mobile and web application could increase student and vendor satisfaction as well as increase the level of accessibility

The application will provide benefits that are not possible with the current meal voucher system. Students and vendors will be able to keep track of their balances and transactions. Students will also have the ability to choose meal plans, request and cancel meal vouchers, and deposit money into their student card account.

5.6. The mobile and web applications are not cost-efficient and will be difficult to implement in the short term

Due to the high level of student dissatisfaction with the current meal voucher system, it is imperative that a new system is implemented as soon as possible. The High Cost Payment System will take much longer to implement due to the applications compared to the much simpler Low Cost Payment System. The yearly cost of implementing the High Cost Payment System is much higher compared to the Low Cost Payment System.

6. RECOMMENDATIONS

6.1 Choose low cost card payment system

The low cost card payment system fits the assessment criteria better than the other options as shown in the table below. This is the system we recommend to implement.

	Paper voucher system	High cost card system	Low cost card system
Cost	High	High	Medium
Security	Low	High	High
Delivery time	5 minutes	Instant	Instant
Environmental impact	High	Low	Low
Protest vulnerability	High	Low	Low

Figure 11. A comparison table of the different systems

6.2 Implement the new system

6.2.1 Card system on campus

To begin the implementation, an additional top up machine will be added in the upper campus food court. The pilot vendor will also be in that food court. This will introduce the students to the new system and facilitate the transition. The system will then be introduced to other shops on campus along with additional top up machines being added. The goal is to have every shop equipped with this payment option within 6 months.

6.2.2 Card system as meal voucher replacement

One residence will be chosen as pilot to implement the meal voucher replacement. Students will have the option of allocating the money to their student cards and use that as payment method. Over a period of 3 months, the amount of meal vouchers distributed will be limited. The usual 50 000 the first month, 30 000 the second month and 10 000 the third month. This will increase the usage of the new system until its complete takeover. The goal is to have every residence using the system 6 months after the pilot.

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Appendix 1: Sample Questionnaire

The following questionnaire was handed to the UCT students who were interviewed. After interviewing the students, their results were analysed and used to help develop an effective solution.

Questionnaire on the UCT meal voucher system:

For our CSC3002F Report Writing Project, we have decided to cover the current meal voucher system and our proposed solution is to allow students to use their student cards to pay for the meals as well as for other, on campus, services. Rather than having a piece of paper, the student will have money put onto their student card which will be scanned when making a payment. We have also considered having a mobile and web application which the students can use to deposit money into their student card and to allow them to check their balance. However, as this is not a cost-effective solution, we had to consider a cheaper option. Our cost-effective solution is similar to the current printing system on campus: the student uses a machine on campus to deposit money onto their card and scans their card on devices that will be provided to third party vendors.

Please answer the questions below based on the current and proposed meal voucher system:

1. On a scale from 1-10, how satisfied are/were you with the current meal voucher system?
2. Which of the three systems (cost-effective, cost-ineffective or the current system) do you prefer?
3. Would you use the simple cost-effective solution?
4. Would you use the web application (cost-ineffective)?
5. Would you use the mobile application (cost-ineffective)?
6. Have you ever been inconvenienced by the current meal voucher system (e.g. lost vouchers, missed collection time, rejected voucher, etc)?
7. On average, how much time do you spend waiting for meal vouchers a day?
8. Do you think the proposed system will be more secure from the students' perspective?

Appendix 2: Mind map