Universitetet i Oslo
Institutt for informatikk

Course Code: INF4260
Course Title: Human Computer Interaction
Deliverable No.: Three

Autumn 2007

Integrating The Student ID Card with the Ticketing System
FINAL REPORT

Brown Msiska   **brownm**

Patrick Chikumba   **patricc**

03.12.2007

1 INTRODUCTION

Information and Communications Technology (ICT) has over the past decades added value to many areas of human life let alone public transport systems. Ticketing is one aspect of public transport that is continually embracing the promises of ICT. According to an April 2007 position paper of the International Association of Public Transport (UITP), "high investments are being made for the implementation of electronic ticketing projects with the goal to contribute to customer convenience and efficiency of public transport operations." The paper goes on to suggest that *technical interoperability* and *organizational cooperation* should be established in order to make effective use of developments in ICT and serve the customer better.

This report concerns the integration of the student card with the public transport ticketing system with the aim of making student travel within the City of Oslo, with respect to purchase of student tickets, more convenient. The nature of the project demands technical interoperability as well as organization cooperation between public transport providers on one hand and the university on the other hand.

The main aim of this project was to develop and evaluate a prototype that will serve to test the viability of such integration.

The report has six main parts. First a methodological approach used in the project is presented, which is followed by a brief background to the project. Next the issue of understanding use and users of the system is discussed touching on relevant literature. This is followed by a discussion of the prototype design process which is itself followed by a look at the evaluation process.

2 METHODOLOGICAL APPROACH

The data was gathered through three different techniques namely interviews, observation and document review. Different techniques were used in order to triangulate our findings.

2.1 Semi-structured interviews

We interviewed the University Foundation for Student Life (SiO) to understand what is required for a student to have the student card and where it can be used. We also interviewed ten students from University of Oslo, selected at random, to find out their knowledge on and about the use of the student card, credit card, the Internet Banking and the Trafikanten ticket.

Semi-structured interviews were conducted on both situations in which questions were both closed and open and also features of structured and unstructured interviews were combined. This type of interview was chosen to maintain consistency for topics covered with each interviewee (Sharp, Rogers and Preece, 2007).

During evaluation we also used this technique to get feedback from evaluators.

2.2 Observation

There was one field observation carried out at the SiO in order to get familiar with the student card production process.

Two other field observations were carried out at Trafikanten in order to appreciate the current situation with respect to the purchase of student cards.

Controlled observations were done during prototype development and evaluation. This was done to get feedback from users as well as evaluators.

2.3 Document Review

The interviews conducted at SiO yielded some documents on Student ID cards which we reviewed in order to get more information about student cards.

Visiting Trafikanten website gave us more information about the various tickets on offer for public transport.

3 BACKGROUND

3.1 Student Card

The student card is produced by the University Foundation for Student Life (SiO) on behalf of the University of Oslo (UiO). It can function as student identification, library card, and access card. It is only valid for student identification when accompanied by a valid semester card from UiO. The student card can also function as a Library Card in all branches of UiO Library to borrow books. Graduate students are entitled to access to university buildings and they use their respective student cards, which are normally activated automatically by respective department, to have such type of access. The student card can be used for accessing the sports halls run by Student Sports by those who have paid the admission fee. The students can also obtain access rights to buildings at SiO's Student Housing through the student cards when only properly activated.

In order to get the student card, a student must have a permanent Norwegian personal number (ID-number) and be registered for a semester and have a valid semester card.

3.2 Ticketing

Trafikanten and other transport providers in the Oslo offer various kinds of tickets for travel by bus or tram within the City of Oslo. These include:

- Hour Ticket – allows a client to travel by bus or tram within the city for an hour
- Day Ticket – allows a client to travel by bus or tram within the city for a whole day
- 7 Day Ticket – allows a client to travel by bus or tram within the city for a whole week
- Month Ticket – allows a client to travel by bus or tram with the city for a whole month
- Student Ticket – allows a student client to travel by bus or tram within the city for a whole month at a subsidized rate.

Once a ticket has been bought the client will have to activate the ticket by stamping it using machines provided at most stations.

3.3 Problem Space

This project, however, focuses on the student ticket which is a monthly ticket that allows a student travel at a subsidized rate. A brief analysis of the current student ticketing system has revealed a number of problems which this project seeks to address. These include:

- *Long waiting times when purchasing a student ticket*: on average one has to wait about 5 minutes before being attended to. The situation gets worse at the end of the month.

- *Availability of Student Tickets*: student tickets are not as ubiquitously available as Hour Tickets. This means one has to find a point where student tickets are sold and in most cases involves traveling.

- *Undue Penalties Resulting from Forgetting*: it has been observed that one can easily forget his/her ticket home or forget to activate his/her ticket (by having it stamped) before boarding a bus or tram. In such a case Traffic Inspectors will deem a person to be a cheat and that a person is liable to pay a penalty.

- *Mismatch between Student Time Constraints and Time Required to Purchase a Ticket*: students like most people are time-constrained but when you look at the time taken waiting on a queue to purchase a ticket plus the time taken traveling to and from the Ticket Purchase point (e.g. Trafikanten) one sees a mismatch.

In order to address these problems we ask the following questions:

- How can we make the ticketing more convenient and time-friendly for a student?
- Is it necessary for one to travel to Trafikanten in order to purchase a Student Ticket?
- Is there a way we can link up the Student ID card (system) with Trafikanten Ticketing system to facilitate purchase of Student Tickets?
- How does such a link affect or improve the interaction between Trafikanten and Students as part of its clientele?
- How can such a link contribute to further improvement of the Trafikanten Ticketing System in general (without constraining ourselves to the student aspect alone)?

3.4 Proposed Solution

As a way of getting around some of the problems and bringing convenience to the student customer, integrating the student card with the public transport ticketing system in Oslo was put forward as a possible solution. This will then enable students to use their student ID cards as "renewable" tickets where purchase of validity days is done via the Internet thereby eliminating the need to travel to a

selling point of student tickets, as is the case currently.

At the heart of this solution is the Student ID card, we therefore make an assumption that most students have Student ID cards or if not can easily get one.

We further assume that a majority of students have bank accounts and are familiar with Internet Banking or use of credit cards. In addition to this we assume that, if not already, Trafikanten Ticketing System can be configured to accept payments via Internet Banking or credit cards.

We also assume ease of use as well as ease of learning of Internet Banking and credit card systems for those students that are not familiar with these technologies.

4 UNDERSTANDING USE AND USERS

Use of any system cannot be separated from users. In fact users often find systems that have been designed without taking into account user capabilities frustrating and difficult to use. "Designing usable interactive products requires considering who is going to be using them, how they are going to be used, and where they are going to be used." (Sharp, Rogers and Preece, 2007 p. 5).

4.1 Who are users?

"Identifying the users may seem like a straightforward activity, but in fact there are many interpretations of 'user,' and involving the right users is crucial to successful user-centered design." (Sharp, Rogers and Preece, 2007 p. 430). Main users of the system are identified as the students of the UiO because they interact directly with the student cards and also the student tickets. Other users are the SiO and Trafikanten who manage the student card and the ticketing systems respectively and will have direct influence on requirements of the proposed solution.

4.2 Interviews

We planned and conducted interviews with the purpose of collecting sufficient, accurate, and relevant data which resulted in producing a set of stable requirements. The interviewees were some students of the UiO and personnel at SiO (responsible for student card production). The interview with SiO was to find out the use and the users of the student card at UiO in which a student was identified as a primary user. Then the interviews with students were conducted to gather data on how

much use and knowledge do the students have on the student card, ticket for transport in the City of Oslo, and bank accounts.

Our idea, that of integrating the student card with the public transport ticketing system in Oslo, and aims of interviews were communicated and explained to the interviewees for them to have full understanding of the whole exercise. We decided to conduct the semi-structured interviews in both situations, in which the interview questions were both closed and open. This was chosen in order to ensure the richness of data collected and to make data analysis a bit easier and less time consuming. The questions were neutral and in simple sentences and layman's terms were used to avoid confusion, among others, to the interviewee (Sharp, Rogers and Preece, 2007 p. 304).

During the interviews, the following steps were observed, as described by Sharp, Rogers and Preece (2007 p. 307):

- introduction in which we introduced ourselves and explained aims of the interview
- in warm-up session, we asked easy and general questions
- main session followed in which specific questions were presented in a logical sequence
- cool-off session in which we presented easy questions to summarize our findings
- interview ended with a word of thanks to the interviewee for the time and information.

We recorded our findings from the interviews through the note taking because we found that it is the least technical way of recording data although it was difficult and tiring to write and listen at the same time (Sharp, Rogers and Preece, 2007 p. 295).

4.2.1 Interview with SiO

A thirty-minute interview with the SiO was conducted in order to find out use and users of the student card at UiO. We found that the main users are the 'valid students' (the students who have registered for a particular semester) of UiO.

From the interview, it was found that the student card is used by the students of UiO and is multi-functional. It can be activated to function in different situations such as the student identification, access the university buildings, the university library, the buildings of SiO's Student Housing, and also sport halls.

4.2.2 Interview with Students at UiO

Much time was spent on the interviews with students at UiO as 'key players' of our project and ten students were randomly selected for the interviews. The interviews were conducted for ten days, one day for one interviewee and at most thirty minutes was allocated to each interviewee

We formulated questions in relation to these areas.

- Questions about the ticket – we wanted to find out which type of ticket (hour, day, 7-day, student, or month ticket) most students buy and why, where they buy their tickets, and problems they experience with the ticket system.
- Questions about the student card – we were interested to know if most students have the student card, where and how frequently they use it.
- Questions about the bank account and the Internet banking – we tried to gather data on use and knowledge of the on-line payments and the Internet banking

The findings from the interviews were analyzed using merely figures and percentages that are useful for standardizing the data (Sharp, Rogers, and Preece, 2007). From ten students interviewed, the following is the analysis of the outcomes:

- all ten students (100%) have student cards which they use to have access to the university buildings (labs and lecture rooms) and five out of ten (50%) use to borrow books from the university library
- all ten students (100%) buy either student ticket (if age is below thirty years) or full month ticket (if otherwise) with a reason that it is cheap and convenient.
- all ten students (100%) have bank accounts and they use on-line payment systems and the Internet banking

From the simple statistics above, it shows that assumptions made in the proposed solution are well supported. The solution is based mainly on the student card, the ticket, and bank accounts which almost all students a UiO have and capable of using them.

4.3 Establishing requirements

In interaction design, as Sharp, Rogers and Preece (2007) mention, it is important to understand the functionality required and the constraints under which the product or system must operate. The following requirements have arisen from the data gathering and analysis of the user's needs.

4.3.1 Functional Requirements

The proposed solution is required to perform the following functions:

- allow a student to register into system using his/her student ID card number
- allow the registered student to purchase days of validity (topping up card) which involves purchasing the number of days a student can use his/her card as a ticket
- allow the registered student to check his/her account status which involves the student logging on the system and being provided up to date information regarding his/her account
- allow the registered student to modify some data such as passwords and personal data
- provide simple help to the system users on how to operate the system
- close the student account when the owner is no longer valid student of UiO
- validate all critical data during the input process

4.3.2 Data Requirements

The proposed system will entirely depend on the electronic data to provide necessary information. Therefore it is required to make sure that the quality of data is well maintained. The data, for the proposed system, must be accurate, consistent, up-to-date, complete, and valid for a particular period of time. For example, the data is valid for the system when and only when an owner is a valid student of UiO.

4.3.3 Technical Requirements

Being a web based, the system will require that the user has access to a computer with internet connection. This could be on campus or at his/her home.

4.3.4 User Characteristics

In order to utilize the proposed solution, it is important for the user (student) to:

- have basic practical experience on using the internet
- have a student card and a semester card
- have a bank account and be familiar with credit cards and/or internet banking

4.4 Use Case

"Use cases describe the interaction between a primary system actor—the initiator of the interaction—and the system itself, represented as a sequence of simple steps" (Wikipedia, 2007a). Therefore, a use case diagram (see Fig 4.1) in this report describes the main interaction between the users (students) and the system.
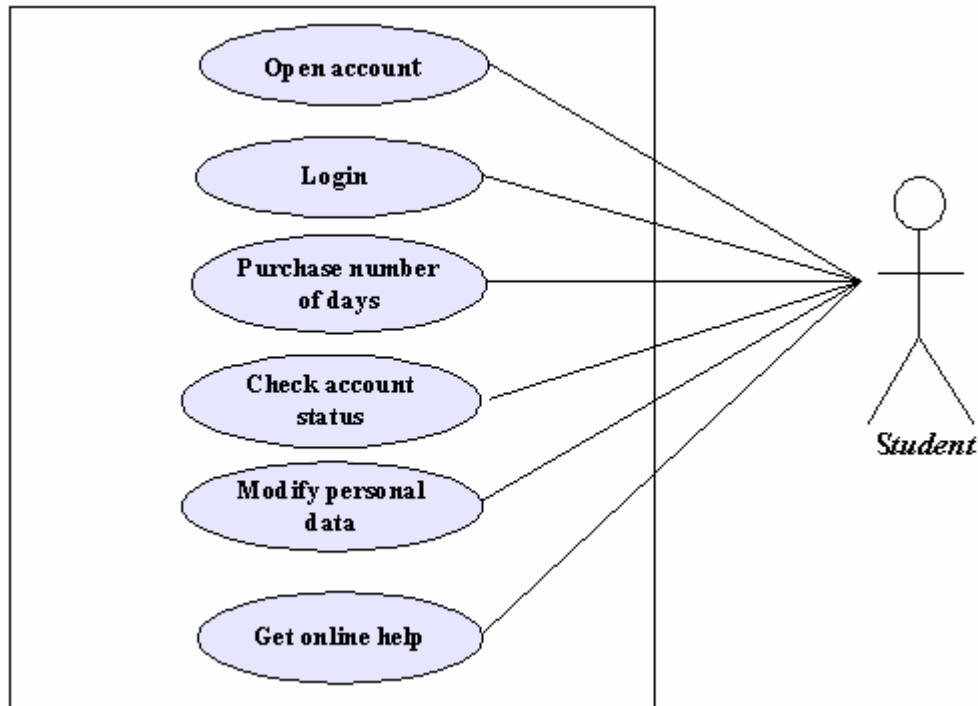

Fig 4.1: Use case diagram for the prototype

5 PROTOTYPING AND DESIGN

"It is often said that users can't tell you what they want, but when they see something and get to use it, they soon know what they don't want" (Rogers, Sharp and Preece, 2007, p.530). One of the major reasons why prototyping was carried out in this project was to elicit requirements from the prospective users of the proposed system. That is, students.

The prototype has also been developed to serve as a tool of communication of ideas with stakeholders in order to induce a general reflection on how the ticketing system could be improved.

5.1 What to Design

The prototyping process concentrated on the students' interaction with the system. The system provides three major functions to a student:

- Registration (or opening of an account)
- Checking account status
- Buying of validity days (a number of days when the student card can be used to access public transport)

The prototype therefore focuses on these three areas of interaction between student and the system. In addition to that the prototype also allows a student to:

- Access historical information about his/her purchases (of validity days).
- Update personal information (this includes: account password, student ID card no in case of loss or moving to another educational institution and contact details).

Screen shots of the prototype are provided in the appendix section.

5.2 Design Principles

In developing this prototype we considered general design principles (Rogers, Sharp and Preece, 2007, p.29 – 33) of an interactive product. These include:

- *Visibility:* how visible are the range of functions that can be performed by a user. With a good level of visibility users are likely to know what to do next. The prototype in this project makes use of this principle by making the range of functionality at each state of the system visible.

- *Feedback:* this involves sending back information regarding an action. Every function a user can perform with the prototype has an appropriate feedback.

- *Constraints:* this involves limiting users from certain actions at given times. There are few instances where this principle has been applied. For example, one cannot buy validity days or check the number of validity days unless they are logged on and one cannot use the services of the system unless they are registered. Otherwise, once a user has met the required access criteria they can perform any visible action in the subsequent interface.

- *Consistency:* this refers to similarity between interfaces and interface elements allowing easy transfer of experience from one interactive product to another or from one part of an interface to another. The prototype has been designed to be consistent within as well as with respect to other systems that support online payments.

- *Affordance:* refers to the ability of an object to let its users know how to use it. The prototype benefits from inherent affordance of interface elements that have been used. For example the button on a web form has inherent characteristic of "inviting clicks".

Since the system is web-based we went further to consider *Jakob Nielsen's* (2000) web interface usability guidelines which include:

- *Simplicity*: this suggests that web interfaces should be simple and uncluttered (crowded web interfaces make it difficult for users to find what they are looking for). The prototype employs this strategy of making the web interface as simple as possible by just presenting exactly what a user needs in order to perform a chosen function.

- *Feedback*: this is as described above.

- *Speed*: this suggests that web pages should have as little download time as possible. As a result it is recommended that graphics and multimedia content in web pages should be kept as minimal as possible. The prototype does not require much of graphics so by its nature it guarantees faster downloading times.

- *Legibility*: this refers to how readable is the textual content of the website. By using tried and tested font settings the prototype strives to make textual content readable.

- *Ease of Use*: this refers to the easiness in carrying out required functions in an interactive product. This depends on other factors like visibility, affordance, consistency and so on.

5.3 Information Presentation

Information presentation in the interface has been guided by consideration of cognitive aspects and affective aspects of interaction.

Specifically, theory suggests that *attention*, *perception* and *memory* are the most important cognitive processes to interaction design. These are the aspects that have been used to guide our design.

5.3.1 Attention

Attention refers to the process of selecting things to concentrate on from a range of possibilities available. "The way information is displayed can also greatly influence how easy or difficult it is to attend to appropriate pieces of information" (Sharp, Rogers, and Preece, 2007, p. 95). In developing the prototype we have strived to structure the information in a manner that makes finding of target information easier.

5.3.2 Perception

Refers to how information is acquired from the environment using different sense organs. Vision is the dominant sense amongst the sighted individuals. With respect to web interfaces theory suggests bordering and spacing as effective ways of grouping information pieces (Sharp, Rogers, and Preece, 2007 p. 99). In the prototype we have used this approach plus colour contrast. A good example will be in the history page (*see Fig 8.8 in the appendix*) of the prototype where a user can access historical information on buying of validity days.

5.3.3 Memory

This involves remembering. In general theory calls designers to desist from overloading user memories. In designing this prototype we took that into consideration. This led us to let users login into the system with a proper username as compared to student ID card number which is longer and hard to remember. Apart from the username and password there is little else a user is required to remember while using the system.

5.3.4 Affective Aspects

We also looked at affective aspects in order to minimize user frustration as result of interaction with the system. In this case we looked at *guidelines on error messages* (Sharp, Rogers, and Preece, 2007 p. 192) and *appearance* (Sharp, Rogers, and Preece, 2007 p. 193).

5.4 The Where Am I? What's here? Where Can I Go? Layout

The layout of the prototype follows the *Where am I? What's here? Where can I go?* Model proposed by Keith Instone (Sharp, Rogers, and Preece, 2007 p. 255). In this layout every web page has three main areas:

- The *top part* answers the "where am I?" part by branding the web page.
- Below on *left-hand side* is an area that answers the "Where can I go?" part by providing a list of links to other sections of the system.
- Immediately *to the right of the second part* is the main content area that answers the "what's here" part.

5.5 User-Centered Approach

We have strived to make the prototyping process in this project user-centered by making the development process iterative. The feedback from the users was used to fix problems with the prototype which was taken back to users for further evaluation and so on. This repetitive approach means that the prototype yields better results with respect to its objectives.

6 EVALUATION

"...running effective evaluations involves understanding not only why evaluation is important but also what aspects to evaluate, where evaluation should take place, and when to evaluate" (Rogers, Sharp and Preece, 2007, p. 586).

6.1 Objectives

Specifically, the prototype was evaluated by considering the following:

- Learnability: finding out how easily the users can learn to use the proposed system

- Predictability: checking whether the users can predict or not what to do next when just looking on the interface without anyone guiding or explaining to them
- Legibility: finding out how easily the users can read the displayed information on the interface.

6.2 The Process

The prototype was evaluated in the laboratory setting which gave us easy control over the evaluation process and to make sure that the evaluation focused on specific aspects of the system. There were three students from UiO as the evaluators of the prototype. Each evaluator evaluated the prototype individually with two observers, who were the developers of the prototype, but at different times. Maximum time of twenty minutes was allocated to each evaluator.

The data was collected through observations, when the evaluator was evaluating the prototype, and short interview after the evaluation to find out their opinions on the prototyped ideas..

6.3 Outcomes

6.3.1 Learnability

The evaluators reported no problems with respect to the learnability of the system. We note however that the evaluators used are mere students some of which, despite taking computing courses have not done much work in interaction design, and therefore cannot be taken as experts in this field.

6.3.2 Predictability

We observed that given a brief description of what the system was all about both the evaluators and users that tried the system needed little assistance in deciding what to do next.

6.3.3 Legibility

Interviews after the evaluation process indicated that the information was legible enough.

6.4 General Comments from Evaluators

- *Support for Multiple Languages*: evaluators noted that the student population comprises students with varying language skills. It will therefore be good to allow users to choose a language (eg. English, Norwegian) they would want to use.

- *Privacy policy*: evaluators also noted that such a system will require a good privacy policy that will induce trust from students that they are not giving up too much private information about themselves.

- *Acceptance*: both evaluators and the students that were given a chance to use the system agreed that this is right course of action to improve ticketing with respect to students. They also added that such a system is not only needed for students but other members of the community as well.

7 REFERENCES

Preece, J., Rogers, Y., Sharp, H. (2007) *Interaction Design: Beyond Human Computer Interaction*, John Wiley & Sons; 2nd Edition

Wikipedia: use case, http://en.wikipedia.org/wiki/Use_case, (accessed 11/2007)

Wikipedia: prototype, http://en.wikipedia.org/wiki/prototype, (accessed 10/2007)

Wikipedia: web usability, http://en.wikipedia.org/wiki/Web_usability, (accessed 10/2007)

Wikipedia: evaluation, http://en.wikipedia.org/wiki/Evaluation, (accessed 10/2007)
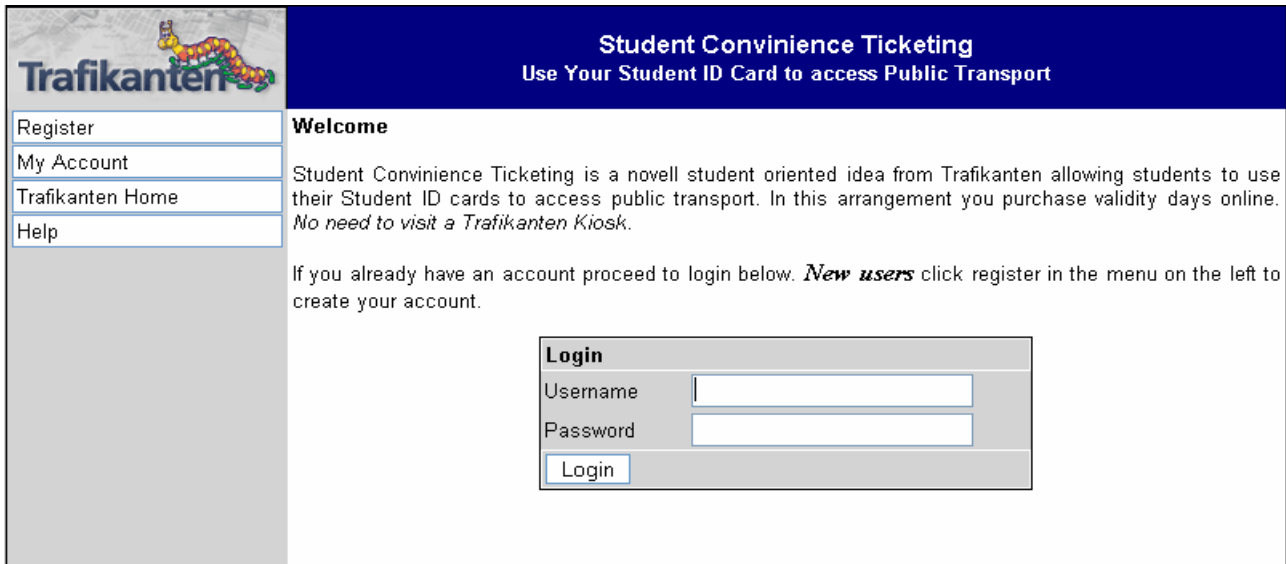
UITP (International Association of Public Transport), *Position paper: everybody local everywhere*, April 2007.

Dix, A., Finlay, J., Abowd, G., Beale, R. (2003) *Human Computer Interaction*, Prentice Hall; 3rd Edition

8 APPENDIX

8.1 Welcome Page

The welcome page is a default page that a user sees if he/she has not logged on. Below is a screenshot of this page.

Fig 8.1: System default page that shows if a user has not logged on

8.2 Registration

Registration involves two steps. The first step (see Fig 8.2) involves entering the student ID card number. In the second step (see Fig. 8.3) a user supplies a username and a corresponding password.

Fig 8.2: Step one of registration – entering student ID card no

Fig 8.3: Step two of registration – confirm name and complete registration

8.3 Account Status

Once a user has logged on the account status is immediately provided (see screenshot below).

Fig 8.4: Account page showing account status and other account information

8.4 Buying Validity Days

Buying validity days has got three steps:

- Choosing Payment Method

- Entering period of validity required
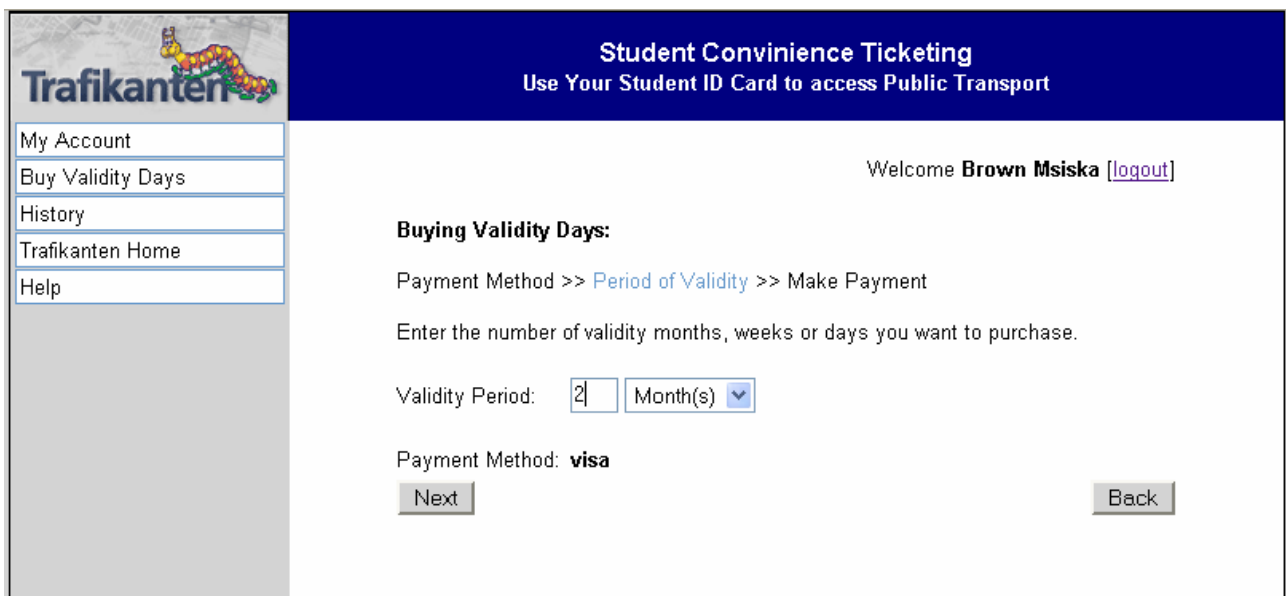
- Making payment
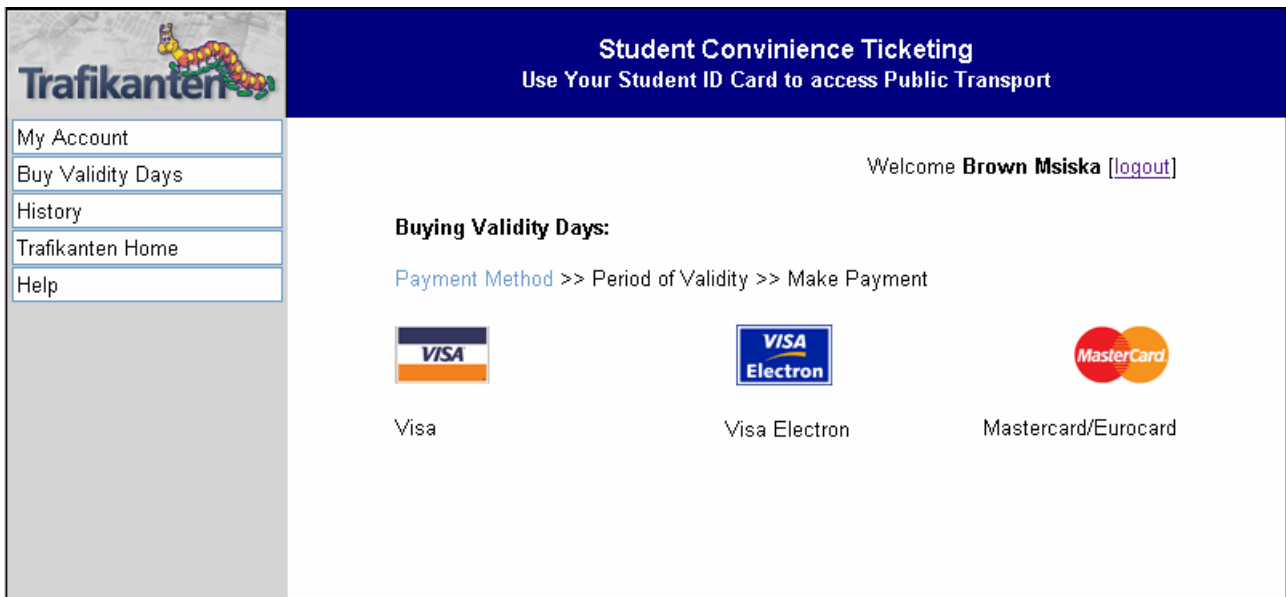
Fig 8.5: step one of Buying Validity Days – choosing payment method

Fig 8:6: step two of Buying Validity Days – period of validity
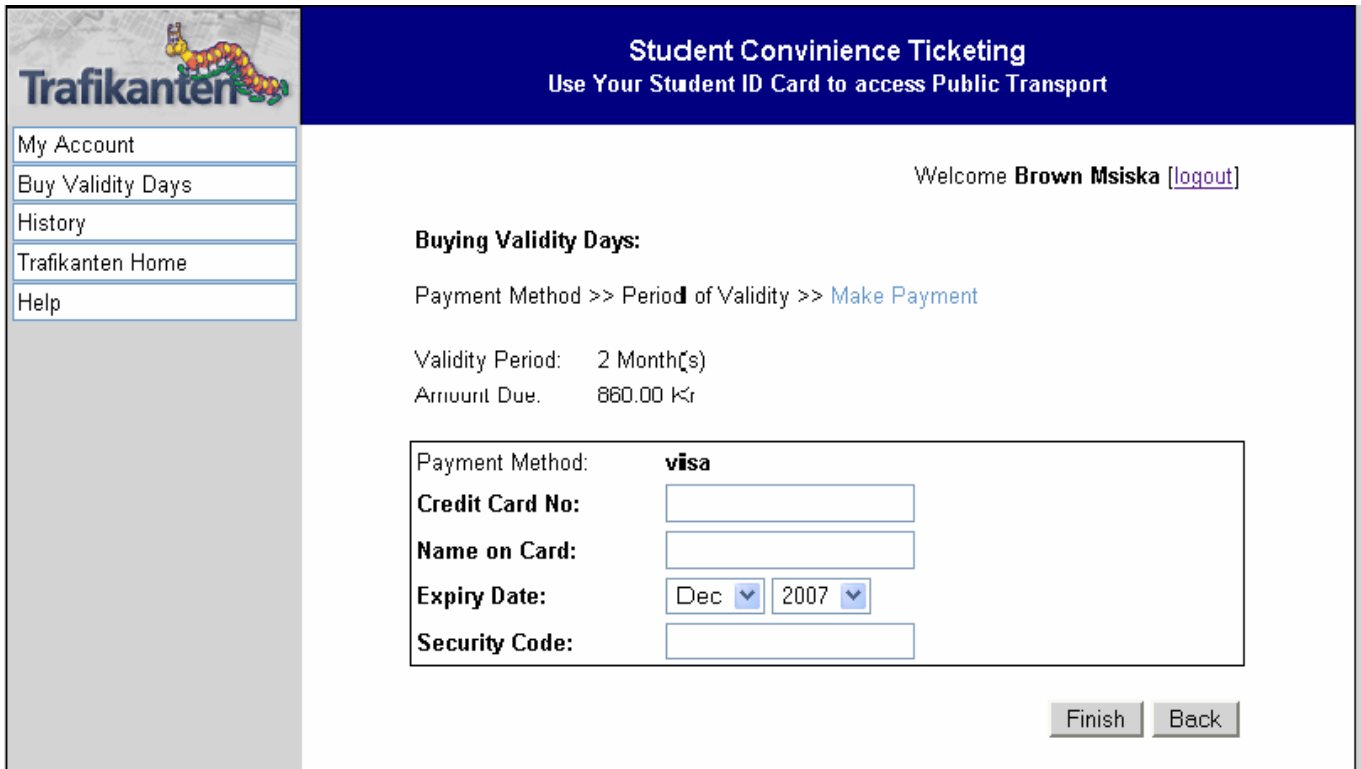
Fig 8.7: Step Three of Buying Validity Days – Make Payment

8.5 Other Pages

In addition to there are other pages which allow users to:

- Change password and other details
- View a History of purchases
- Get online Help

Below we provide screenshots of two of such pages:

Fig 8.8: History Page

Fig 8.9: Change Password