In this paper we consider the use of ticket vending machines of the Athens-Piraeus Electric Railways by riders who purchase tickets from these machines to allow them to commute through the transportation system in Athens, Greece. We then identify ways in which the ticket vending machine artefact could be redesigned to include new features and functionality and document the requirements for this new digitally augmented artefact.

1. Description of the Setting

In this section we provide a description of the domain. First, we begin with a brief overview of the structure of the Athens-Piraeus Electric Railways system and then give an overview of its present day structure. Second, we describe the fare collection system that is currently in place. Third, we provide a description of the automated ticket vending machines that are in use by the railway to support ticket-selling operations.

1.1 Structure of the System

The Athens-Piraeus Electric Railways is a commuter rail service operating in Athens, Greece. It is the oldest part of the rail system (founded in 1869) and is referred to usually by locals as I.S.A.P. or more recently as Line 1 [1]. The Athens-Piraeus Electric Railways service is now part of the Urban Rail Transport S.A. that is usually referred to by locals as S.T.A.S.Y., this is the organization that in addition to the Athens-Piraeus Electric Railways also owns the Athens Metro system and the Athens Tram. These organizations ultimately fall under the auspices of the Athens Urban Transportation Organization, which is responsible for all public transport in the Athens area including bus service. The Athens-Piraeus Electric Railways system presently spans from Kifisia (which is the northern terminus of the line) to Piraeus (which is the southern terminus of the line) and is comprised of 24 stations [1]. There are currently plans being considered that would increase the number of stations by 13 to a total of 37 [1]. The majority of the line and stations are above ground with three stations and their surrounding track located under ground, these are: Kato Patissia, Victoria, and Omonia. The system is open all day except from 1am to 5am.

1.2 Current Fare Collection Practices

An honour based fare collection system (also known as a proof-of-payment system) has been in place in the Athens-Piraeus Electric Railways since 2000. Under this system train riders are required on entry into the train system to validate their tickets before entering the platforms unless they are transferring from another transit service with tickets that permit a transfer. In such an event the tickets must have been validated in the original service. Ticket inspectors randomly check passenger tickets at times working undercover (without uniforms). Passengers that are caught without a validated ticket are required to pay a fine that is 60 times what their fare would have cost. It is calculated that any loss in revenue by fare evaders would be absorbed by any income collected through these fines [1]. In addition to the stations tickets can also be purchased at metro stations, tram stations, suburban railway stations, blue or yellow ticket offices, and at many newsstands throughout the city. Regular tickets for the Athens-Piraeus Electric Railways are one euro and forty cents in value and reduced fare tickets are 70 cents. These tickets allow unlimited travel for a period of 90-minutes on the Athens-Piraeus Electric Railways as well as the ability to transfer to any public transportation in the Athens area except for the Airport train. 90 minutes is adequate time for a passenger to travel the entire length of Line 1 (from Kiffisia to Pireus). There are also one day, three day, seven day, and monthly unlimited-ride passes available for purchase.

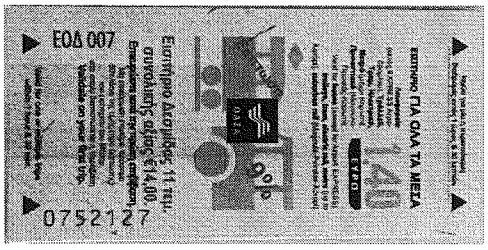


Figure 1: An image of an Athens Urban Transportation Organization ticket that is valid for Athens-Piraeus Electric Railways system travel. The dimensions of the ticket are about 3.5cm by 7cm.

Individual train stations can be divided into two distinct areas for simplicity. The first is the lobby of the station, which passengers first arrive upon their entrance into the station. In the lobby

tickets (an sample of which can be seen in figure 1) are available for sale at staffed ticket counters, which also serve as information booths for anyone with queries regarding the train service. Adjacent or opposite of the ticket counters are a limited number of automatic ticket vending machines. The second part of the train station is comprised of the platform where passengers await the arrival of trains. Separating the two areas is a line of ticket validation machines. An example of the ticket validation machines and their placement can be seen in Figure 2. Tickets are validated by sliding them into a single clearly marked slit on the machine and then waiting to hear a distinctive beep sound, which indicates that the ticket has been validated.

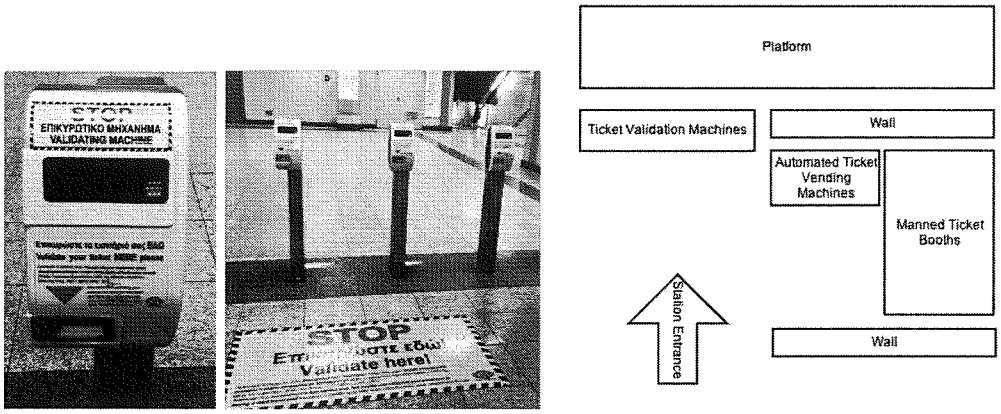


Figure 2: Ticket validation machine (left), ticket validation area at the entrance to the platforms (middle), plan of sample station organization (right).

1.3 Automated Ticket Vending Machines

Automated ticket vending machines (an example of which can be seen in Figure 3) are only found in Athens-Piraeus Electric Railways public stations near the entrances adjacent to staffed ticket counters. The positioning of the machines near the staffed ticket counters is strategic as it allows for the staff to keep an eye on the machines and report maintenance issues which include refilling the machines with tickets and emptying the machines of coins. The machines are simple in structure and have not changed since their introduction. They contain a series of buttons that correspond to the ticket types that are available for sale on the machines. Not all types of tickets are available on the machines. In order to use the machines patrons first select their desired ticket from the available

options. The options are one-ride regular and reduced price tickets and the recently introduced one day unlimited ride passes. There are also options to purchase one-ride regular and reduced price bus / tram tickets. Below these options the automatic ticket vending machines have a series of four buttons that allow one to select if they would like to purchase additional tickets of the same type. and a number of tickets from 2 to 5 that would like to be issued. An LCD shows the selection that is made and shows the amount of money that must be input in the machine for the transaction to complete. The machines only accept coins of value 5, 10, 20, and 50 cents as well as 1 and 2 euros. Once the money has been entered the tickets are released into a slot near the bottom of the machine. Users are able to stop the transaction before they enter the required money by hitting the cancel button.

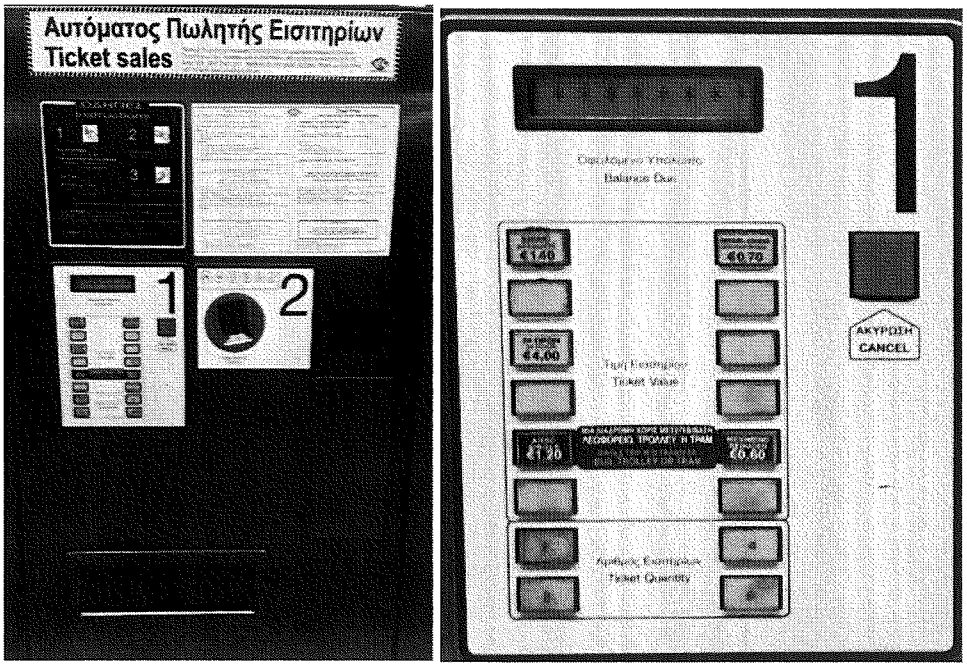


Figure 3: An example of automatic ticket vending machine (left), a close up image of the menu of the automatic ticket vending machine (right).

2. Approach, Elicitation and Notations

A model-driven method was selected to guide our elicitation process as described by Nuseibeh and Easterbrook [2]. The use of modelling as an elicitation approach is proposed by Dardenne et al. [3] who explain that through the process of modelling an environment one can

generate its requirements. Specifically, we employ scenario-based modelling and generate user scenarios in order to obtain a more complete understanding of the requirements for creating an improved artefact. As part of that process we attempted to use a combination of elicitation techniques as suggested by Jones and Maiden [4]. Jones and Maiden [4] observe that there has been a movement in requirements engineering where practitioners combine a variety of elicitation techniques as each technique has its own strengths as well as weaknesses. One elicitation techniques that was considered but not used was that of prototyping as Maiden & Rugg [5] state that such an approach is more appropriate for new systems. Instead we follow the advise of Gougen [6] who proposes that it is good to start begin with acquiring a basic understanding of the artefact and environment using a technique such as ethnography and then zooming in to obtain a deeper understanding using a technique such as interviewing. We therefore divided out elicitation activities into two phases. In the first phase our approach entailed us obtaining an overview of the domain and understanding how users interact with the artefact. This was accomplished through the use of two traditional elicitation techniques: 1) the distribution of a survey; 2) and video-based fieldwork.

Selecting to use a survey in the first phase of our elicitation process was seen as appropriate for two reasons. The first is that it was recommended as an effective elicitation technique to be employed early in the requirements process by Zowghi & Coulin [7]. The second is in the nature of surveys, which are known to be efficient and cost effective in their approach to collecting information. Pohl & Rupp [8] write on p.26 of their book entitled *Requirements Engineering Fundamentals,* "questionnaires can elicit a magnitude of information in a short amount of time and at low costs". These benefits thereby make using surveys an ideal technique for gathering information quickly and cheaply. They also have the benefit of providing consistency to the manner in which data is collected as all participants are exposed to the same questions [9]. The survey was seen to elicit the stakeholder's conscious requirements. The primary purpose of using a survey was to gauge individuals' current satisfaction and use habits of the automated ticket vending machines to guide further requirements work. It was developed using our present understanding of the artefact and its use. The survey was distributed to a convenience sample and the snowballing method by initially

sending an announcement through Facebook using a descriptive personal message directing acquaintances to a link on the surveymonkey.com website and encouraging participants to forward the message to any acquaintances they believe might be interested in also participating.

The second traditional elicitation technique that was used was that of video-based fieldwork as suggested by Jirotka & Luff [10]. The use of observation in the elicitation of requirements is described by Goguen as an effective way to overcome the problems surrounding the elicitation of tacit knowledge [6]. This is the problem of having to elicit tacit knowledge from users is a common problem in requirements work as one is sometimes limited by the users ability to express the way they work with an artefact even though they regularly use it and might even be considered an expert in its use [11]. In other words tacit knowledge is knowledge that an individual possesses but cannot effectively describe [12]. As such, it would be difficult to employ techniques such as surveys, interviews, and focus groups to elicit that knowledge. We complement observation with the use of video to allow for a more intensive analysis of any activities including collaboration and interactions that take place in the environment. The Monastiraki train station was selected for the video-based fieldwork due to its location. It was in a central part of the system and had a high volume of traffic. This would ensure that the artefact would be used enough times to collect adequate data to generalize on the way it was being used by users. Fieldwork was conducted periodically over a period of four days in short phases as was recommended by Jirotka & Luff [10].

For the second phase a series of semi-structured interviews and a focus group were used to try and ascertain if there was any additional information that could be elicited as to the way the artefact was being used and whether there were any additions which the users felt could be included to the artefact to enhance its functionality. The use of semi-structured interviews was selected to directly overcome one of the limitations of video-based fieldwork and surveys that is that there is no bi-directional communication between the user and the individual conducing the requirements work [13]. In regards to the use of surveys respondents are already limited in their responses to the domain that they have been placed in by the creator of the survey. In other words depending on the way each questioned is structured an influence is exerted to each participant by that question [8]. Finally a focus

group was used to expand on the ideas that were identified through the interviews. The focus group was put together from participants that had been previously interviewed and were willing to participate in a focus group session to further look into their interaction with the artefact. We should note that focus groups in particular foster the social element of working with the artefact to be developed. Focus group participants can work together to build their understanding of the artefact and the way in which it is used as well as what it could be especially so when they reach what Bohm [14] refers to as a state of dialogue which allows for an ideal mode of communication between the users. One of the weaknesses of focus groups is that they are open to political manipulations [6] and as such attempts were made by the facilitator to encourage all participants to contribute.

3. Analysis

A user scenario based approach as described by to Potts et al. [15] was used to analyse the data that was collected. Using this approach any information that was collected through the employment of a survey, video-based fieldwork, interviews, and the focus group were analysed to uncover patterns that could be used in the generation of the user-scenarios. The first user scenario was generated from footage that was captured during the video-based fieldwork. An adult customer is wishing to purchase a ticket to ride on the train service. An overview of the activity can be seen in Figure 4 were the sequence of photos captures the main actions that took place. Please refer to the video entitled VideoClipA.mov for the footage that was used to generate this sequence of images. Footage in VideoClipB.mov supports the observations in VideoClipA.mov. We can see from the video that adult customer is selecting a ticket from the top left of the artefact that corresponds to a single ride full-fare ticket for the use with the train system. We also identify out first stakeholder, an adult train rider.

User Case Scenario for Business Case: "purchase ticket for Athens-Piraeus Electric Railways"

Actor: Adult Customer

1. Prior to proceeding to ticket validation machines train riders go to a ticket vending machine

2. Select ticket type from the available options.

- Is the rider able to see tickets that are available?
- Is the rider able to find the ticket that he intends?

3. Select the number of tickets.

- What will the riders do if more tickets 5 tickets are required for purchase?

4. Customer sees on the LCD that amount of money that is needed to purchase the ticket.

5. Customer inputs in coins the required amount.

- What if the customer does not have change?

6. Customer picks up released tickets and any change from the ticket dispending slot at the bottom of the machine.

Figure 4: A series of images showing the purchasing of single ride ticket by an adult female.

The second user scenario was again generated from footage that was captured during the video-based fieldwork and reflects an exception case. An adult customer, who can be seen as the central figure in Figure 5 is wishing to purchase a ticket for himself and the lady that appears to his left to ride on the train but has questions regarding the transaction. He asks for the help of a fellow rider that appears to his right. Please refer to the video entitled VideoClipA.mov for the footage that was used to generate this sequence of images.

Exception case scenario for Business Case: "purchase ticket for Athens-Piraeus Electric Railways"

User requires assistance to use the machine

Actors: Adult Customer, Information Provider

1. Prior to proceeding to ticket validation machines train riders go to a ticket vending machine

2. Customer requests assistance from passer-by on machine use.

    - What if the passer-by is not able to assist?

3. Select ticket type from the available options.

4. Select the number of tickets.

5. Customer sees on the LCD that amount of money that is needed to purchase the ticket.

6. Customer inputs in coins the required amount.

7. Customer picks up dispensed tickets and any change from the ticket dispending slot at the bottom of the machine.

Figure 5: A series of images showing the purchasing of single ride by an adult male being aided by a passer-by.

The third user scenario was again generated from footage that was captured during the video-based fieldwork. An adult customer is wishing to purchase a ticket for himself and his family to ride on the train service. An overview of the activity can be seen in Figure 6 were the sequence of photos captures the main actions that took place. The customer can first be seen using the machine on the left

where he discovers there are no reduced fare tickets available in the machine to be purchased for use by his child. He then proceeds to move to another automated ticket vending machine to attempt the transaction again. Please refer to the video entitled VideoClipA.mov for the footage that was used to generate this sequence of images. We also identify a second stakeholder, an adult train rider that has a family that includes a child that qualifies for a reduced fare ticket and a third stakeholder the staff member who is responsible for providing maintenance to the automatic ticket vending machine.

Figure 6: A series of images showing the purchasing of single ride by an adult male being aided by a passer-by.

Exception case scenario for Business Use Case: "machine not working as expected"

There are no tickets of the required type in the machine

Actors: Adult Customer with Family that includes a child that qualifies for a reduced fare ticket

1. Prior to proceeding to ticket validation machines train riders go to a ticket vending machine
2. Select ticket type from the available options.
3. Customer is shown message that machine is out of the ticket type he has selected.
4. Customer identifies another machine and goes to that machine.
    - What if another machine is not available?
5. Select ticket type from the available options.
6. Select the number of tickets.

7. Customer sees on the LCD that amount of money that is needed to purchase the ticket.

8. Customer inputs in coins the required amount.

9. Customer picks up dispensed tickets and any change from the ticket dispending slot at the bottom of the machine.

The fourth user scenario was generated from the focus group, which can be listened in its entirety by referencing the file entitled FocusGroup.mp3 (supported by audio in files InterviewA.mp3 and InterviewH.mp3). During the focus group one of the participants brought up a desire to be able to pay for tickets using electronic forms of payment. The relevant part of the interview follows.

I: How do you see the [automatic ticket vending] machines working at this moment? Do you see them meeting the needs of customers such as yourself?

Ms# 1: They can be improved definitely…

Ms# 2: …Another option might to have a touch screen like they have in New York or having the option to use credit cards…

What-if Scenario for Business Use Case: "ticket purchase using an electronic payment"

Actor: Adult Customer

- What-if customers could pay for transactions using an electronic form of payment such as their credit card?
    - Would it be secure?
    - Would they feel an invasion of their privacy?

The fifth user scenario was generated from one of the interviews, which can be listened in its entirety by referencing the file entitled InterviewA.mp3. During the interview one of the participants brought up a desire to be able to purchase monthly tickets using the automatic ticket vending machines. The relevant part of the interview follows.

I: Are there any features that you feel are missing from the automatic ticket selling machines

Ms: Emm... well [slight cough] ... I think one reason is because they don't take credit cards

I. Do you feel that is worrisome?

Ms: And you can't purchase monthly ticket.

What-if Scenario for Business Use Case: "purchase monthly transit tickets"

Actor: Adult Customer

- What-if customers could purchase monthly passes form the machines?
    - Would it be too expensive to pay for monthly tickets using only coins?
    - Would that lead to increases in the number of stolen tickets?

3.1 Reflecting on Experiences and Envisioning Possible Improvements to our Approach

It was argued by Maiden [16] that one of the key activities of successful requirements work is engaging in reflective learning to refine existing practices and in the process uncover additional information about the prospective system. Reflecting back on the exercise it was evident that there were several areas that could be improved in the elicitation process. Moreover, there was also a feeling that the way in which the techniques were implemented to elicit information could be further improved. This thought relates to the work of Sillitti & Succi [17] who write on how it is difficult to elicit all of the requirements in one iteration and instead recommend an evolutionary approach to elicitation which Goguen [11] classifies as "requirements evolution". Therefore, one improvement that may have a positive effect on our activities might be to incorporate a spiral approach as suggested by Boehm [18, 19] in eliciting and analysing requirements. Another alternative approach might be to use the Inquiry Cycle Model proposed by Potts [15]. In both Potts's and Boehm's work the cyclical nature of the requirement elicitation process is considered as a central tenant to their approaches. As such, the incorporation of either of these approaches into our future work should allow us to improve the quality of the material that was elicited as well as the analysis and overcome the aforementioned limitations that were experienced.

While employing a cyclical approach to elicitation gathering would most likely improve the requirements process as a whole we should also reflect on the activities that we undertook as part of this exercise. One of the more challenging areas was that of video-based fieldwork. Specifically, one of the hardest tasks was in identifying an appropriate position to capture the environment and the interaction that were taking place. There were many different possible placements each telling the story of how the artefact was being used from its own unique perspective. In addition, even though some placements of the camera seemed more promising than others they were not possible as they were in locations that either had too much traffic in front of the camera or were blocking public walkways. Moreover, there were events taking place nearby that might have been interesting that it was not possible to capture, as there was only one camera and many artefacts in close proximity to one another. This experience highlighted the difficulties that are experienced when using video-based fieldwork. A possible improvement to this issue may be found in having additional staff assisting during the video-based elicitation problem. This would have helped by allowing there to be multiple cameras capturing activity giving a more complete understanding of the environment. Furthermore, had there been additional staff assisting with the elicitation process we could have been able to approach the artefact users as they left and use a complementary elicitation technique such as interviewing to acquire additional information about their experiences and perceptions with the artefact.

During the analysis process one of the challenges was the concern of whether the use of user scenarios was an appropriate technique to use and whether there are any limitations that should be taken into account. We found during the reflection exercise that the use of user scenarios for analysis is mentioned by Sutcliff [20] who warns that a user scenario can produce attention towards a rare and exceptional viewpoint and bias the requirements process against scenarios that serve more common processes. Avoiding irrelevant requirements according to Lamsweerde [21] is a important concern. "Scenarios contain information about operation of the current system and its environment." [22]. Our analysis could thus be improved by taking into consideration that not all of the user scenarios are equal and some measure of importance should be assigned to reflect that additional information.

4. Requirements

An outline of the basic requirements that were identified follows.

Requirement Number: 1

Requirement Type: Functional

Relates to: "Select ticket type", Normal Case Scenario step 3; "Purchase monthly transit tickets", What-if Scenario.

Description: The system shall provide customers with the ability to purchase all tickets types including monthly passes.

Requirement Number: 2

Requirement Type: Functional

Relates to: "Customer is shown message that machine is out of the ticket type he has selected", Exception Case Scenario for "machine not working as expected" step 3.

Description: The system shall -

1. Show users that there is a limitation on the available functionality, such as that a certain ticket type is not available, without them having to initiate the ticket purchasing process.
2. Inform the pertinent staff members responsible for performing maintenance operations in real-time on the automated ticket vending machines that their attention is required and provide a diagnosis of what the possible problem they will encounter may be, for example that the machine is out of reduced fare train tickets.

Requirement Number: 3

Requirement Type: Functional

Relates to: "Customer requests assistance from passer-by on machine use", Exception Case Scenario for "purchase ticket for Athens-Piraeus Electric Railways" where "User requires assistance to use the machine" step 2.

Description: the system shall provide users with support for basic questions regarding the use of the automatic ticket vending machines as well as transit using the train system.

Requirement Number: 4

Requirement Type: Functional

Relates to: "Customer inputs in coins the required amount", Normal Case Scenario step 5; "Ticket purchase using an electronic payment", What-if Scenario.

Description: the system shall allow users to pay for tickets through a spectrum of different ways including the use of coins and electronic payment (including credit-card).

4.1 Examining How the Proposed Artefact Might Transform Users Activities and Practices

The proposed artefact might transform the activities and practices through the introduction of new functionality. In this section we shall briefly discuss the four most positive effects we can see being realized if the new tool was released. The first would be that users of the system would be able to obtain basic assistance and answers to their questions regarding the train system from the machine itself. The second benefit would be realized through the ability of users to obtain purchase tickets of a greater variety of types including monthly passes. Thereby riders of the train system would not have to use the staffed ticket-selling booths at the first of each month to obtain their monthly passes. This should hypothetically alleviate some of the hassle of purchasing monthly tickets, as the ticket salesmen would be assisted by the automatic vending machines in their task. If additional ticket types were included such effects should be multiplied. Thirdly, the users of the automatic ticket vending would be able to purchase their tickets using electronic forms of payment such as credit cards giving customers more flexibility in terms of payment options. Lastly, any issues with the machines would be received by the machine maintenance staff in real-time and would allow them to be promptly corrected.

5. Requirements Communication

A requirements document has been written based on the Volere [23] template. This document is drafted as to reflect how a requirements document might be structured to represent the information presented in the previous sections of this work and as such is not a complete requirements document.

5.1 Project Drivers

5.1.1 The Purpose of the Project

The purpose of the project is to modernization the automated ticket vending machines in the Athens-Piraeus Electric Railways. The goal of the project is to overcome any weakness in the current system and improve overall user satisfaction leading to increase use of the railway system.

5.1.2 The Client, the Customer, and Other Stakeholders

The client is the Urban Rail Transport S.A., which is the government entity that is responsible for managing the sale of tickets and any technology related to that activity. In this case the client is also the customer of the machine. However, it is important to note that the machines will not be used for ticket purchases by the Urban Rail Transport S.A. but rather by the riders of the Athens-Piraeus Electric Railways. Thus, the clients from the actual point of view would be the users of the Athens-Piraeus Electric Railways. Other stakeholders are the residents of the city of Athens that do not ride the Athens-Piraeus Electric Railways are also stakeholders in this project as they are directly affected by the introduction of this new tool. As an increased use of the system by others should result in easier commute times for those that do not use the system.

5.1.3 Users of the Product

5.1.3.1 Hands on Users of the Product

The hands-on users of the product are:

- Riders of the System. The following sub-groups of users are identified:
    - Adults: Use the automated ticket vending to purchase regular-fare tickets for train and bus travel.

- Students: Use the automated ticket vending machines to purchase reduced-fare train and bus tickets. The tickets that are purchased through these machines could be of single use or unlimited passes.
- Head of Family: Use the automated ticket vending to purchase multiple tickets, possibly of different types including normal and reduced fare tickets, appropriate for each of the family members that are traveling with him.
- Regular Commuters: Use the automated ticket vending machine to purchase unlimited ride monthly passes.
- Senior Citizens: Use the automated ticket vending to purchase reduced-fare train or bus tickets.
- Tourists: Use the automated ticket vending to purchase single ride tickets or unlimited passes for train or bus travel of short duration such as one day or seven day passes.

• Train System Staff – The staff uses the system to tell how many tickets of each particular type have been sold through the automated ticket vending machines.

5.1.3.2 Priorities Assigned to Users

There is no hierarchy assigned to users and automated ticket vending machine use is determined solely on a first-come first-served basis.

5.1.3.3 Maintenance Users

Maintenance users are a special type of hands-on users that are responsible for performing operations on the automatic ticket vending machines relating to its upkeep. The maintenance users will have the responsibility of ensuring the machine is clean and stocked with tickets, therefore they must have access to the machine in such a way that they can perform their duties.

5.1.3.4 Service Technicians

Service technicians are a special type of hands-on users that are responsible for repairing the automatic ticket vending machine and supporting operations relating to its upkeep. They will therefore require appropriate access to the machine to perform their duties.

5.2 Project Constraints

5.2.1 Solution Constraints

There is currently no database in place keeping track of ticket sales in the system as such the solution should not expect integration with such a system but should be able to support such functionality as it is expected that there will be needs to remotely obtain and track ticket sales through the use of a database in the future.

5.2.2 Implementation Environment of the Current System

The automatic ticket vending machines will be installed in each of the train stations in the Athens-Piraeus Electric Railways. This will mean that each of the twenty-four stations will need to be equipped with these machines. There must be at least two machines in each station with the ability to install additional machines in busier stations. There should also be the ability to increase the locations in which the machines are installed, as there are plans to increase the number of stations in the system to a total of thirty-seven. At the moment there is no data cable leading to the machines so there is no way for them to transmit information to a server.

5.2.2 Partner Applications

The automatic ticket vending machines should be able to dispense the standard size tickets that are used through the Athens transit system.

5.2.2 Off-the Shelf Solution

The automatic ticket vending machines technology is not a new innovation and existing solutions are in place in transit systems throughout the world. Therefore off-the shelf solutions should be used as much as possible to ensure that there is no duplication of work.

5.2.3 Schedule Constraints

There are no known schedule constraints.

5.2.4 Financial Constraints

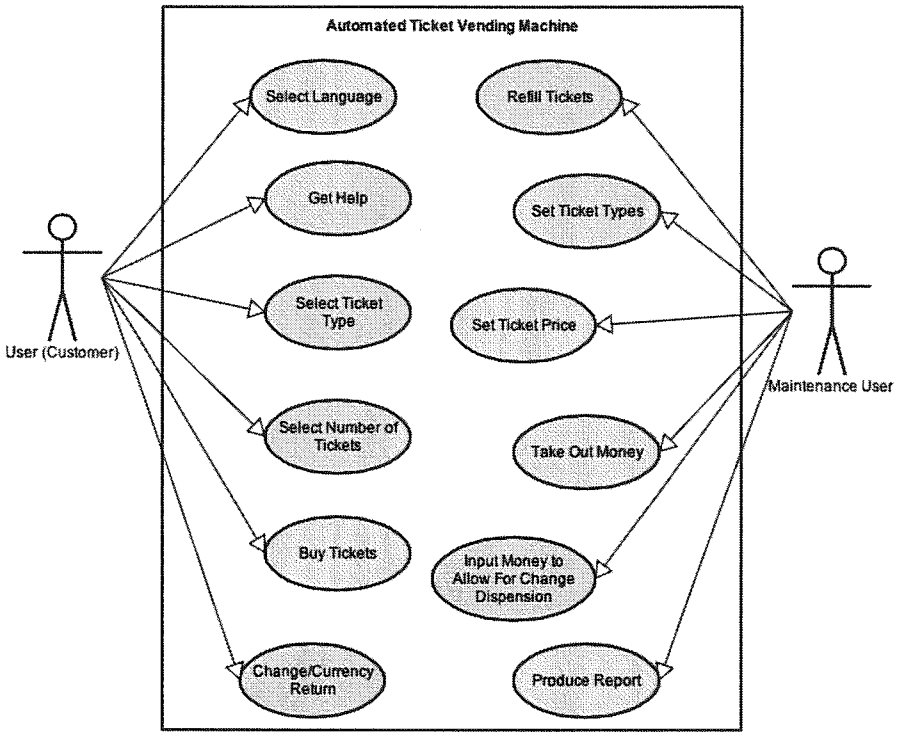
There are no known financial constraints that would influence this project. However, as this is a public works project and there is a need to cut budgetary expenditures throughout all operations care should be taken to ensure that the most effective solution is put in place for the money that is invested into this project.

5.3 Functional Requirements

5.3.1 The Scope of the Work

The current situation allows for full-price and reduced-price single ride tickets to be purchased from the automatic ticket machines. Customers may purchase up to five tickets of the same type during each transaction. It is not possible to combine different ticket types in the same transaction. It is not possible to purchase more than 5 tickets in any single transaction. Instructions to use the machine appear in the Greek and English languages.

5.3.2 The Scope of the Product



5.3.2 Functional and Data Requirements

Requirement Number: 1

Requirement Type: Functional

Description: The system shall provide customers with the ability to purchase all possible tickets types.

Rationale: To allow train riders to purchase tickets at any time without needing to purchases their tickets from the staffed ticket selling booths enabling them to use the system.

Fit Criterion: Users shall be able to purchase any type of ticket from the machines.

Supporting Materials: "Select ticket type", Normal Case Scenario step 3; "Purchase monthly transit tickets", What-if Scenario.

Dependencies: The ability to pay electronically for large transactions (Requirement number 4).

Priority: 1 (1 highest, 5 lowest)

Conflict: None

History: Created January 4th, 2013

Requirement Number: 4

Requirement Type: Functional

Description: The system shall allow users to pay for tickets through a spectrum of different ways including the use of coins and electronic payment (including credit-card).

Rational: Users would not easily be able to pay large transactions with only coins.

Fit Criterion: Transactions are paid for electronically.

Supporting Materials: "Customer inputs in coins the required amount", Normal Case Scenario step 5; "Ticket purchase using an electronic payment", What-if Scenario.

Dependencies: Ability to connect to an external payment system.

Priority: 2 (1 highest, 5 lowest)

Conflict: None

History: Created January 4th, 2013

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