Application of Artifact-based RE in Fortified Cards

Sayli Pradhan, Aniket V. Patil, Dr. Birgit Penzenstadler
Department of Computer Engineering and Computer Science,
California State University, Long Beach, USA
Sayli.Pradhan@student.csulb.edu, Aniket.Patil@student.csulb.edu, Birgit.Penzenstadler@csulb.edu

Abstract—**Credit / Debit card transactions are one of the most widely used means for purchasing items. As such, security is a critical concern in redesigning systems that can improve the security of those transactions, and the involvement of the future users is important. In this paper, we demonstrate the use of Requirement Engineering (RE) techniques to include the user's acceptance of the security decisions before implementation, designing for ease of use, and making them aware of and responsible for their own security. We illustrate the application of a set of RE artifacts to elicit specific requirements for the security of the Fortified Cards, a revamped design of current credit/debit cards that uses QR code.**
Index Terms— International Mobile Equipment Identity (IMEI), Quick Response (QR) Code.

I. INTRODUCTION OF FORTIFIED CARDS

The advancement in the field of technology specifically in the financial domain has been phenomenal over the past few decades. We have seen a rapid growth in the banking sector, which revolutionized the way people carry out transactions. From the era of carrying cash and writing checks, we have moved on to an era of using credit and debit cards. Nonetheless, as it happens with every technology, questions regarding the security of these cards were raised, and they are still some of the most vital questions that stand in our face. This is where Fortified Cards come into the picture.

Fortified Cards are essentially a revamped design of the current credit/debit cards that we possess. Each fortified card contains a unique encrypted QR Code of the corresponding bank account. This encrypted QR Code will be linked to IMEI number of the account holder's smartphone, which will be registered with a bank when a person opens a bank account. An IMEI number is a 16 – digit globally unique phone identification number.

While paying for an item, one needs to scan the QR Code of the Fortified Card using his/her smartphone and then scan the QR Code of the vendor's bank account. A confirmation of the amount will be asked upon which the transaction shall take place. Note that only the phone, which is registered with the bank, will be able to scan the Fortified Card. If some other phone is used, the application will deny the transaction, as the IMEI number of the smartphone that scanned the QR Code on the Fortified Card doesn't match the registered IMEI number.

In a situation, where a person loses his/her Fortified Card he/she need not panic. The card won't be misused because the smartphone that is registered with the bank will be used exclusively to scan the card instead of having to swipe the card on a different machine. This will largely reduce the credit/debit card theft problems. Under no circumstances, the sensitive data from the card is made to interact with external devices like the magnetic stripe reader, which has the capability to store the information about the credit/debit card that are swiped.

II. ARTIFACT-BASED RE FOR FORTIFIED CARDS

For this project, we used a combination of elicitation techniques and documented the requirements in a small set of artifacts as described below (for a more extensive description of the artifact model, see [1]).

A. System Vision Modelling

A system vision is a rich picture [2] of the system agreed upon by all the stakeholders. While performing RE in Fortified Card, the first artifact created was a System Vision. This enabled to project the idea in a visual format to the non-technical stakeholders and communicate the concerns as well as the advantages of the Fortified Cards over the current credit/debit cards in use.

An indication that comprehends the effectiveness of the use of System Vision was seen during the TEDxCSULB 2016 Event, where this idea was communicated to the selection committee, comprising of people from non-technical backgrounds. They evidenced that the System Vision diagram could help them understand the idea better than the verbal explanation provided.

B. Peer knowledge exchange

One of the most important phases of RE is identification of the potential stakeholders visualizing the active stakeholders, passive stakeholders and the anti-stakeholders. Being involved in research groups help in exchange of knowledge amongst the peers that come from varied backgrounds and experiences, and in our case it helped with eliciting the complete list of stakeholders. Fortified Card benefitted from a research group, the "Resilience Lab". This involvement helped to identify the important stakeholders that were left unconsidered during the inception phase of the project.

C. Scaling down the use of jargons

The selection committee for the TEDx event understood the concept with the help of System Vision as opposed to the verbal explanation provided. They suggested to scale down the use of technical terminologies in the verbal explanation since, this would help to help to propagate the concept best to the
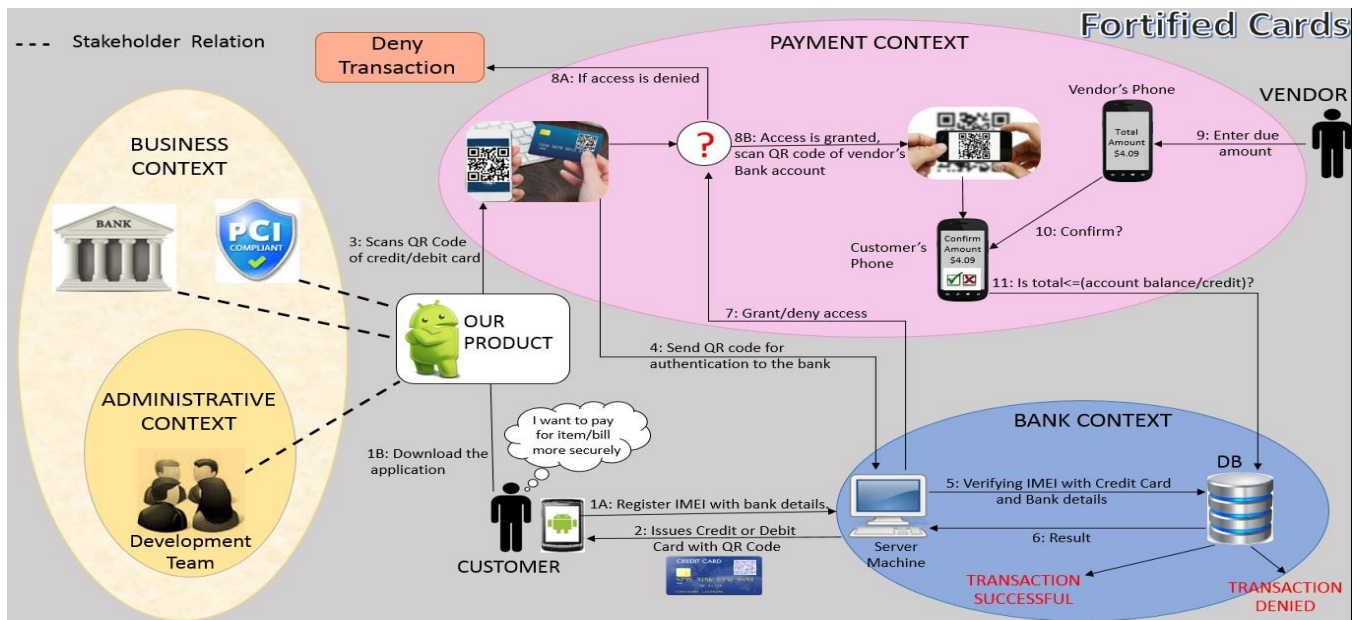
Figure 1 System Vision of the Fortified Cards System

audience at the event and consequently get the most feedback on our idea.

D. Massive Requirement Gathering

To increase the likelihood of acceptance of our idea, any type of activity that involves a large number of potential users was welcome. These activities help in broadcasting the ideas, understanding user needs, and finding loopholes in them from which they can be protected. The salient reason to make Fortified Card a part of an event like TEDx was to gather requirements and views of the potential users of the system. This helped to evaluate the acceptance criteria of the application early on during development. Our requirements gathering created awareness amongst the audience about IMEI numbers and the QR Code technology. Explaining them the concept and further a Q&A session helped to understand their views, too. Few of the attendees unfortunately had a previous experience with credit card theft, and so their questions and suggestions helped to improve the foundation of this concept. TEDx like events help in involving potential users to be a part of the security decisions that could be taken in the near future, which is rare. Thus, it becomes plausible to involve the people to be secured in the acceptance analysis rather than imposing security measures on them.

E. Prototype Demonstration and Artifacts

Further efficiency can be increased to obtain unambiguous requirements, which involves the development of a prototype or a module of a prototype along with the corresponding artifacts. The development of a prototype enables the requirement engineers to communicate the concept in an elaborative manner and to abate misinterpretation of the requirements. Thus, an iterative requirements gathering process using the prototype will lay down a solid foundation for design and implementation phases.

Efficient RE involves modeling a set of artifacts like stakeholder model, goal model, usage model and quality requirements. This helps to identify a number of influential factors in the software development process visualizing conflicting goals, roles and responsibilities of the stakeholders, user interaction with the system and the benchmarks with respect to the quality expectations.

III. CONCLUSION

RE faces the challenge of potential scope creep. With every analysis and deeper understanding of the system under consideration, increasing of the scope becomes likely. One such circumstance was faced during goal modeling. Two goals, easy to use and vendor enters due amount on his or her smart phone conflicted with each other, which resulted in the inclusion of embedded systems. It's important that a user's perspective is considered in RE for which it becomes a necessity to help them grasp the concept in a better and efficient manner. Graphical representations, like the System Vision, proved to be a useful tool in doing so during the RE for Fortified Cards. On the basis of this work, we will perform studies on the impact of the scope creep on system development and on the usefulness of System Visions in further stakeholder interactions for Fortified Cards.

IV. ACKNOWLEDGEMENT

REFERENCES

[1] B. Penzenstadler, J. Mehrabi, D. J. Richardson, "Supporting Physicians by RE4S" in IEEE/ACM 4th International Workshop on Green and Sustainable Software, Florence, 2015, pp. 36-42.

[2] A. Monk, S. Howard, "Methods & Tools: The Rich Picture: A Tool for Reasoning about Work Context", New York, 1998, pp. 21-30.