Applied Mechanics and Materials Vols. 479-480 (2014) pp 1038-1042
Online available since 2013/Dec/06 at www.scientific.net

doi:10.4028/www.scientific.net/AMM.479-480.1038

An Innovative but Low-Cost Mechanism for E-payment, E-ticketing, and E-Identity Document: A Case Study of Multiple Perspectives in Innovation Management

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Keywords: innovation management, multiple perspectives, e-payment, mobile payment, e-ticket, e-identity document.

Abstract. An innovative but low-cost mobile phone-based mechanism for e-payment, e-ticketing, and e-identity documents was proposed in an earlier article by Chan [1], who also discussed the business and technical rationales behind the innovation. Albeit it is still yet to see to what extent the mechanism will benefit the real world, it is no doubt an example of a mechanism developed with very minimal funding. In fact, the highest cost was related to its patent applications. Therefore, its development is a typical illustration of inexpensive innovation of ideas as opposed to costly experimentation and instrumentation. Specifically, this innovation, be it substantial or not, was initiated by and founded on multiple-perspective thinking, which had been popularized in educational systems and communities worldwide in recent years despite such thinking's somewhat arcane philosophical origin. Being a qualitative, applied, industrial article instead of a piece of theoretical work, this article further elucidates the multiple-perspective model underlying the aforementioned innovation in order to exemplify the application of multiple-perspective thinking to innovation management in general. The model explores multiple perspectives as subsumed under the categories of objectives, time, locations, roles, and incidents. Further refining these categories by translating them into individual requirements of the mechanism, it ends up with what it is today. This case study underscores how multiple-perspective thinking can be leveraged as an integral and instrumental part of innovation management.

Introduction

An innovative but low-cost mobile phone-based mechanism for e-payment, e-ticketing, and e-identity documents (patent pending numbered 201210442466.8 and PCT/CN2012/084224) was put forward in a previous article by Chan [1], who also explained the business and technical rationales behind the innovation by highlighting the way major existing e-payment mechanisms fell short of what was required by a dilemma resulting from some well-known "crucial factors determining particular e-payment mechanisms achieving critical mass." As enumerated in Chan [1], such major existing e-payment mechanisms include

- payment cards, e.g., credit cards, charge cards, and debit cards,
- smartcards,
- stored-value cards,
- electronic cash (e-cash),
- payment service providers (PSPs), e.g., PayPal, RBS WorldPay, etc.,
- e-micropayment,
- mobile payment, inclusive of Near Field Communication (NFC), and
- e-checks

whereas such crucial factors refer to the following:

a. Hardware and software independence, i.e., operability on a broad range of general-purpose (preferably not specialized) hardware and software.

b. Interoperability and portability across various e-payment service operators and/or providers, network operators, financial institutions, etc. and across both online and physical (bricks-and-mortar) merchants as payment recipients.
c. High security for information assurance (i.e., confidentiality, integrity, and availability) and authentication (i.e., confirmation of customers being whom they claim to be and not impersonating others or paying with others' money) and non-repudiation (i.e., establishing the genuineness of payment details) in respect of each payment and thus for safeguard against impersonation, forgery, unauthorized alteration, etc. [2].
d. Anonymity of customers as payers.
e. Divisibility, i.e., small minimum and large maximum payment amounts.
f. High payment success rates.
g. Operational ease and efficiency.
h. Low payment cost.
i. Globalization of operation.
j. Sufficient legal indisputability as to the genuineness of payment details tendered by the legitimate customers [2].

Chan's [1] mechanism aims to at least basically satisfy all the above crucial factors' requirements. Fig.1 is a schematic diagram of the mechanism's infrastructure for e-payment applications in a representative mode of operation whilst Fig. 2 delineates the data structure of PR_1, PR_2, and PR_3 in Fig. 1. For details of the mechanism, readers may refer to reference [1].

Notwithstanding the mechanism's application, if any at all in the end, to the real world being still yet to be realized, it is no doubt an illustration of a mechanism developed with limited funding. In fact, the largest expenses concerned its patent applications. Therefore, its development is a typical example of inexpensive innovation of ideas instead of costly experimentation and instrumentation. Specifically, this innovation was inspired by multiple-perspective thinking. As a qualitative, applied, industrial article as opposed to a piece of theoretical work, this article attempts to further expound on the multiple-perspective model underlying the aforesaid innovation in order to demonstrate the application of multiple-perspective thinking to innovation management in general.

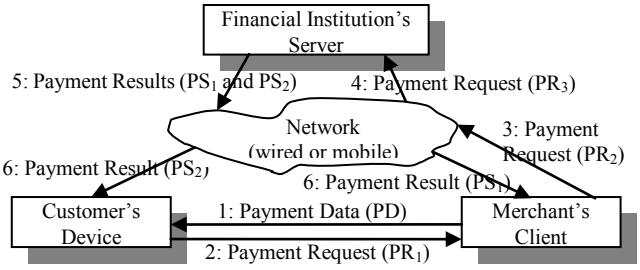

Fig. 1. The mechanism's e-payment infrastructure.

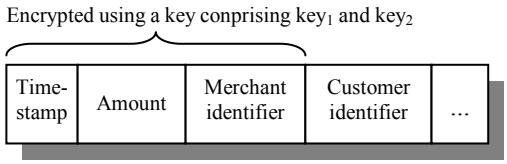

Fig. 2. PRs in a representative mode of the mechanism.

A Multiple-Perspective Model

The notion of multiple-perspective thinking has been promoted extensively in educational systems and societies worldwide in recent years despite its philosophical origin. Philosophically, Heidegger [3] asserts that mono-thinking, as opposed to multiple-perspective thinking, stems from science. He conceives of science as only one perspective of thinking, which contributes significantly in particular disciplines but fails to contemplate from perspectives beyond such disciplines. Put simply and practically, thinking from the perspective of science (or probably any other disciplines of knowledge) is far from sufficiency and comprehensiveness. This is true even when dealing with engineering issues, which are almost invariantly perceived as science. That is why multiple-perspective thinking should come into play.

Obviously, the aforesaid innovation of ideas in the development of the mechanism introduced in the last section was spurred by the major existing e-payment mechanisms falling short of what is required by the "crucial factors" enumerated in the section. To devise a mechanism as a solution to this issue, the multiple-perspective thinking model in Fig. 3 was adopted in order to explore multiple perspectives as subsumed under the categories of objectives, time, locations, roles, and incidents when mapping out the requirements of the mechanism (as a result of the aforesaid "critical factors" or otherwise). For example, the perspective category "roles" translated into the requirements from the viewpoints of different roles (i.e., members of the category "roles", such as the financial institutions, conglomerate merchants, small-to-medium enterprise [SME] merchants) and the prioritization of such requirements, if applicable. Based on the requirements analogously derived from all the five perspective categories, the ensuing mechanism would aim to meet a super-comprehensive set of requirements. In other words, in the development of the mechanism, the multiple-perspective model served the purpose of exhausting all the prospective requirements that might otherwise be subject to oversight.

Fig. 3. The multiple-perspective model adopted by the development of the mechanism.

Application of the Multiple-Perspective Model to the Development of the Mechanism

Table 1 contains the analysis outcomes upon applying the multiple-perspective model in Fig. 3 to the development of the mechanism, listing the categories of perspectives, their members, and the requirements of the mechanism corresponding to each member of each perspective category, and how the ensuing mechanism finally developed meets the requirements.

Table 1. The analysis outcomes upon applying the multiple-perspective model in Fig 3 to the development of the mechanism.

Category of Perspectives	Member	Requirements [the Related "Crucial Factors," if applicable, in square brackets]	How the Mechanism Meets the Requirements
Objectives	E-payment	Supports it.	The infrastructure in Fig. 1 coupled with the data structure of PRs in Fig. 2.
	E-tickets	Supports them.	Slight modification of the data structures of the PD, PRs, and PSs in Figs. 1 and 2 and the actions associated with PSs, as detailed in reference [1].
	E-identity documents	Supports them.	
	Social acceptability	Environmentally friendly.	Paperless and plastic-free operation
Time	Future	The security level to advance with time.	Independent of any encryption algorithms and almost all auxiliary security technologies (e.g., one-time passwords) and thus compatible with any latest ones.

Locations	Worldwide use as opposed to domestic use	Possible and economical [i].	The "customer's device" in Fig. 1 needs no access to any telecommunication or Wi-Fi network to avoid costly roaming.
Roles	Customers	Inexpensive hardware and software [h] and fast and easy operation [f, g]. Anonymity [d].	The "customer's device" in Fig. 1 in the form of a mobile phone, a tablet computer, an iPod®, an iPad®, etc. No plain customer identity in PRs of Fig. 2.
	Conglomerate merchants	Interoperable and portable hardware and software [b].	The merchant's client implementable on general-purpose hardware and portable software.
	SME merchants	Inexpensive hardware and software [a, b, h] and full automation to save cost [h].	The merchant's client implementable on general-purpose hardware and portable software. PR_1 in Figs. 1 and 2 possibly in the form of a barcode. No manual process.
	Online merchants	Supports them [b].	PR_1 in Fig. 1 receivable by a webpage of the "merchant's client."
	Physical merchants	Supports them [b].	PR_1 in Fig. 1 receivable by the "merchant's client" one way or another. PR_1 possibly in the form of a barcode.
	Financial institutions and e-ticket issuers	Full automation to save cost [h].	No manual process.
Incidents	Passwords possibly transmitted over the network	Passwords not disclosed [c, j].	Passwords never transmitted over the network.
	Large payment amounts or expensive tickets	Allowable [c, e, j].	Key_1 and key_2 authenticate the customer and assure the integrity, non-repudiation, and legal indisputability of the PRs in Fig. 1 and 2.
	Multiple e-payment instruments and e-tickets with one customer	Centralize them.	Differentiated by the distinct "merchant identifiers" and "customer identifiers," etc. of Fig. 2 but operating on the same "customer device" of Fig. 1.
	Stolen, duplicate or re-used e-payment instruments and e-tickets	Safeguard against them [c].	Comparison of timestamps in Fig. 2 and PR_3 in Fig.1
	Passwords possibly key-logged.	Minimize the chance [c, j].	Passwords inputted on the "customer's device" in Fig. 1 but never on the "merchant's client."

Incidents (continued)	Inertia of existing e-payment and e-ticketing operators' dominance.	Line up with them.	Compatible with and workable on top of global infrastructures of Visa, MasterCard, UnionPay, etc., and current e-ticketing systems.
	The global e-payment and e-ticketing markets worth trillions of US dollars annually [4], [5]	Capture it.	All the above.

Conclusion

By applying the multiple-perspective model to the development of the mechanism, a super-comprehensive set of requirements as revealed in the third column of Table 1 were devised and thus were a set of pivotal features of the ensuing mechanism finally developed as presented in the fourth column of Table 1. Such requirements and thus features might very likely have been overlooked in the mechanism's development if the multiple-perspective model had not been employed. Hence, this patent pending mechanism's development is a typical demonstration of multiple-perspective thinking as an integral and instrumental part of the innovation process.

Acknowledgments

This article was supported by Grant (number yet to be determined) of the Science and Technology Development Fund, the Government of Macao Special Administrative Region.

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Applied Science and Precision Engineering Innovation
10.4028/www.scientific.net/AMM.479-480

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