How can M-Commerce be safe and secure?
Empirical Analysis of M-Commerce Security Factors

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ABSTRACT
In today’s world, if any business person wants to extend his business and compete, he must follow the supporting activities provided by the well known potter-millers’ value chain model. And M-commerce is one of those activities. In previous years, E-commerce is an essential part of successful business trend setup in the global world. But as technology shifts more towards wireless communication, M-Commerce is now under attention. But there are a lot of threats and vulnerable causes an M-commerce strategy may have that will affect the global business arena and this will be one of the topics under discussion within this research. Within this paper we try to elaborate the factors including communication integrity, attack prevention and proof of non-repudiation by which we can make a secure mobile based wireless application that has strong backend structure and provide user friendly environment to attract the customer, so that the customer can easily be facilitate anywhere with this modest safe and secure business technology. The paper concluded with discussion on results that are obtained during research.

Index Terms -M-Commerce, Communication Integrity, Proof of non-repudiation, Attack Prevention.

1. INTRODUCTION
Rapid growth of technology and its extensive use in business and industry has increased the competition manifold among organizations across the globe, and the worker of the 21st century is facing more challenges as compared to his/her predecessors. Due to these forces, organizations are continuously reshaping the business strategies, re-engineering business processes, and altering several practices, thereby, forcing the organizations to ensure the modern and innovative business models with unique technology.

Many businesses and business analysts see mobile commerce as the future of online trading. Prominent industry players are taking a keen interest in developing this technology, and observing its adoption by customers. Mobile commerce is currently considered to hold many drawbacks as well as many benefits. However, consumers are not going to take full advantage of a technology that is of not much benefit to them.

1.1 Study Objective
This study is aimed at conducting a research on M-commerce security measures and its usage either significant or not for end-users and business personnel even as well. In order to explore various factors affecting M-Commerce safety assuming diverse sectors among Pakistan.

1.2 Significance of Study
M-Commerce is a developing technology in Pakistan. The Pakistan public and private sector (especially financial) is putting a lot of efforts, towards the better adoption and utilization of this wireless technology. This study will not only help the business professional organizations but also end-users to understand its importance.

1.3 Research Methodology
The research is quantitative in nature and a tailored questionnaire, is designed and distributed in various consumers and professional sectors all over Pakistan to collect the primary data. Among them 60 questionnaires containing all information are accepted while incomplete questionnaires are discarded.

The population of this study comprises of all business professionals and customer in Pakistan and includes managers, system analysts, network managers and end-users.

The respondents responded to questions under each variable on five point Likert Scale with “Strongly Agree” dictating the highest level of satisfaction, “Strongly Disagree” as the highest level of dissatisfaction. Several supportive questions were also asked for clarification and more interpretation of respondents’ answers.

1.4 Variables
Following are the major factors contributing in mobile commerce at different professional business sectors.

- **M-Commerce Safety and Security**
- **Communication Integrity** (the exchange of messages or transactions between sender and receiver must not be altered or tampered).
- **Attack Prevention** (the unauthorized sending or re-sending of messages is detected and rejected).
• **Proof of non-repudiation** (Proof is needed that the message was indeed received and none of the sender/receiver can later reject exchange take place).

• **Manual handling controls** (means that person, who has an access to the m-commerce application, can steal or modify data, misuse of device or system)

2. **M-COMMERCE AND OTHER CHALLENGES**

The advent of mobile commerce has been made possible by the various mobile technologies that have recently become available. It is necessary to remember an understanding of these technologies in order to fully know their application in a business environment.

Although the mobile commerce trend is following the previous trend in web-based e-commerce, the factors affecting the success of mobile commerce differ significantly from those affecting web-based e-commerce. These differences can be attributed to various differences between mobile devices and the desktop computers used for web surfing, as well as the differences between two network channels i.e. wireless and wired.

2.1 Definition

There are numerous definitions of the M-commerce [1]. There are different views as of the purpose of this communication. Some of them restrict it to transactions involving the monetary value, whereas other definitions generalize the term to services that involve information, transaction, communication and entertainment. Summarizing, we define m-commerce as using a mobile device for business transactions performed over a mobile network through several channels in terms of mobile applications, SMS/MMS & mobile internet.

2.2 Mobile Devices

M-commerce is not only related to use cell phones as end user devices [2]. The following list gives an overview of different kinds of mobile devices:

- Mobile phone
- PDA (Personal Digital Assistant)
- Smart phone – the smart phone combines mobile phone and PDA technology

Each mobile device has certain characteristics, such as

- Size and color of display
- Input device, availability of keyboard and mouse
- Network connectivity, bandwidth capacity

3. **COMPARISON WITH E-COMMERCE**

In comparison to e-commerce, m-commerce offers both advantages and disadvantages.

3.1 Advantages

- **Ubiquity** – the end user device is mobile, that is, the user can access m-commerce applications in real time at any place.

- **Accessibility** – accessibility is related to ubiquity and means that the end user is accessible everywhere at any time. It is probably one of the major advantages in comparison with the e-commerce applications involving a wired end user device.

- **Security** – depending on the specific end user device. For example, the SIM card that is commonly used in mobile phones is a smart card that stores confidential user information, such as the user’s secret authentication key. Also there would be some biometric identification system used while issuing SIM, for security concerns. [11][12]

- **Personalization** – mobile devices are usually not shared between multiple users. That’s why it is possible to adjust a hand handled device to the user’s needs and wishes (starting with the mobile phone ringtones and housing). On the other hand, a mobile operator can offer personalized services to its users, depending on specified user characteristics.

3.2 Disadvantages

- Mobile devices offer limited capabilities between mobile devices these capabilities vary so much that end user services will need to be customized accordingly.

- The heterogeneity of devices, operating systems (OS), and technologies related to network is a challenge for an end user platform. For such reasons, the standardization level consisting of device manufacturers, telecommunication companies, and value-added service (VAS) providers embed their work. For example, many current mobile devices implement an IP stack to provide standard network connectivity. At the application implementation level, the J2ME (Java 2 Micro Edition) offers a standardized application platform for heterogeneous devices.

- Mobile devices are more prone to theft and destruction. According to a government report, more than 700000 mobile phones are stolen in the UK each year [4]. Since mobile phones are highly personalized and contain some user information that is confidential, they must be protected as per the highest level of security standards.
4. TECHNOLOGY TO SECURE M-COMMERCE

As far as the latest trend is concerned the technologies serve as a security channel to M-commerce applications are GSM and UMTS

- **GSM** is an abbreviation of Global System for Mobile communication, it is previously or originally known as Group Special Mobile [7], [8]. It is a mobile telephony system that sets the standard on how mobile telecommunication networks work. It encompasses everything that refers to mobile communications.

- **UMTS** is the third generation (3G) of mobile telecommunications technology [9], [10]. It is one of the latest commercially available technology which are used by mobile phones, PDAs, and smart phones in today’s world. With this development, internet access including email, web browsing, video calling, text messaging (SMS) and MMS all are now possible along with the use of normal phone. [10]

5. DATA ANALYSIS AND FINDINGS

5.1 Hypothesis Formulation

**H₀ (Null hypothesis):** There is a relation between M-Commerce safety and security with communication integrity, attack prevention, proof of non-repudiation and manual handling controls.

\[ H₀ : β₁ = β₂ = β₃ = β₄ = 0 \]

**H₁ (Alternative Hypothesis):** There is no relation between M-Commerce safety and security with communication integrity, attack prevention, proof of non-repudiation and manual handling controls.

\[ H₁ : β₁ ≠ 0 \]

5.2 Model

- M-Commerce Safety and Security (M-S&S) as dependent variable.
- Communication Integrity (CI), Attack Prevention (AP), Proof of Non-repudiation (PnR) and Manual Handling Controls (MHC) as independent variables.

The basic model is:

\[ M-S&S = f (CI, AP, PnR, MHC) \]

Basically, M-S&S = \( α + β₁z₁ + β₂z₂ + β₃z₃ + β₄z₄ + e \)

Where, M-S&S = M-Commerce Safety and Security,
\( z₁ \) = Communication Integrity,
\( z₂ \) = Attack Prevention,
\( z₃ \) = Proof of non-repudiation, and \( z₄ \) = Manual handling controls.

There \( α \) is constant and \( β₁, β₂, β₃, β₄ \) are coefficients to estimate, and \( e \) is the error term.

5.3 Descriptive Analysis

| Table No. 1 Descriptive Statistics [Source: This Study] |
|-----------------------------------|------|------|-------|
|       | Mean | Std. Deviation | N |
| SS    | 3.91 | .553           | 60 |
| CI    | 3.79 | .442           | 60 |
| AP    | 3.86 | .383           | 60 |
| PnR   | 3.97 | .504           | 60 |
| MHC   | 2.81 | .464           | 60 |

**Table No. 1** shows the mean value depicting the overall importance of “M-Commerce S&S”. As far as this descriptive statistics is concerned, M-S&S is above satisfactory level (with a mean value of 3.91 on a 5 point Likert scale). The table also suggests that the main factors on which the business managers are generally satisfied. As far as the mean values are concerned, respondents are fairly satisfied on Communication Integrity, Attack Prevention, Proof of Non-repudiation and Manual Handling Controls. This satisfaction comes from:

<p>| Table No. 2 Model Summary [Source: This Study] |
|-----------------------------------------------|------|------|------|</p>
<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.625*</td>
<td>.396</td>
<td>.385</td>
<td>.59702</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), CI, AP, PnR, MHC

5.4 Analysis of Variance

<p>| Table No. 3 ANOVA(^b) [Source: This Study] |
|----------------------------------------------|------|------|------|</p>
<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>90.295</td>
<td>4</td>
<td>15.052</td>
<td>42.218</td>
<td>.000</td>
</tr>
<tr>
<td>Residual</td>
<td>140.092</td>
<td>55</td>
<td>.357</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>26.181</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), CI, AP, PnR, MHC

b. Dependent Variable: SS

From the ANOVA Test it shows the table Sig. value 0.05 is greater than the calculated Sig. value 0.000. It reflects the null hypothesis at 5% level of significance. It means there was a significant correlation between dependent variable and independent variables. Therefore M-Commerce safety and security depends on automated security measures in different private business firms in Karachi, Pakistan. But it does not
mean that all factors of M-Commerce have significant involved, Attack Preventions involved, and Proof of Non-repudiation has significant correlation with the dependent variable.

The overall predictability of the model is shown in Table No. 2 above. The adjusted R square value of .385 indicates that the model explains roughly about 38% of the factors responsible for M-Commerce secure business.

The ANOVA table shown under Table No. 3 depicting significant F values implies that the model and data are well fit in explaining M-Commerce safety level. Based on the data found in Table No. 4 below, it can be interpreted that the independent variables such as Communication Integrity, Attack Prevention, and Proof of Non-repudiation have strong impact on M-Commerce safety level:

Hence, the other variable Manual Handling Controls involved has been dropped from the final analysis based on (99% level of significance).

5.5 Co-efficient Analysis

Table No. 4 Coefficients * [Source: This Study]

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B  Std.Error</td>
<td>Beta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>-.183</td>
<td>.264</td>
<td>-.703</td>
<td>.482</td>
</tr>
<tr>
<td>CI</td>
<td>.254</td>
<td>.062</td>
<td>.187</td>
<td>4.257</td>
</tr>
<tr>
<td>AP</td>
<td>.402</td>
<td>.072</td>
<td>.282</td>
<td>5.683</td>
</tr>
<tr>
<td>PnR</td>
<td>.266</td>
<td>.055</td>
<td>.247</td>
<td>4.736</td>
</tr>
<tr>
<td>MHC</td>
<td>.064</td>
<td>.193</td>
<td>.054</td>
<td>.332</td>
</tr>
</tbody>
</table>

* Dependent Variable: SS

5.6 Regression Model

From the above findings we can develop the following regression model:

\[ M-S&S = -0.183 + 0.252z_1 + 0.403z_2 + 0.265z_3 \]

Standard Error: (.264) (.062) (.072) (.055)

T values = (4.257) ** (5.683) ** (4.736) **

The research conducted on the empirical analysis of the importance of procedure to be performed during the development of m-commerce application for customers showed significant relationships with the variables discussed in this study.

Further work may be conducted to analyze more factors which may affect the overall importance of M-Commerce including privacy, confidentiality, which eventually leads to more satisfied customers while doing business through the modest secure business.

REFERENCES


[5] “Digital cellular telecommunication system (Phase 2) ;


[10] Port-Based Network Access Control, IEEE Standard

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AUTHOR

Muhammad Adeel Mannan received the B.S. and M.S. degrees in Computer Science and Computing from University of Karachi in 2008 and SZABIST in 2010, respectively. He is now with Khadim Ali Shah Bukhari Institute of Technology as Lecturer.