Mobile Commerce Business Model for Customer Oriented Business Transactions

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Abstract. Mobile commerce environment pertains to multiple transactions with the purpose of providing goods and services to customers. The customers are using wireless devices like smartphone, mobile phone and PDA to shop for a broad range of products and information related services. The success of commercial business models for mobile commerce environment depends on the method of providing value to the customers. Modeling the specific characteristics of each business participant is a challenging task in dynamic business environment. In this paper, we propose a formal description of business model by identifying the specific characteristics of mobile participant and illustrate with examples in a trading scenario. The proposed analytical concepts assist in developing innovative user friendly interfaces and also to model e-business domain.

Keywords: Mobile commerce · Customer · Business model
Transaction · Product · Participant

1 Introduction

A mobile commerce business involves activities like purchasing and sale of commodities, banking and foreign exchange activities which takes place through mobile device. The environment supports exchange of huge data during selling, buying and financial related mobile transactions. The business environment includes mobile customers, mobile vendors, technological developments, demographics, social and economic trends. As the priority of each customer changes, it is required to seggregate individual and group preferences based on their profile to provide tailored services and products. The m-commerce has focused mainly on designing innovative applications and mobile transactions. Issues like analyzing the transactions and modeling the business entities (e.g., customer, vendor, broker, banker) need to be addressed to develop innovative business models for commercial purpose.

Due to the ever changing nature of mobile business environment and also to cater to the customer demands, there is a need to develop pragmatic models adapting to new business situation. To enable transactions quickly among business entities in such complex environments, the challenge is to understand the

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customer behavior, goals and responsibilities based on educational, economical, social and professional background.

The users can access M-commerce services anywhere, anytime by using small computing devices and also the IOT paradigm allows *'people and things to be connected anytime, anyplace, with anything and anyone, ideally using any path/network and any service'* [1]. The proposed model in [2] describes the significance of deducing context based beliefs about a business customer or vendor and which can be utilized by applications to execute business transaction according to current situation.

In this paper, we describe the method of developing mobile commerce business environment by identifying the characteristics of electronic products, transactions and business participants. We have proposed customer behavior as an important parameter in understanding their new purchase requirements. We have proposed mobile commerce businesss model as a specific case of [3] which facilitates in defining the professional skilss, goals, responsibilities and financial criteria of mobile customer, mobile vendor, mobile broker, and mobile bankers in e-business domain.

The rest of the paper is organized as follows. In Sect. 2, we briefly describe some of the related works, Sect. 3 describes the mobile commerce environment, Sect. 4, provides the formal representation of mobile commerce business model. In Sect. 5, we describe the mobile commerce business system, and lastly the conclusion.

2 Related Works

The rapid development of mobile commerce technology has enabled the establishment of new services. The customers can now conduct on line transactions anytime, anywhere using smart devices. A business model [4,5] deals with information flow between business participants and thereby delivering a product or service to the customers. The transaction management technology, [6] provides data consistency and service reliability in mobile commerce environment. The changing business environment [7] has influence on each participant like government, business organization and customers who are involved in market exchanges. The works in [8] determine user location obtained from GSM base stations and bluetooth sources for personalization using hybrid method.

The paper [9] proposes an analytical framework for the issues like coordination, cooperation, customer value and core competence. The research [10] on m-commerce usage activities are highly influenced by demographic and motivation variables. The m-commerce service providers study the customer's behavior to formulate appropriate marketing strategies. The business model [11] refers to strategies of multiple players, m-commerce services, and also revenue generation. The work [12] discusses how the mobile users have to carry out day-to-day m-commerce transactions with minimal effort in trusted and secured manner. A viable business model evaluation framework based on the VISOR model is

presented in [13] which helps to determine the sustainable capabilities of a mobile commerce business model. The business model [14] represents a concept on how the business functions and includes defining the goals, visions and other factors.

The research [15] summarizes the guidelines and factors to create business models based on context information. The use of context-awareness [2] enhances the satisfaction level of business participants in marketing approach. The proposed framework in [16] improves business interoperability through context-based ontology reconciliation. However, the above models dealt with customer demographic variables, security issues and service aspects without defining clearly the goals and responsibilities of individual business participants (e.g.,vendor, broker, banker, wholesaler and retailer) to understand the real business world.

3 Mobile Commerce Business Environment

The proposed business environment mainly consists of mobile participants who are involved in various business activities. Figure 1 shows the commercial environment which has been setup for electronic goods sales and purchase. The customers are using wireless devices like smartphone, mobile phone and PDA to shop for a broad range of products and information related services. The database is established for storing the sales history of products, product benchmarking features and also the transactions. The benchmarking features helps to identify an efficient product to a customer. The description of mobile commerce service provider, mobile customer, vendor and banker are given below in the following sections.

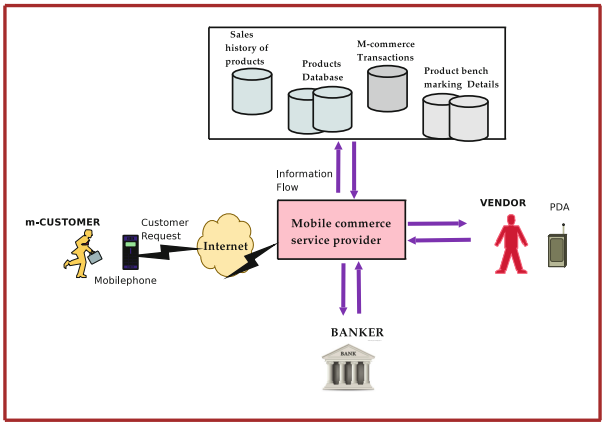

Fig. 1. Mobile commerce business environment

3.1 Mobile Commerce Service Provider

The function of MCSP is to provide services to customers either directly or through gateway of another company. They act as mediators between customers and vendors and offer services to mobile customers.

3.2 Electronic Product

A product is a thing that can be offered to a customer and satisfy a want or need of mobile participant. Each electronic product can be described with three kinds of attributes like general attribute (i.e., quality, brand, price), technical attributes(i.e., memory capacity, display size etc.) and commercial attributes (i.e., product rating, number of products sold, etc.) Let PR represents a product, and each product belong to a broader category of electronic goods with certain technical features. The electronic product description is given by the tuple,

$$PR = \langle GA, TA, CA \rangle \tag{1}$$

where GA, TA, CA represents set of general, technical and commercial attributes respectively, for example,

$$\begin{aligned} GA = \{ga_1 = \text{is ModelID},\ ga_2 = \text{Product Code},\ ga_3 = \text{Product Name},\\ ga_4 = \text{Display Resolution},\ ga_5 = \text{Size},\ ga_6 = \text{Product Weight},\\ ga_7 = \text{Product Brand},\ ga_8 = \text{Product Color}\} \end{aligned} \tag{2}$$

$$\begin{aligned} TA = \{ta_1 = \text{Operating Frequency},\ ta_2 = \text{Processor Speed},\\ ta_3 = \text{MemorySize}, ta_4 = \text{Battery Time}\} \end{aligned} \tag{3}$$

$$CA = \{ca_1 = \text{Best Selling Rank},\ ca_2 = \text{Customer Review}\} \tag{4}$$

The Best selling rank gives the ranking given to products based on the number of units sold. The customer review is the average "score" or ratings as submitted by reviewers. The electronic products which can be offered to a mobile customer in M-commerce are Television, Personal Digital Assistant, Calculators, VCRs, Digital Cameras, Audio Devices, headphones, Hard Disks, Pendrives, Camcoders, Clocks, Printers and many other products.

3.3 M-Commerce Transactions

M-commerce transactions represent a set of activities or interactions involved between mobile customers and vendors for buying or selling of goods or services. The transactions can be generated by mobile device and is defined as any kind of activity or exchange of information between business participants. Activity represents in general the action performed by the mobile participant during any kind of transaction. It is defined by the following tuple,

$$T = \langle TID, Dt, PR, Prc, P_i, P_j \rangle \tag{5}$$

where, TID represents Transaction Identifier, Dt represents the Date of transaction, PR is the type of electronic product, Prc represents the price of the product and P_i, P_j represents the roles performed by i^{th} and j^{th} business participants. Some of actions involved during transaction could be sending *purchase order, viewing bank details, sending quotation, transferring of goods, account statements, balance enquiry, direct debits, bill payments and so on.* Tables 1 and 2 gives some of the examples and description of mobile commerce transactions.

Table 1. Examples of M-commerce transaction

Transaction no	Example of transaction
T_1	Request for purchase order using mobile phone
T_2	Request for money transfer for the product purchased using smartphone
T_3	Request for after sales service
T_4	Request for business calculator general information during business hours.
T_5	Issuing a quotation for the product

Table 2. Description of transaction

Transaction no	Description of transaction
T_1	⟨0001, 11-11-2011, Calculator, 750 Rs, Mobile Customer, Vendor⟩
T_2	⟨0015, 01-01-2012, Camera, 15500 Rs, Mobile Customer, Banker⟩
T_3	⟨0017, 01-01-2013, Laptop, —, Mobile Customer, Vendor⟩
T_4	⟨0025, 01-05-2015, Business Calculator, –, Vendor, Mobile Customer⟩
T_5	⟨0055, 05-05-2014, Camcoder, —, Vendor, Mobile Customer⟩

3.4 Business Participants

A mobile participant is a person or an entity dealing with any kind of transaction and has different roles in business domain. A specific behavior is exhibited by each participant during any business transaction (e.g., buying, selling). The transactions are established by mobile phone and thereby initiating a process with the system (e.g., smart phone or mobile phone), when purchasing electronic goods. Business participant is an important entity and we describe briefly about each participant in the following sections.

Mobile customer: The customers represent an important class of business participants. A mobile customer is a person who is using mobile devices like Smart phone or PDA for making commerce related transactions. Customer interacts with his device for getting desired service from M-commerce service provider. They use mobile phones or smart phones to browse information, purchase products, manipulate price comparisons, read product reviews or interact wirelessly with service providers to get specific service. Some customers are using multiple mobile devices for personal and professional life. Text message is the most common method of receiving mobile advertisements and few smartphones also provide location-based services. The mobile customer behavior refers to the buying decision using mobile phones to satisfy his want or need. It involves study of how customers buy, what they buy, when and why they buy. Moreover, there is a strong influence of groups like family, friends and colleagues on the customer purchasing behavior. Table 3 gives description of mobile customer behavior for purchasing activity based on several factors.

Table 3. Mobile customer behavior for purchasing activity

Classification of customers	Sources of information	Influence of advertisement	Price comparison	Payment mode	Social network
High school student	Friends	High	Low	Cash	Medium
College student	Friends	High	Low	Cash	High
Employed full time	Colleagues	Low	Medium	Credit	Low
Old age	Family	Low	High	Cash	Low

Mobile Vendor: Vendor represents an entity or a person who is responsible for conducting transaction to the customers anytime, anywhere. They perform the complete transaction cycle with mobile customers directly or via their mobile phones during their working business hours. The vendors send alerts, receive payment, issue coupons and track customers. The sales history of vendors contains the number of products sold, the price of product, the date of selling, the name of customer and so on.

Mobile Broker: A person or an entity acting as an agent for arranging transaction between mobile customers and vendors. The function of broker is to provide timely information about market conditions to a moving customer based on his/her location. The broker provides information on product price, product commercial information, market index and so on to a mobile customer.

Mobile Banker: A Banker is an entity who establishes financial and banking services with hand held devices. Some of the functions include, opening of account for mobile customer, money transfer service using mobile devices.

3.5 Benchmark Testing

The benchmark testing procedure provides information about how an electronic product performs better than other in real world environment. The parameters typically used and measured are cost per unit of product, time and quality of product. These methods quantify the user experience to do business, take decisions and thereby recommending for the products. Some of the functional capabilities of the electronic products being compared are:

- Product weight, strength, durability and size
- Data transfer rates and capacity of storage
- Ease of setup, configuration, assembly and usage
- Completeness of user documentation
- Evaluation of the product technical feature set
- The value in terms of Function vs Cost
- Ratings of ease of use and user satisfaction

4 Formal Representation of Mobile Commerce Business Model

A Mobile Commerce Business model is constituted with mobile participants, mobile transactions, mobile devices and the type of products involved in commercial business activity. The MCBM is described by

$$MCBM = \langle MP, T, A, PR, D \rangle \tag{6}$$

where, MP = $\{mp_i,\ where\ i = 1, 2, .., m\}$ is a finite set of mobile participants, T = $\{t_j,\ where\ j = 1, 2, .., n\}$ is a finite set of transactions executed by participants, A = $\{a_1, a_2, .., a_q\}$ where 'q' is the number of activities or actions initiated by mobile participants (e.g., *balance inquiry, downloading account statement, ordering cheque books, viewing recent transactions*, *browsing for catalogs* etc.), PR represents the electronic product involved in commercial business transaction, D = $\{d_i, i = 1, 2, .., k\}$ is a set of participant mobile devices (e.g., Mobile phone, smartphone, PDA). Each participant $mp_i \in$ 'MP' has distinct role 'r' in business domain is identified and characterized by two sections namely *identification section* and *specification section* which we describe in the following sections. The works in [17,18] present high level conceptual templates based on ontology design patterns to understand the business world.

1. *Identification section* (IdntSec): The identification section, contains information such as name, unique id and email id of each business participant IdntSec(mp_i) = [name(mp_i), id(mp_i), email id(mp_i)]

- name (mp_i) $\in$ string; mobile participant name.
- id (mp_i) $\in$ integer; identifier of mobile customer or vendor.
- email id (mp_i) $\in$ string; participant email identifier.

2. *Specification section* (SpecSec): The specification section describes the specific characteristics of mobile participants such as Goals (G), Professional Skills (PS), Responsibilities (R) and Financial Criteria (FC) exhibited during mobile transactions. The representation of specification section of each individual participant is as follows.

$$SpecSect(mp_i) = [G(mp_i),\ PS(mp_i),\ R(mp_i),\ FC(mp_i)] \tag{7}$$

Goals: the business objectives laid by customer/vendor and given by

$$G(mp_i) = (l, f), l \in string, f \in string; \tag{8}$$

where, 'l' and 'f' gives a natural language description of specific characteristics of the participant.

Professional Skills: the set of activities initiated by mobile device during product purchase or selling in a business environment. For example, the professional skills of participant initiates a specific product purchasing action with a role as buyer through mobile device.

$$\begin{aligned} PS(mp_i) = (a, pr, r) \mid (mp_i, a, pr, r), \\ a \in A,\ pr \in PR,\ r \in \{\text{“buyer, mobile customer}''\}; \end{aligned} \tag{9}$$

Responsibilities: actions involved in achieving a business goal with role as mobile customer. The responsibilities of a mobile participant is to place a purchase order with mobile device.

$$\begin{aligned} R(mp_i) = \{(a, r) \mid (mp_i, a, r),\ mp_i \in MP, \\ a \in A,\ r \in \{\text{“mobile vendor}'',\ \text{“wholesaler}''\}; \end{aligned} \tag{10}$$

Financial criteria: The financial criteria permits the participant to buy cost efficient products. Financial status of participant indicates whether to buy costlier or cheaper product.

$$\begin{aligned} FC(mp_i) = \{(pr, l) \mid (mp_i, pr, l),\ mp_i \in MP, \\ l \in \{\text{cheaper, costlier}\}; \end{aligned} \tag{11}$$

In the following section, we discuss several business situations with examples for each mobile participant.

4.1 M-CUSTOMER (MC)

A M-customer receives goods, service or product from vendor or wholesaler at his location. Let $MC = \{mc_1, mc_2, .., mc_{m_1}\}$ be a set of customers, where 'm_1' represents the total number of customers involved in business activity. The customer specification section is described as follows:

The *goal* is to buy a product with high discount with role as customer.

$$\begin{aligned} G(mc_i) = \{(pr, d, r), \mid (mc_i, pr, d, r),\ mc_i \in MC,\ pr \in PR, \\ d \in \text{very high discount, high discount}\},\ r = \{\text{“customer}''\}; \end{aligned} \tag{12}$$

The *professional skills* initiates the activity of funds transfer for the product purchased with mobile device.

$$PS(mc_i) = \{(a, pr, d) \mid (mc_i, a, d), \\ a \in A,\ d \in \{\text{“smartphone”},\ \text{“mobilephone”}\}; \tag{13}$$

The *responsibilities* of mobile customer is to initiate an activity of placing a purchase order for a product with mobile device.

$$R(mc_i) = (a, pr, r) \mid (mc_i, pr, a, d),\ pr \in PR,\ mc_i \in MC, \\ a \in A, d \in \{\text{“mobilephone}''\text{,}\ \text{“smartphone}''\text{,}\ \text{“PDA}''\}; \tag{14}$$

The *financial status* is high to buy good product.

$$FC(mc_i) = (l, f), l \in \{\text{low},\ \text{moderate},\ \text{high}\}, \\ f \in \{\text{bad},\ \text{good}\}; \tag{15}$$

4.2 M-VENDOR (MV)

Mobile vendor sells goods or services to the customers through mobile device. Let $MV = \{mv_1, mv_2, .., mv_{m3}\}$ be a set of vendors, where m_3 is the total number of vendors involved in mobile commerce business.

The *goal* is to initiate selling of products based on location and earn profit.

$$G(mv_i) = \{(a, pr, k), \mid (mv_i, a, pr, k), a \in A, \\ pr \in PR,\ k = \text{high dividend}\}; \tag{16}$$

The *professional skill* is to provide timely information about product prices with role as mobile retailer or wholesaler.

$$PS(mv_i) = (a, pr, r) \mid (mv_i, a, pr, r), \\ a \in A,\ pr \in PR,\ r \in \{\text{“seller,}\ \text{wholesaler}''\}; \tag{17}$$

The *responsibility* initiates an activity of sending quotation throug e-mail for the electronic product with role as dealer.

$$R(mv_i) = \{(a, r) \mid (mv_i, a, pr, r), \\ mv_i \in V,\ a \in A,\ pr \in PR,\ r \in \{\text{“dealer,}\ \text{wholesaler}''\}\}; \tag{18}$$

The *Financial status* initiates the action of purchasing maximum electronic products.

$$FC(mv_i) = \{(a, l),\ a \in A, \\ l \in \{maximum, minimum\}\}; \tag{19}$$

4.3 M-BROKER (MBR)

The broker has to promote transactions by co-ordinating between potential sellers and buyers in M commerce environment. Let $MBR = \{mbr_1, mbr_2, .., mbr_{m_2}\}$ be a set of brokers, where m_2 represents total number of brokers. The mobile

broker does not take the ownership of the product being sold, but receives commission from the mobile customer or mobile vendor or both of them.

The *goal* is to initiate transaction from vendor to mobile customer.

$$G(MBR) = \{(mc_{i1}, mv_{i2}, a) \mid (mbr_i,\ mc_{i1},\ mv_{i2}, a), \\ mbr_i \in MBR,\ mc_{i1} \in MC,\ mv_{i2} \in MV,\ a \in A\}; \tag{20}$$

The *professional skill* initiates the activity of collecting the timely information on product availability.

$$PS(MBR) = \{(a, pr) \mid (mbr_i, a, pr)\ mbr_i \in MBR\ a \in A, pr \in PR\}; \tag{21}$$

The *responsibility* of the broker is to arrange for money transfer transaction using mobile device with role as mediator.

$$R(MBR) = \{(a, d, r) \mid (mbr_i, a, d, r)\ mbr_i \in MBR, \\ a = \langle \text{“money transfer”} \rangle, , d = \langle \text{“mobile device”} \rangle,\ r = \langle \text{“mediator”} \rangle; \tag{22}$$

The *Financial status* of broker initiates the action of sending mobile advertisements to customer mobile device.

$$FC(MBR) = \{(a, d) \mid (mbr_i, a, d),\ mbr_i \in MBR,\ a \in A, \\ d \in \{\text{mobile device}, \text{smart phone}\}\}; \tag{23}$$

4.4 M-BANKER (MBK)

The banker performs the business of banking, which is described as payment of cheques, organizing current accounts, and also collection of cheques through mobile phone. A mobile banker also conducts the M-commerce transactions such as deposit accounts, loan amount payment and also exchange of bills for mobile participant. Let $MBK = \{mbk_1, mbk_2, .., mbk_{m_4}\}$, where m_4 represents total number of bankers involved in commercial business.

The *goal* is to conduct timely and secured transactions through mobile devices to build brand of the bank.

$$G(MBK) = \{(a, d) \mid (mbk_i, a, d), mbk_i \in MBK, a \in A, \\ d \in \{\text{mobile device}, \text{smart phone}\}\}; \tag{24}$$

The *professional skill* initiates the activity of opening the accounts to multiple mobile customers through the mobile device.

$$PS(MBK) = \{(a, mc_i, d) \mid (mbk_i, a, mc_i, d), mbk_i \in MBK\ a \in A, \\ mc_i \in MC,\ d \in \{\text{mobile device}, \text{smart phone}\}\}; \tag{25}$$

The *responsibility* is to collect mobile cheques from his customers with role as banker.

$$R(MBK) = \{(a, mbk_i, r) \mid (mbk_i, a, r)\ mbk_i \in MBK,\ a \in A,\ r = \langle \text{“Banker”} \rangle; \tag{26}$$

The *Financial status* allows to arrange for opening accounts of mobile participants at various counters.

$$FC(MBK) = \{(a, mp_i) \mid (mbk_i, a, r),\ mbk_i \in MBK,\ a \in A,\ mp_i \in \{\text{Customer}, \text{Vendor}, \text{Broker}\}\}; \tag{27}$$

In the following section, we describe the working of our business model to understand the concepts of business process.

5 Mobile Commerce Business System

A Mobile commerce business system consists of information about mobile participants (e.g., customer, vendor), products, set of roles and actions performed during a commercial transaction. In addition the database is created to store mobile commerce transactions. The relational algebraic model concept can be utilized for information composition at different levels. The information/data and process flow between distinct business entities is realized using relational algebra operators such as (σ, π, $\cup$, $\bowtie$, $\cap$). A transaction of product purchase is analyzed with following steps. The attributes for each entity is given by

LOCATION(LocationID, LocationName, LocationArea)

PRODUCT(ProductID, ProductPrice, ProductLocation)

VENDOR(VendorID, ProductType, ProductPrice, ProductBrand)

CUSTOMER(CustomerID, CustomerLoc, CustomerEd, CustomerFs)

Each customer is identified by ID, qualification and financial status

$$\exp_1 = \sigma_{\text{CustomerID}=55}(\text{CUSTOMER}) \tag{28}$$

$$\exp_1 \Rightarrow \text{CustomerID} : 55,\ \text{CustomerLoc} :\ \text{shoppingmall},\ \text{CustomerEd} : \text{B.E},\ \text{CustomerFs} : \text{medium} \tag{29}$$

The $\exp_1$ retrieves the record of customer with ID = 55.

$$\exp_2 \leftarrow\ \text{CUSTOMER} \bowtie_{\text{ProductType} =\text{scientific cal}}\ (\text{VENDOR}) \tag{30}$$

The $\exp_2$ gives information about vendors who sells scientific calculators.

$$\exp_3 \leftarrow\ \pi_{\text{ProductPrice, ProductBrand}}\ (\exp_2) \tag{31}$$

The $\exp_3$ gives the price and brand of scientific calculator information to a business customer. We have proposed relational algebraic technique to model a specific business situation. The mobile commerce business model could further be expanded to include the roles and actions executed by participants.

6 Conclusion

In this paper, we propose a formal description of business model by identifying the specific characteristics of mobile participants and illustrate with examples in a particular trading scenario. The proposed analytical concepts assist in developing innovative user friendly interfaces and also to model e-business domain. In future, we want to extend our design aspects to implement context-aware business models by analyzing the context information and thereby assisting business participants to conduct transactions anytime, anywhere.

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