Application of "Internet of Things" in Electronic Commerce

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Abstract

Electronic commerce which had researched 7.0 trillion’s market scale in china by the end of 2011 has become one of the most important models of modern business, greatly promoting commercial activities. Internet of Things (IoT) in which wireless network of uniquely identifiable objects was used for the Internet has extended into our daily lives. So far there have already lots of works on the related subjects. And lots of researches about the applications of IoT, also some papers engaged in the application of IoT in E-commerce. But almost all of the works either focused on the two different subjects respectively, or only touched on the application of the later in the former, in this paper we made some researches of the application in details from the points of business models and technologies related, also we discussed about some related questions such as “Privacy and Security Issues” that was needed to deal with in the future.

Keywords: Internet of Things, Electronic Commerce, Business model, Technology

1. Introduction

Electronic commerce which is the electronic delivery of services and information is the connection of business and internet, all the application of internet in commerce. Generally speaking, E-commerce improved the quality of goods, services and increased service delivery speed. Services are another kind of goods[1,3]. Electronic Commerce is playing an increasingly important part nowadays; greatly promote commercial activities, becoming one of the most important business models all round the world. E-commerce of which the total market has been increasing for the last 10 years and reached 7.0 trillion by the year of 2011 in china is playing an increasingly import part in commercial activity nowadays. There are several kinds of Electronic Commerce: Business-to-Business (or B2B) is the kind of commerce carried out transactions business between two or more businesses, while Consumer -to-Consumer (C-to-C), Business-to-Consumers (B-to-B) is the transactions between consumers and businesses, respectively [5]. At the same time the concept of the Internet of Things (IoT) is becoming the one being chased by capital with the progress of technology, development of IoT will surely benefit E-commerce in the future. Provide relative shareholders great benefits, and become another promotion of economic prosperity. The concept refers to the dream of connecting smart devices together with the internet, so people can control the devices remotely. In china the concept of IoT has been heighted, lots of researches touched on the subject, also various companies cut in the field. Jiabao Wen who is Chinese Premier made his point in the city of Wuxi calling for the rapid development of Internet of Things technologies. He gives out the famous equation: Internet of Things+ Internet = Wisdom of the Earth, just at that time.

One of the important applications of IoT is its use in Electronic Commerce. There are already lots of researches majored both in Electronic commerce and Internet of Things respectively, also lots of books, papers touched on the subjects, but less of them mentioned the application of IoT in Electronic Commerce in details, paper [1-2] discussed several application of RFID which is the key technology of IoT, paper [7] were the single analysis Electronic Commerce, paper [12] give a introduction of IoT, and made discussed several problems of ToT, paper [15] referred to the frame of IoT., author analyzed several feasible frames of IoT. In this paper we discussed about the applications of IoT in Electronic Commerce, we would firstly do some research about the developments of “Internet of Thing” and Electronic Commerce in section 2, in this section we will give introductions to both “Internet of Thing” and Electronic Commerce, some blocks and statistical dates will be given. And then we would talk about the business model and related technologies of the application in section 3 and 4, the model will be discussed from the point of Innovation of commodity management, Supply chain, Transaction, several problems need to be solved will also be discussed in section 5, finally a conclusion will be
given to summarize the results. Figure 1 is level of Internet of Things. In the paper, lots of figures and tables are given to make an intuitionist elaboration of the application.

2. Developments of "Internet of Things" and Electronic Commerce

Electronic Commerce is playing an increasingly part in modern times, greatly promote commercial activities. Figure 2 is the business models of Electronic Commerce. At one side, electronic commerce is the electronic delivery of services and information. At another side, E-commerce is the connection of business and internet, all the application of internet in commerce. Generally speaking, E-commerce improved the quality of goods, services and increased service delivery speed. Services are another kind of goods.

E-commerce cut cost of commercial activities; also address the needs of consumers, merchants’ organizations. Business-to-Business (or B2B) is a kind of commerce carried out business transactions between two or more businesses. Business-to-business E-commerce has been developing a new industry in the past 10 years. Business-to-Consumer is the new method of traditional retailing, but business is carried out the Internet, though the Internet, all the information and details are transferred though the Internet. B-to-A means the transactions carried out between businesses and government bodies. At the same time, Consumer -to-Consumer (C-to-C), Business-to-Consumers (B-to-B) is the transactions between consumers and businesses, respectively. Each has its own characteristics. For each model, we all have lots of famous companies in and abroad, some statistics are listed in table 1[2]. Table 1 is some representative companies. Jiabao Wen who is Chinese Premier made his point in the...
city of Wuxi calling for the rapid development of Internet of Things technologies. He gives out the famous equation: Internet of Things + Internet = Wisdom of the Earth, just at that time [2].

<table>
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<tr>
<th>MODEL</th>
<th>INTRODUCTION</th>
<th>REPRESENTATIVE COMPANIES</th>
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<tr>
<td>B2B</td>
<td>business transactions between two or more businesses</td>
<td>Alibaba, Hc360, Made-in-china, Mymai, Chinacaigou, TradeKkey, Tradevv</td>
</tr>
<tr>
<td>B2C</td>
<td>business transactions between businesses and consumers</td>
<td>Vancl, Jingdogn, Dangdang, Tmall, Amazon, Okbuy, Ectrade</td>
</tr>
<tr>
<td>C2C</td>
<td>business transactions between two or more consumers</td>
<td>Etaopiao, Taobao, Docin, 123pai, Wowsai, Ebay, Ubid, Onsale, Yahoo Auctions</td>
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</table>

In china we must highlight the trend, and do our best to catch up with the developed countries. More than 1 billion smart phones or pads besides 2 billion PCs have been connected by Internet, nowadays. However, there is a trend, that the time of "Internet of PCs" will move towards an "Internet of Things", it is said that 100 billion devices will be connected by the so called “the Internet of things” in the next 10 years. The Internet of Things which possibly has a profound influence on future development of the world, is a technique that connects all the things by information sensing devices with Internet. With the IoT, we would surely realize self management and intelligent identification of device itself. There are lots of institutes and researches study the subject, it is regarded as the promotion and propulsion of the next age of economic growth.

The appearance of The Internet of Things (IoT) has never been the development of single science and technology, but the progress of various subjects. During the past 10 years, we have been making steady progress in the subjects of computer science, microelectronics, communications and electronic engineering, IC, RFID, software, and so on. Mechanics and information technology. Most importantly we are faithful to see another 10 years’ prosperity in the related subjects. So the science of IoT is a combination of sciences mentioned above. Thanks to the sciences we are able to bridge the gap between the virtual and physical world.

By connecting the smart devices of the physical world to the traditional Internet, using embedded sensors and actuators provided by IC companies, we are able to gather huge volumes of data of
physical, the date would be transmitted through wired and wireless network, and finally to control computer for us to make farther decision after analysis [3]

3. Business model innovation of Electronic Commerce stock using "Internet of Thing" System

So far E-Commerce is regarded as one of most important commercial models. The market scale of E-commerce in China has reached 7.0 Trillion by the end of 2011. Network technology is the basic of the so called “Internet of things”. Radio Frequency Identification (RFID) tag technology is playing the most important role in the trend. Figure 3 shows layers of Internet of Thing. At the same time sensor which can percept the signal of electricity, displacement, heat, sound, force, and light is the skill of IoT, as it has the ability to percept real world, also it offer the information of outer “stimulus” of the IoT, and then after process of center computer, feedback, will be given. At the same time the internet of things is been realized with the progress of related technologies. There would appear various applications of the internet of things. The internet of things would surely give another boom to E-commerce. There would be several innovations generally speaking, the innovation of commodity management, and the innovation of exchange, logistics and the way to prevent knockoffs [4]. Figure 4 is Market scale of E-commerce in China recently.

3.1. Innovation of commodity management

Traditionally, commodities from various factories would be stocked according to sources, batches, date of manufacture and other targets, in warehouses of E-commerce, so managers would easily manage goods [5].

![Market Scale of E-commerce in China](image)

Figure 4. Market scale of E-commerce in China

There would be details of the commodities, so managers would make operations to goods of the same batch and factory, but there is a truth, that is commodities of the same batch and factory would still vary, managers do not know the details of each goods. With the technology of internet of things we can solve the problem, to realize fine management. Each goods will be given a unique ID, a RFID tag. The details of the goods and special cautions will be recorded in the tag. At the same time, warehouse must meet some requirements to match with goods. Special “capsules” (with receivers and emitters) for each goods, when goods were stocked in the capsules, we would gathering information of each goods and located each one all the time [5]. So managers would find the exactly the right goods with the right release date, brand. Figure 5 and 6 is traditional management new proposal.

3.2. Supply chain

Better and more reasonable business plan and production plans would be made due to IoT. The applications of IoT to supply chain management can help companies share information of goods from the rote of tags and sensors, "bullwhip effect" trouble would also be wiped off by the new applications, as information would be enlarged in supply chain. Real-time product information becomes a reality.
thanks to the applications of Internet of things, which means there is a break though in the traditional transmission model of information [6].

Electronic Product Code (EPC) is very important. People need register in the EPC global. Supply chain members could acquire messages of service and foods though the net, just like distributor, suppliers, and manufactures, when application users offer information of goods. If registered, supply chain members must set the parameters of the IoT and related devices. Thanks to the IoT we would not only locate the location of product during the manufacturing and delivering, but also acquire the information of products constantly. We can not only optimize production processes, but also check the flow of activity by the application of IoT, as in the system we can connect items with information technology, using embedded smart equipment, IDs and data carriers, which would interact with an intelligent supporting network and information systems. If we could acquire effective messages about the real-time situation of shop floor, parameters of lots and the situation of manufacture machines, we would optimize production schedules and improved logistics. And now we could make it by embed tags in items and packs. Self management and intelligent production procession would be proposed by identifiable items [6].

3.3. Transaction

Traditionally customers can only acquire formation offered by sellers and the product information as it is fixed cannot be changed. But information from raw material to products and from products to goods can be acquired if EPC tags were employed into the procession, as the whole procession of manufacture and management can be recorded. So as soon as they acquired the information through ToT, they may make better choice and decision during the transaction, as they can choose the right goods with the suitable parameters and characteristics.

4. Technical analysis
The so called “Radio Frequency Identification” (RFID) which is consist of tags, readers and antennas is a new concept appeared during the last several years, it is something related to wireless automatic identification. It is used to acquire automatic identification. There are several methods to realize tags, mostly tag is based on the technology of CMOS, sometimes surface acoustic wave (SAW) is another choice, and also tuned resonators can still be regarded as the related technology. Readers give out radio signals, which would offer power to tags. Also batteries are another choice of tag’s power [7]. RFID can be sorted as signal direction, or two way communication. Former means the information can only be transferred in the fixed direction, while the later means information can communicate between tags and readers. Tags usually transfer information to readers by changing the loading of the tag antenna in a fixed way, but also information can be transferred after modulated. So there are some algorithms used to modulate information [8].

![Figure 7. Block of RFID](image)

Related information was stored in tags. If the tag was in the workplace of RFID, antenna send signals to tags, then the tags was activated, thus there were induced currents in tags, to support the tag.

![Figure 8. Block of WSN](image)

When received the dates transferred from antenna of reader, the tags reads the date stored in its internal memory, and then changes the loading on the tag antenna in a coded manner corresponding to the stored data. Once reader received date sent back from tags, it would decode, and demodulated it and send it to control system, which would carries out corresponding processing and control according to different settings, and sends out instruction signals to control the actions after judges the legality [8]. Figure 9 is flow of RFID. The sensor is the sensory skin of machines to apperceive stimulate externally. All the useful stimulate external can be gathered by sensor. Thus there are lots kinds of sensors, which can be sorted as heat, force, light, electricity, sound, and displacement sensor [9]. Once stimulates were gathered by sensor, they would be sent to control system, where they would be analyzed, and subsequent instructions would be give then. microminiaturization, smartalization, informationization, and being networked are the trendy of sensor development [10, 11]. Wireless sensor networks (WSNs)
is a system that can gather information of some monitored place, the date would be transmit to sink node and internet, be analyzed. Thanks to the progress of science and technology, wireless sensor networks have gained worldwide attention in the past several years.

Figure 9. Flow of RFID

WSN can be sorted as structured and unstructured. Each has its own merits and demerits. Unstructured WSN may have lots of sensor arranged densely. The sensors can monitoring some place without special attention paid by managers. But the system may pay a heavy price for management and test jobs [12].

Table 2. Merits and demerits of structured and unstructured WSN

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<th>Structured</th>
<th>Unstructured</th>
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<tr>
<td><strong>Merits</strong></td>
<td></td>
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<tr>
<td>Some place may lost</td>
<td>Fewer cost</td>
<td></td>
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<tr>
<td><strong>Demerits</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fewer cost</td>
<td></td>
<td>Great cost for net management and test jobs.</td>
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In a structured WSN, we use fewer sensors which are deployed in a pre-planed way. Though there may be some place lost, the cost of network maintenance and management were lowered down greatly. Table 2 is merits and demerits of structured and unstructured WSN [13, 14].

Figure 10. RFID

5. Several problems need to be solved

5.1. Privacy and Security Issues

New technologies and business models of connecting devices into the internet, perceiving and controlling the devices in the remotely give birth to the so called “Internet of things”. The Internet of things may greatly help improving people’s living standard, promotes economic development. But it may to bring about another problem: Privacy and Security Issues. There are 2 prerequisites. Firstly from the point of human nature, legal jargon written in privacy policies must be perplexed. Actually
people are not likely spend their limited time and bandwidth downloading and reading the documents; secondly from the point of technologies, system protocols tend to support cooperation among all participating nodes, as in the system, sensors and other wireless devices and items must connected with each other, to form a net, and communicate with each other in a automatic way without assistance from a fixed infrastructure. So dates must be transmitted among potentially non-trustworthy networks, where they may be stolen or altered without authorized [14].

5.2. Legal environment

decentralized policy organizations is a must as all the requirements and benefits of all stakeholders involved, managed by several entities and private sector, civil society and international organizations need to be taken seriously, to improve legitimacy and democratic participation. The beneficiaries and related bodies’ cooperation would improve level of coordination and cooperation [15]. Including all stakeholders concerned with the IoT in one way or the other generally ensures a form of reasonable representation, being an important aspect when considering the legitimacy of institutions. Thus the system must be designed meet with the rules of fair, also the system must base on protocols of formal documents, and the protocols define the rules and give details of how the rules are applied. Figure 11 shows a survey (in a university) of peoples’ attitude toward Privacy and Security Issues of E-commerce (if he or she was care about the information of the activity of E-commerce), 7 means very concern, 1means no concern, while 3 means have not thought about that [16].

![Statistics of Student](image)

Figure 11. Statistics of peoples’ attitude toward Privacy and Security Issues

5.3. Energy

Because today’s packaging is so bulky to provide space for batteries, besides “stand-by time” is so short. The application of IoT and Wireless Sensor Networks is faced with a big hindrance, which is the miniaturization and storage of power supply. New technologies of high-capacity energy storage must be developed to meet the requirement of inefficiency batteries replacement. Electrostatic, piezoelectric and electromagnetic, energy conversion schemes, thermoelectric systems and micro coolers, photovoltaic systems, Micro fuel cells and micro reactors, Micro combustion engines for power generation and propulsion, and Materials for energy applications are key solutions aimed to avoid the problem of batteries inefficiency is the harvesting of energy from the environment, which would automatically recharge small batteries contained in the objects.

6. Conclusion

In this paper we made some research on Application of “Internet of Things” in Electronic Commerce. With the technology of internet of things we can solve the problem, to realize fine management. Each goods will be given a unique ID, a RIFD tag. The details of the goods and special cautions will be recorded in the tag. At the same time, warehouse must meet some requirements to match with goods. Special “capsules” (with receivers and emitters) for each goods, when goods were stocked in the capsules, we would gathering information of each goods and located each one all the time. The applications of IoT to supply chain management can help companies share information of goods from the rote of tags and sensors. Also when consumers acquired the information through IoT,
they may make better choice and decision during the transaction, as they can choose the right goods with the suitable parameters and characteristics. “Radio Frequency Identification” (RFID) and Wireless sensor networks (WSNs) are among the most important technologies in the application of IoT, we give some discussion about the technologies. At last we also mentioned the problems of Privacy and Security Issues, Legal environment, Energy, which are the obstacles in the way of application.

7. References


