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IOT Technology Research in E-commerce

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Abstract: Internet of Things (IOT) is a new revolution in information technology after the internet and mobile communication network, it contains a huge room for innovation and opportunity. Internet of things takes advantage of smart devices and sensing technology to perceive and recognize the physical world. By RFID radio frequency technology, network transmission interconnection, signal processing and computing, information is shared and seamless connection is realized between things or between persons and things, the real-time monitoring things, accurate management and scientific decision-making are achieved. In this study, the development trend of IOT applications has been analyzed in e-commerce, the problems are described in traditional e-commerce. In the IOT technology application, there are three important aspects, such as e-commerce inventory, logistics, payment. We studied the key technical issues of Things development, e-commerce security measures, their system configuration structures and that the intelligent identification, positioning, tracking, monitoring and management are integrated between the IOT and e-commerce.

Key words: Internet of things, e-commerce, intelligent platform, RFID, secure payment

INTRODUCTION

E-commerce generally refers to a new business model, where consumer makes online shopping, online transactions between merchants and online electronic payments and a variety of business activities, trading activities, financial activities and related integrated services activities, buyers and sellers are not met to conduct various business activities based on browser/server application mode. At an open network environment of the Internet, there are a wide range of commercial and trade activities around the globe (Zheng, 2014). E-commerce is that the micro-computer

technology and network communication technology are used for business activities. E-commerce is not equivalent to business electronically.

Internet of things is a network which is composed with Radio Frequency Identification (RFID) (Zhang and Xu, 2011; Jin *et al.*, 2007), infrared sensors, global positioning systems, laser scanners, gas sensors and other information sensing device, according to the agreed protocol, any goods is connected with the Internet for information exchange, communication, IOT is used to make intelligent identification, positioning, tracking, monitoring and management. Things Internet Schematic diagram is showed in Fig. 1.

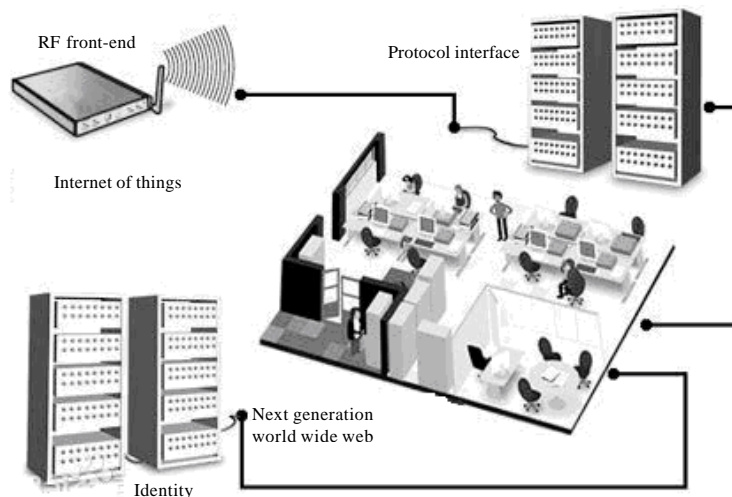


Fig. 1: Things internet schematic diagram

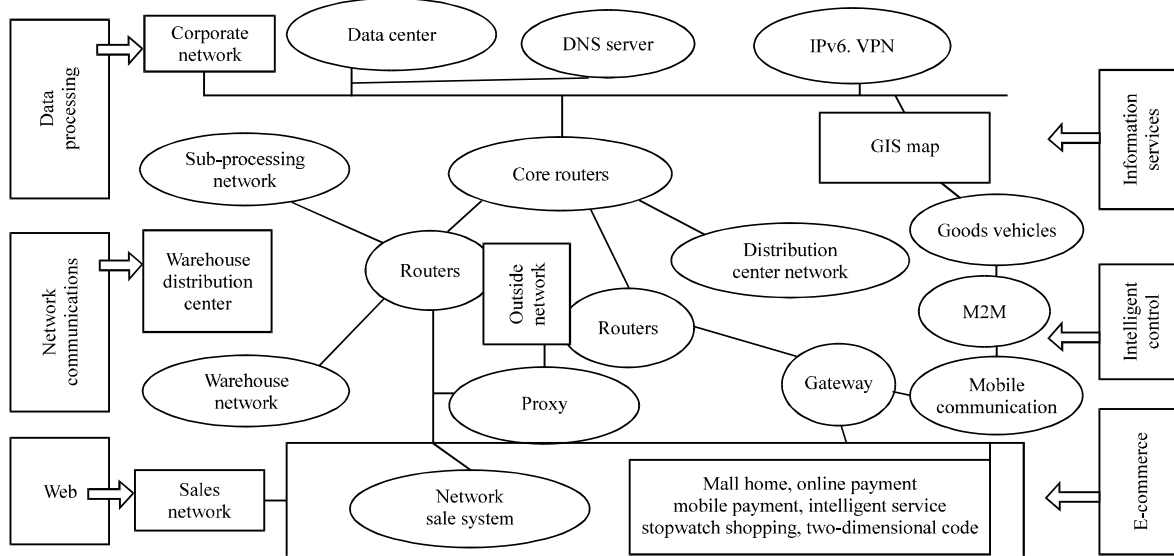


Fig. 2: IOT is combined with e-commerce to form new IOT e-commerce system

With the rapid development of e-commerce, its technology requirements will also increase on all aspects of future e-commerce. Firstly, the e-commerce applications are combined with IOT development and IOT technologies are applied in three important aspects of e-commerce, such as inventory, logistics and payment. The RFID (radio frequency technology) and ZigBee technology can be applied in inventory and logistics chain, the payment security and its solution are discussed. Intelligent warehouse management system is proposed, “take-away” type logistics is envisaged, the mobile payment is an important means of future e-commerce payments. At the same time, the recommendations of the IOT technical feasibility is proven in all aspects of e-commerce development.

The future of e-commerce will be towards the development of diversification and convenient, the competition will become more intense. An e-commerce system includes inventory, logistics, electronic payment and other important aspects, if IOT technology is used in various aspects of e-commerce, e-commerce will greatly improve the efficiency of the system, for example, operating costs can be reduced, customer experience is improved, in this way, e-commerce has entered a new development stage. IOT is combined with e-commerce and new IOT e-commerce system is formed, their architecture is showed in Fig. 2 (Han and Li, 2012; Yang and Ran, 2011; Yang and Tian, 2012).

PROBLEMS IN TRADITIONAL E-COMMERCE

E-commerce market had evolved on the basis of the past retail sector, so the traditional e-commerce

infrastructure exists behind, the innovation is lacked in business models. In addition, the product quality is difficult to guarantee, the pay security is poor, logistics are not in place and these issues have seriously hampered the development of e-commerce.

Payment issues: Payment convenience and security are important to ensure the rapid development of e-commerce. The current online payment services still need to be improved and deepen. Despite online payment has the breakthrough growth in terms of subscriber base and transaction volume, however, the online payment service still needs to be improved. The main problems include: User action cumbersome, payment security with hidden danger, no reliable security system, no specific standard financial system on the network payment, no sufficient support on online payment, lack of motivation. Corresponding laws and regulations development are lag on online payment. In addition to the current method of payment, it is a big difficulty to pay for users in remote areas and to meet online shopping needs, these have further hindered the promotion of e-commerce market (Song and Mitchell, 2011; Van Deursen *et al.*, 2008).

Logistics and distribution system problems: Development of e-commerce is also closely related with enterprise distribution system. The business activities of inventory, logistics, finance, payment and other components should be had in a complete e-commerce. Logistics is an important part of e-commerce operation and plays an important role in e-commerce, logistics and distribution efficiency is indispensable. With the rapid development of e-commerce, logistics and distribution

requirements are also increasing. In China, although there are a number of courier companies and postal courier companies, they only completed the basic logistics system and distribution services and their services are for a long time, they have poor access, poor customer reputation and it can not meet the requirements of the high efficiency and low-cost in e-commerce logistics and distribution, the rapid development of e-commerce is severely restricted.

Weak capacity of the network infrastructure:

E-commerce is the business activity based on network traffic information, its characteristics is real-time, rapid. The development of e-commerce depends on the size of the information infrastructure at some extent. In China, the network infrastructure is still relatively slow and lag. Network has been built and its quality is also far away from the requirements of e-commerce. Therefore, infrastructure construction need be intensified, investment efficiency need be improved, the communication network backwardness need be effectively changed and it becomes the most important to promote the development of e-commerce applications.

IOT TECHNOLOGY FUNCTION IN E-COMMERCE

Current automatic control, information sensing, RFID radio frequency identification technology and industrial development have been basically mature, these are necessary for IOT development, telecom operators and system equipment providers also have reached a higher level, IOT will permeate and expand to all areas, IOT will have a significant role in promoting e-commerce.

Stock: Here's inventory includes branch offices, warehouses, distribution centers. As a large e-commerce companies, a number of branches are established according to their regions, each branch manages well a warehouse and distribution center which are set in a region. For such manners of more stock, network system is required to support a smart inventory operating. There should be three parts in the network system.

Branch network: Branch is connected with Corporation via an access router. the management network, the warehouse network, the network of distribution centers and subordinate sales network are interconnected through RFID radio frequency technology and ZigBee short-range wireless communications technology, these constitute a huge "Network". By this "Net", real-time

sales data are aggregated on sales platforms and are reported to the head office. Information feedbacks to company and corporation is coordinated with linked warehouse and distribution center network, real-time data of goods are currently acquired, warehouses and distribution of goods can be controlled.

Warehouse network: Accurate inventory is based on market demand, the order production must meet market and consumer demand and can precisely control distribution channels, price, inventory number, production date and other basic information. By the IT technology, the flow of product information can be accurately grasped, adjustments are made timely on the Internet, production efficiency is improved, market competitiveness is improved. IT technology is mainly composed of bar code technology and RFID systems. Warehouse management systems are established, fixed bar code reader is applied automatically to identify goods on inbound or outbound, pallet label is adopted on the transport system, information is uploaded to computer system, after being checked, cargo on tray will be transferred into or out appropriate locations by the system command. While the RFID system is used to cargo management for smart warehouse (Deng *et al.*, 2014; Han, 2013), the related information management should be effectively solved between warehouse and the goods flow. The RFID tags is affixed to the intersection or doors which the goods must pass through (Phan *et al.*, 2011; Song and Mitchell, 2011), readers and antennas are put on the warehouse handling car, bar code is affixed to each cargo and its information is stored in a central computer in the warehouse. When the goods are loaded to be transported elsewhere, their data is identified by another reader to inform the computer center, where the goods are placed on trucks. Such management center learns in real time how much inventory and how many sales, the location of merchandise goods can also be determined. The RFID technology of the mobile e-commerce is shown in Fig. 3 (Van Deursen *et al.*, 2008; Ha *et al.*, 2008; Van Deursen and Radomirovic, 2009).

Distribution center network: The EPC technology and continuous replenishment system is used in the distribution sectors, if all goods are affixed with EPC tags, when goods enter the distribution center, reader on the door will read labels of all cartons on pallets and the cargo information is stored in the database. Information and delivery records will be checked in the system to detect possible errors and then the latest location and status of

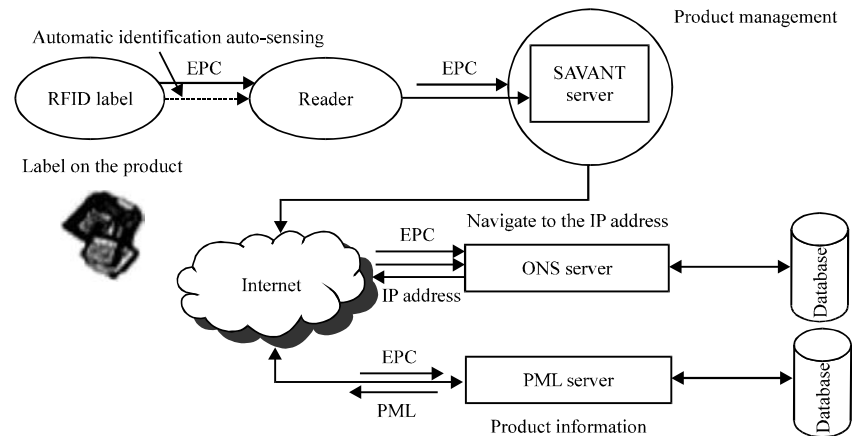


Fig. 3: RFID technology in the mobile e-commerce

EPC label merchandise storage are updated. This ensures to control accurate inventory or even how many goods are known exactly in transit, origin and destination of transport and the expected arrival time and other information are known exactly. By using continuous replenishment system, the staff do not have to spend a long time on how to automatically identify the goods and the system automatically updates its records. If the goods are lacked in inventory, intelligent replenishment system sends order to the production base, production base suppliers restock to distribution centers.

LOGISTICS

IOT intelligent logistics system: As e-commerce logistics chain, the most important feature is the timeliness, convenience and safety. E-commerce logistics chain is the whole process of the goods delivery, supplies, transportation based on instruction of corporate computer systems. Location of operating transport vehicles within the jurisdiction, transporting merchandise type and number are managed and controlled by IOT intelligent logistics systems. Logistics center is connected with mobile communication network through a gateway, mobile communication network is communicated with vehicle and transportation through M2M. With GPS systems and logistics distribution center display, managers easily grasp the current location and distribution of goods transport vehicles through GIS maps. Intelligent logistics architectures for e-commerce logistics and distribution are shown in Fig. 4.

The main roles of the IOT smart logistics system are as follow:

- **Management tools intelligent upgrades:** Computer technology, barcode technology, RFID technology are embedded in the logistics chain, they are help to improve efficiency and to reduce costs in the logistics chain
- **Transport intelligent upgrades:** In the transport system, GPS and network technology are used to realize the visualized tracking management in the part process, accurately predict the arrival time of goods, shorten delivery time, improve efficiency, customers are allowed to experience shopping service as the same as the 'Takeaway' order
- **Product safety upgrade:** Product intelligent traceability network systems are built based on RFID technology, such as food traceability systems. These smart product traceability system provide a solid cargo logistics support for the food cargo security, drug goods safety, special product security
- **Fourth side logistics:** Logistics industry will develop towards green logistics, efficient logistics and fourth party logistics and electronic information in the future. Now-a-days in order to meet the market demand, many companies and e-suppliers let the logistics outsourcing to third-party logistics service providers, inventory costs are reduced and distribution efficiency is improved. However, third-party logistics is also flawed, a single integrated third-party logistics skills are lacked and application integration is limited, the business must be outsourced to multiple separate third-party logistics providers, these increases the uncertainty of supply and manage difficult. If traditional business models are combined with IOT technology, e-commerce to form a supply chain, supply chain outsourcing

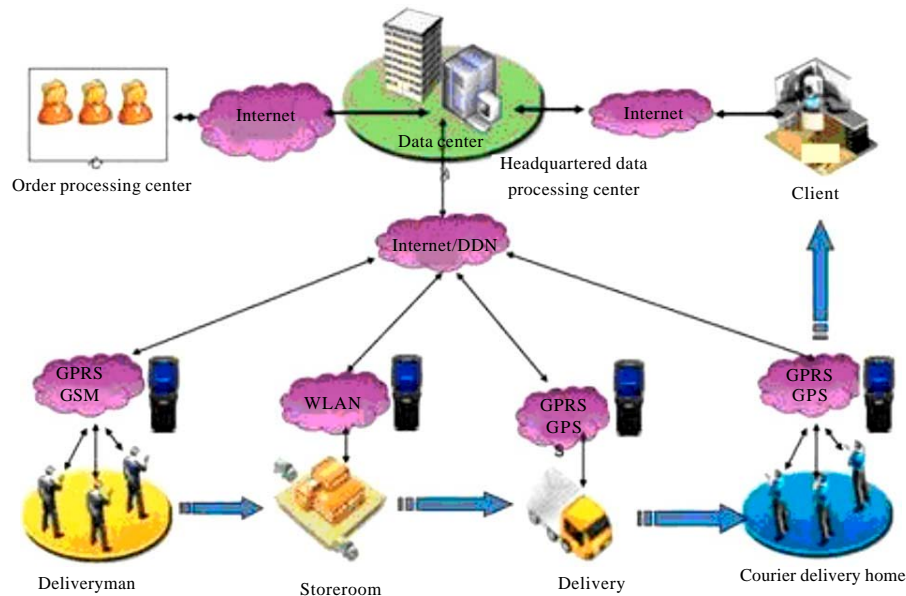


Fig. 4: Intelligent logistics architectures for e-commerce logistics and distribution

behavior was linked in unified entity, the efficiency and effectiveness will greatly improved. Thus a fourth party is created

The fourth side is not practical to undertake a specific logistics activities. The IOT technology in the Fourth is mainly Service Oriented Architecture (SOA) system, its design is based on the overall architecture of SOA, automatic interaction technology is used between heterogeneous systems, so that the interaction can be achieved between the original heterogeneous systems. In fourth supply chain program, there are multiple supply chain functions and processes operation, process integration, systems integration and operational handover. The various supply chain functions are strengthen through new IOT technology, the supply chain processes are collaborated and re-engineered. Fourth future development meets the needs of the entire logistics system, the latest technology and social resources are incorporated largely, cargo delivery time is reduced and the logistics efficiency is improved.

PAYMENT

In paying session, the e-commerce payment based IOT has many advantages and development space. By the application of IOT technology, the payment security and convenience are improved, the frequency is reduced in illegal transactions which occur in hacking and phishing websites. Here focuses on mobile payments.

IOT PDAs payment: Firstly, the pocket perceive PC is a personal mobile intelligent terminal of the e-commerce businesses. Lightweight Tablet PC is used as a carrier with an embedded RFID reader payment module, smart card payment is perfect integration with online sales, it realizes a simple and secure payment application mode. IOT PDAs payment resolved program is that RFID reader module is combined with tablet PCs for the first time, the user does not need to pay by cumbersome online banking, there is just a portable handheld computers, the entire process is completed by swiping.

The IOT smart card payment is different payment with other online payment tool, such as Alipay, Tenpay, this payment is the innovation applications of the latest IOT RFID contactless technology. Internet shopping is combined together with IOT payment, lightweight Tablet PC is used as a carrier, payment module is embedded in the RFID reader, a simple and secure smart card payment application mode is achieved by technical means. In IOT handheld payment, all funds were allocated through a bank dedicated channel to avoid security risks due to the Internet open. By using the DES algorithm, all the data are encrypted for users on the card and on data transmission from mobile devices to clearing center, these ensure maximum safety of funds.

In IOT handheld computers, such payment technology is bound to a lightweight handheld perceive computer terminals, payment module is embedded in RFID reader, in the back of the Pocket PC, there is a sensing area with similar mini-bus card size, consumers shop by

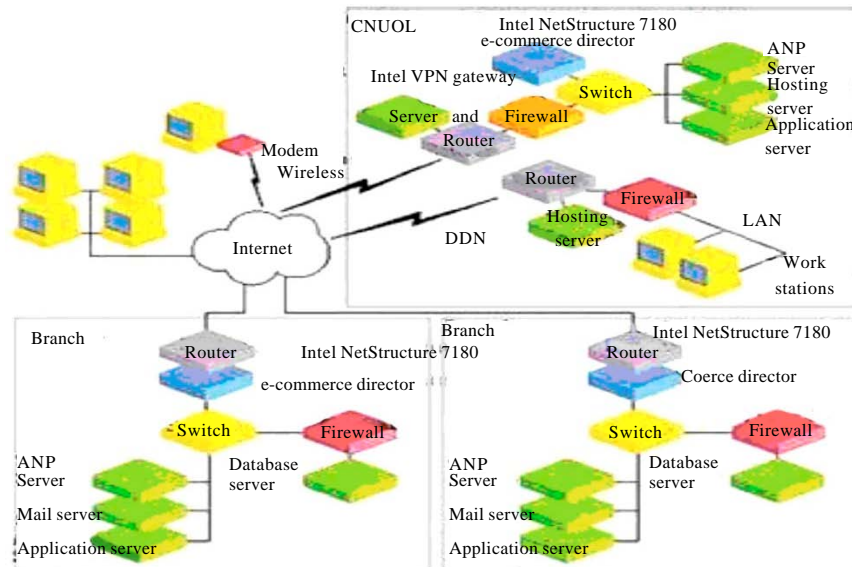


Fig. 5: IOT E-commerce secure payment mode

using this terminal products. Compared with the traditional online payment, it is no further complicated operation, when the IOT smart card only is gently captured in the vicinity of the sensing area, you can complete the entire payment.

Smart SD card payment: Today mobile, phones have become an indispensable tool in people's lives. Mobile carrier's mobile payment tool lets people see new hope in the mobile payments. Mobile phone payment becomes the closest people's daily habits and consumption habits on mobile payment, mobile payment also presents a multi-purpose, multi-formalized development prospects, such as SIMPASS technology payment, RF-SIM payment, NFC payment and so on. Smart phone SD card payment is also one of them.

Under the principles to unchanged mobile phone motherboard and SIM card in smart SD card mobile payment, the RFID module is placed in the smart memory card. The advantage is that the phone is no changed, the payment function is migrate to the SD memory card with a smart PC platforms or other mobile terminal platform, the payment convenience is greatly improved. The RFID function is integrated on an smart SD memory card in Smart SD Card mobile payment while antenna pins is reserved on the memory card, mobile network is connected POS machines through mobile terminals, smart SD card completes the payment on the POS machine.

Smart SD card payment has the following characteristics:

- **Operational security:** SD smart card is built in smart security chip, data encryption, digital signature, signature verification, the cryptographic computation is performed in the security chip, the uses of various keys are not outside the card. Core components of the SD card also supports a secure connection protocol functions
- **Certified security:** Mobile client achieves two-way authentication with a secure connection protocol, it ensures that the client and server can not be forged. Sensitive information is transmitted through a secure channel in the transfer process, it can effectively prevent hacker attacks, but also the intrusion of phishing sites is prevented
- **Convenience in use:** Smart SD card payments are in line with the user's habits. By the use of smart SD card payment, users do not need to replace the phone and SIM card, mobile payment functionality can be used. Compared to other mobile payment, whether in safety, convenience, or user experience, there are obvious advantages. IOT E-commerce secure payment mode is showed in Fig. 5

CONCLUSION

In this study, the development trend of IOT applications has been analyzed in e-commerce, the

problems are described in traditional e-commerce. In the IOT technology application, there are three important aspects, such as e-commerce inventory, logistics, payment. We studied the key technical issues of Things development, e-commerce security measures, their system configuration structures and that the intelligent identification, positioning, tracking, monitoring and management are integrated between the IOT and e-commerce.

The IOT technology applications is very broad in e-commerce, its application methods and types are varied. IOT technology can be used in various aspects of e-commerce, it has brought not only a new economic growth point in e-commerce and a series of problems can be solved and the core competitiveness is enhanced significantly for e-commerce. But it must be clearly recognized that the application of IOT technology is still at a relatively and early stage, the relevant technology is not mature. This requires our focus on the long term, IOT technology and standards also are improved and elated. Only in this way, we can make good use of this new IOT technologies, there is a huge impetus to the development of e-commerce.

Telecom operators and system integrators should do the work well in the following areas:

- The sensor network, real-time communication network are strengthened and cloud computing data processing platform is built. Cloud computing services is developed positively, such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS) and other cloud computing services, cloud Computing Center is deployed and “public cloud” service infrastructure is constructed, there is breakthrough in cloud storage, cloud services, cloud security and other core technologies, cloud computing technology is accelerated in the areas of finance, online payment, e-commerce, etc., cloud computing services are developed for the manufacturing industry
- It is of great importance to attach the presence of network security, system stability, data protection and other issues. There are good alternatives, a good balance is grasped between development demand and technology management system, the order and healthy development is achieved in the IOT industry. the development of machine-to-machine IOT business is accelerated in electric power, logistics, manufacturing, security and other fields. The support system of IOT technology, service platforms and

management platform are built and the operating environment is created to adapt to universal access IOT

- The IOT technology and industry solution programs need be developed in related-party of e-commerce industry chain, product costs are reduced, thereby the threshold is downed for online shopping and the user’s shopping experience is enhanced further. The key technologies are breakthroughed in IOT, such as Radio Frequency Identification (RFID) and wireless sensor network software and system integration, as well as IOT standards, common technical exchange interface. Large-scale industrial application of IOT technology is promoted

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