The Hong Kong Polytechnic University
Hong Kong Community College

CC3309 Society and the Engineer
Group Assignment

Literature Review of the Octopus Cards

<table>
<thead>
<tr>
<th>Name:</th>
<th>Nickname:</th>
<th>Student ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHOW, Man Kwan</td>
<td>Timothy</td>
<td>06048725A</td>
</tr>
<tr>
<td>LAU, Kin Wai</td>
<td>Bede</td>
<td>06044751A</td>
</tr>
<tr>
<td>WONG, Wing Hei</td>
<td>Ah Hei</td>
<td>06039206A</td>
</tr>
<tr>
<td>LEE, Pak Lun</td>
<td>Paul</td>
<td>06040137A</td>
</tr>
<tr>
<td>LEE, Cheuk Hang</td>
<td>Poko</td>
<td>06040752A</td>
</tr>
</tbody>
</table>

Tutorial Group: 101D
Submit to: John Chan
Date: 12th November, 2007
# Table of Content

1. **Introduction**
   - 1.1 The most frequent heard sound in Mass Transit Railway station  
   - 1.2 Great rate of using Octopus card in Hong Kong  
   - 1.3 The development of Octopus card  

2. **Methodology**
   - 2.1 Inspection on the KCR West Rail station  
   - 2.2 Literature review through the internet, library, the journal  
   - 2.3 Interview with the user of two different contactless smartcards  

3. **Technology of the Octopus Cards’ system**
   - 3.1 The technology used in Octopus card system  
   - 3.2 How the card communicate with the reader/writer  
   - 3.3 The security systems of the Octopus Cards system  
   - 3.4 The settlement systems of the Octopus  

4. **Usage or application areas of Octopus Card**
   - 4.1 How to use the card  
     - 4.1.1 Types of the cards  
     - 4.1.2 How to use octopus cards for the payments  
     - 4.1.3 Re-value of the cards  
   - 4.2 Using in transports  
   - 4.3 Using in retails  
   - 4.4 Using in leisure facilities and self financed services  
   - 4.5 Using in personal identifier  

5. **The reasons for the success of octopus card in Hong Kong**
   - 5.1 Convenience of using Octopus card in Hong Kong  
   - 5.2 Using Octopus Card a lot of discount will be given  
   - 5.3 Wide usage of octopus card in Hong Kong  
   - 5.4 Simple flow of applying and returning the card  
   - 5.5 Uniqueness of e-money  
   - 5.6 No limit of having the octopus card  
   - 5.7 Great varieties of sub products  

---

C3309 Society & the Engineer Group Assignment  
Literature Review of the Octopus Cards  
Page 2
6. **Comparison with other smart card system over the world**

   6.1 The other contactless smart cards over the world
   
   6.1.1 Shen Zhen Tong in Shenzhen
   
   6.1.2 Easy Card in Taipei
   
   6.1.3 Suica in Japan
   
   6.1.4 Yang Cheng Tong in Guangzhou

6.2 **Comparison between Octopus Card and the other cards over the world**

   6.2.1 Strong sides of Octopus Card
   
   6.2.1.1 The first successful smartcard system over the world
   
   6.2.1.2 The highest number of the card per citizen
   
   6.2.1.3 Octopus cards have no time limitation
   
   6.2.1.4 No application is required for retail payments
   
   6.2.1.5 Octopus Card has no rental charge
   
   6.2.1.6 Octopus Card is easy to return
   
   6.2.1.7 The only smart card system in the city

   6.2.2 Weak sides of Octopus Card
   
   6.2.2.1 Not integrated with public service in the card
   
   6.2.2.2 No card reader for personal usage in the market
   
   6.2.2.3 Not integrated with integrated mobile phone

7. **Future development of the Octopus**

8. **Suggestion for improvement of Octopus Card**

   8.1 Increase the type of identities for personal Octopus Card
   
   8.2 Integrate with mobile phones and provide the reader using in home
   
   8.3 Minimize money stored limit
   
   8.4 Increase services provider to accept Octopus Cards
   
   8.5 Improve the revalue system of Octopus Cards
   
   8.6 Use internationally
   
   8.7 Improve security system

9. **Conclusion**
10. Reference

List of Figures

The result of inspection on the time for buying single ride ticket
1. The time for buying single ride ticket
2. The time for using octopus cards to go inside the paid area
3. Ratio of people between using octopus card and single ride tickets

List of Tables

Table 2 The summary of the different Contactless smartcard system
Table 3 Comparison between Octopus Card and the other cards over the world

Appendix

Transcript of the interview

Total No of Page with Content: 23 - 4 = 19 Pages
1. Introduction

1.1 The frequently heard sound in MTR\(^1\) station

Do you know what the most frequent heard sound in the Hong Kong MTR station is? Surely, no one will challenge my answer. The answer should be “Bee” which is the sound emitted after the processing of using Octopus card. The Octopus card (八達通 in Chinese) is a rechargeable contactless stored value smart card. It used to transfer electronic payments like the transportation fee in Hong Kong. Every Hong Kong people will know what Octopus card is. It is because 95% in the age group 16 – 65 at least have one Octopus card. And almost every HongKonger will use it for the transportation everyday.

1.2 A Great rate of using Octopus cards in Hong Kong

The rate of using the Octopus cards in Hong Kong is extremely great. According to the Octopus Holding Limited’s statistics, there are 15 million octopus card already issued. Over 50000 Octopus processors are installed in 460 services provider. The Octopus cards system will be handled over 10 million transactions with transaction value exceeding HK$80 million per day. You can see the how great of the rate using Octopus card in Hong Kong are. Since the services providers are so many and wide in different aspects including the public transport system, and thus it cannot separate with the HongKongers’ life.

1.3 The development of Octopus card

\[\text{Figure 1.1 The timeline of the key year of the Octopus Card}\]

**1992 - Investigate of new generation fare collection system**
MTR Corporation has made the investigation of new generation fare collection system in order to replace the Common Stored Value Tickets system and improve

\(^1\) MTR is the short form of Mass Transit Railway which is one of the major railway systems in Hong Kong.
performance of the ticket system. After the investigation, the contactless smart card system is used for further development.

1993 – Creative Star Limited established
Five major public transport operators established Creative Star Limited (renamed Octopus Cards Limited in 2002) for the contactless smartcard system's development and implementation.

1997 - Octopus smartcard system launched
Octopus smartcard system launched. It can be used in six public transport systems. The Common Stored Value Tickets system stopped to use at the same time. In the first three months, 3,000,000 cards are sold.

1999 – 2000 Octopus card not only the card for transportation but also for retails
Octopus cards system obtained a Special Purpose Deposit-taking Company authorization from the Hong Kong Monetary Authority. The Octopus services started in retail shop. And the automatic add value services are provided.

2001 Changing from non-profit making status into profit making
The new agreement was signed by shareholders and the Company was transformed from its previous non-profit making status into profit making.

2001 – 2004 More and more services are added to Octopus cards system
The Octopus cards services were extended many kind services namely trams, Peak tram, cross-border buses, supermarket, cinema ticketing, Chinese wet market, photocopying, public swimming pools, sporting venues, etc.

2005 Corporate restructure and launched “Octopus rewards”
Octopus Holdings Limited was established as a holding company for Octopus Cards Limited and the newly set up subsidiaries responsible for the non-payment business of Octopus. The “Octopus Rewards” programme started.
2. Methodology

The methodology used in this research is inspection on the KCR\(^2\) West Rail stations, literature review though the internet, library books, the journal.

2.1 Inspection on the KCR West Rail station

We went to the KCR West Rail station to count the time for using octopus card go inside the pay area and the time for buying and using the original single ride ticket go inside the pay area.

2.2 Literature review though the internet, library, the journal

We have done a Literature review though the internet, library, the journal in order to collect all the information needed in this research.

2.3 Interview with the user of two different contactless smartcards

In order to get a proof of the following research, an Interview with the user of two different contactless smartcards has been done. The transcript of the interview can be found on following the appendix.

\(^{2}\) KCR is the short form of Kowloon-Canton Railway.
3. **Technology of the Octopus Cards’ system**

3.1 The technology used in Octopus card system

The technology used in Octopus system is the application of radio frequency identification (RFID). The function of RFID is identifying physical objects through a radio interface. To implement the function of RFID, the octopus cards contain two main components, the RFID chips and antenna. The RFID chips in octopus cards are made by Sony 13.56 MHz FeliCa microchip which is attached to an antenna. The power sources of this chip are running in passive mode. Under the passive mode, there is few kind of characteristic namely, all power comes from the reader’s signal; tags are inactive unless a reader activates them; it is cheaper and smaller, but shorter maximum range.

3.2 How the card communicate with the reader/writer

The Octopus system is the application of RFID with passive power mode mentioned on above. So, when the card placed near the reader/writer, the radio signal emit by the reader/writer will induced the EMF\(^3\) inside the octopus card circuit. The chips inside the card will be activated. (The Detection processing shown in figure 3.1) The communication between the card and the reader will start. After the authorization of security system, the card will send out some information about this card and the reader/writer will process the received data at the same time. After the process of data by the reader/writer, it will send back some signal to the Octopus card in order to change the memory (like the remaining money of the card) inside the card.

![FeliCa TECHNOLOGY](Sources: SONY Global http://www.sony.net/Products/felica/mov/data/wht_FeliCa.wmv)

**Figure 3.1 How the Octopus cards connected to the card reader/writer**

(Sources: SONY Global http://www.sony.net/Products/felica/mov/data/wht_FeliCa.wmv)

---

\(^3\) EMF, Electromagnetic Field, a main component for generating power of octopus card
3.3 The security system of the Octopus Cards system

A faultless security system is used in the Octopus Cards system. The communication between the Octopus card and the reader/writer are only established when mutually authenticated between the card and the reader/writer. When the card is activated, the card or reader/writer will be proving that it is genuine by sending a random coded challenge. After the sending of code, the card or the reader/writer will process the received data and send back the processed data. (Shown in Figure 3.2) This challenge can only be answered correctly if the card and the reader/writer reply with the appropriate response. After the authentication, the transfer of the data will be encrypted. So that, no one can know what data is being transferred easily.

![Figure 3.2 Mutual Authentications of Octopus Cards](Sources: SONY Global http://www.sony.net/Products/felica/mov/data/wht_FeliCa.wmv)
3.4 The settlement systems of the Octopus

The whole design of settlement systems of the Octopus is shown on Figure 3.2. After the reader/writer (at the Level 4) receive and process the transaction data, it will save for sending back to Octopus Central Computer at the end of each day for clearing and settlement. Before it sends back to Octopus Central Computer, it will pass through several systems. Let’s use the sending back route of transaction data of buses as an example. When the bus finished its daily works and go back to depot, the received transaction data at level 4 will be send to Depot’s computer at level 3. And that the transaction data will send to Service Provider Central Computer at level 2. Finally, the transaction data will send to Octopus Clearing House System. And all the payments or income will of the service provider will be settled at this stage.

Figure 3.2 The settlement system of Octopus cards

(Sources: Octopus Holding Limited http://www.octopuscards.com/corporate/technology/architecture/en/index.jsp)
4. Usage / application areas of Octopus Card

4.1 How to use the card

Even though Octopus Card is containing enormous function, it is very simple to use. So that, it can be used by 3 – 100 years old people in Hong Kong. The Octopus Cards is classified to 4 types. Different types of cards give different charges and function. (Shown in table 1) The Octopus card is a rechargeable contactless stored value smart card. It can be used for payments and can be recharged.

4.1.1 Types of card

There are 4 types of octopus card. (Shown in following table)

<table>
<thead>
<tr>
<th>Type</th>
<th>Colour</th>
<th>Cost and use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child</td>
<td>Pink</td>
<td>Children aged between 3 and 11. This card is sold for HK$70 with an initial value of HK$20. Children's fares are deducted where applicable.</td>
</tr>
<tr>
<td>Adult</td>
<td>Yellow</td>
<td>The standard version of the Octopus card. This card is sold for HK$150 with an initial value of HK$100.</td>
</tr>
<tr>
<td>Elder</td>
<td>Green</td>
<td>Eligibility aged varies between different public transport companies. If no elder fares are available, adult fares are deducted. This card is sold for HK$70 with an initial value of HK$20.</td>
</tr>
<tr>
<td>Personalised</td>
<td>Multi-colored</td>
<td>Personalised card is available on registration. This card is sold for HK$100 with an initial value of HK$30 and a handling charge of HK$20.</td>
</tr>
</tbody>
</table>

Compiled by CHOW. Man Kwan 06048725A)

4.1.2 How to use octopus cards for the payments

To use the Octopus card, we need to place the card the over an Octopus card reader from up to a few centimeters away, even if the card is in a wallet or a purse. And then, wait for processing of the transaction about 0.3 second. The reader will acknowledge payment by emitting a bee sound, and display the amount deducted and the remaining balance of the card.

4.1.3 Revalue of the cards

For adding more value to the card, you can to find the Add Value Machines,
customer service centres and ticketing offices located at MTR and KCR stations or authorized service providers such as 7-Eleven add more value to the cards by cash, or all of the payments accepted by service providers.

4.2 Using in transports

Using in transportation is the first application of Octopus. Almost every type of public transport excluding taxi in Hong Kong is accepted Octopus cards for the payments. For example, the railways (MTR and KCR), ferries, buses and maxicabs to coaches and trams are accepted Octopus.

4.3 Using in retail

Nowadays, Octopus are covered many re tails. The coverage ranges from large chain stores to supermarkets, pharmacies, convenience stores, fast food shops and household stores and over 3,000 retail outlets are now accepting Octopus as a payment option.

4.4 Using in leisure facilities and self financed services

Octopus is also used in leisure facilities and self financed services. For the self financed services, 5,000 photo booths, public pay phones, kiosks, vending machines like the buying the drinks and the foods or even the books, photocopier are accepted Octopus for the payments. For the leisure facilities, Octopus is used for admission to public swimming pools, sports facility bookings, racecourse admission, cinema ticket payment, payments within private clubs, theme park admission, etc.

4.5 Using in personal identifier

Octopus can use in personal identifier and the Access Control since each Octopus has a unique ID. After ID of Octopus stored in the central security system by registering Octopus at the management office, the authorized holders only need place their Octopus over the reader at the door/gate to enter the building. Octopus holders who are not residents or employees will not be able to gain access to the building. By the same reason, it can be tools as the administrative work in the school / office. After the holders place the Octopus over the reader, the attendance will be counted.
5. The reasons for the success of octopus card in Hong Kong

Octopus card is successful throughout the last 10 years in Hong Kong and received a lot of international award is due to a number of reason. They are the convenience, the wide usage in Hong Kong, uniqueness of e-money, none of age limit, simple flow of applications and retuning the card, and great varieties of sub products.

5.1 Convenience of using Octopus card in Hong Kong

Octopus card is the first e-money that almost everyone has one card in Hong Kong. There are already 15 million octopus cards in use in Hong Kong. Moreover, it is much more easy to use this e-money compare with all the others appeared in Hong Kong before. The special character of the card is when you want to make a payment or transaction, you just need to put your octopus card on the card reader, and the contactless technology can finish that in a very short time. By our observation, it just need 0.3 seconds to do the data exchange of the reader and the card. However, the time for buying a traditional single ride ticket at least 12 seconds which is 40 times longer than using Octopus Cards. (Proven on the inspection on the KCR West Rail Station shown in Figure, page 26.) It can save a lot of time.

Besides, the popularity of octopus card can also reduce the cash handling and the use of cash. It will help improving the speed and the accuracy of the cash exchange. Therefore, company can reduce the input of human resource to handle the cash and the use of cash can be reduced. So that the cash will not be easily to be damage and the bank can extent the time slot of replacing the old cash notes and coins.

5.2 Using Octopus Card a lot of discount will be given

Using Octopus Card will offer you many discount in different aspects. For example, the rewards are given if you are using Octopus Cards in payment of fee in Light Rail services after a specific amount. Also, fewer fees will be charged if you are using in payment of fee in Buses, MTR, KCR East and West Rail, KCR Light rail, etc. Furthermore, the discount will be given on exchange in different transportation system only if you are using Octopus Cards for the payments. All these discounts will encourage citizen to buy Octopus Cards in order to reduce their expense.
5.3 Wide usage of Octopus Card in Hong Kong

In the very beginning, the Octopus Card is jointly developed by the public transport companies to convince the public to replace the coins with a. For 10 years development, the Octopus Card is not longer only use for transportation. Now, it can be used in many aspects, one of that for fast food shop. McDonald’s, Fairwood. These fast food multiple shops have already installed the card readers. Besides, the 2 major supermarket and the convenience stores have the card readers too. With the personal Octopus Card is released, many company and new estate had cooperated with the Octopus Card company to add the identities to the card. Hence it can be the staff card, resident card, and even the student ID card. With the multi-use of the Octopus Card, the market power of it is very great now.

5.4 Simple flow of applying and returning the card

To apply for an Octopus Card, the flow is very easy. Anyone who would like to apply the card can just simply go to any Mass Transit Railway (MTR) or Kowloon-Canton railway (KCR) stations’ customer service counter. With a $50 charge including a refundable deposit, customer can get it at once.

For personal Octopus Card, the application flow is simply too. Customer can get the application form from any MTR or KCR stations’ customer service counter. Then fill the form and give it back to the customer service counter. Then after some process day, you might get your personal Octopus Card at specify customer service counter. To return the Octopus Card, you can simply return it to any public transportation company's Customer Service Centers. Then you can obtain the remaining balance and deposit. Some charges may be necessary depends on the different types of Octopus Card.

5.5 Uniqueness of e-money

The Octopus Card is the only contactless card that most of the shops accept. As there is no competitor and similar product in Hong Kong that is such easy to use. Therefore, Hong Kong citizens are already familiar with the technology and the card. And this make the market share of Octopus Card is then very high and make a huge success in Hong Kong.
5.6 No limit of having the Octopus Card

Another advantage that makes the Octopus Card success in Hong Kong is that there is no limit for citizens to have Octopus Card. Anyone in any age group can apply the Octopus Card and there is also no limitation in the numbers of Octopus Cards that one can have. But for classification of different user types, there are mainly 4 types of Octopus Card to let people to choose, including children, student, adult and elder.

5.7 Great varieties of sub products

As the Octopus Cards develop, there are many sub products that had been invented. The most common and well-known is the octopus viva daily prizes. This is a function joined by many shops. When Octopus Card user shopping in these stores, they can store some points for each payment and then use the points to trade some discount or use them as the bonus cash. Meanwhile, the Octopus Card Company has inserted the Octopus Card technology into watch and mobile to make them appear in more ways. The Octopus Card Company has also developed some special edition Octopus Card with different themes and the recent promotion of the card is the mini Octopus Card. With the great varieties of sub products of Octopus Card, Hong Kong citizens can always have a fresh mind and view towards the card and this is absolutely the reason that makes the Octopus Card success in Hong Kong.
6. Comparison between Octopus Card and each card

6.1 The other contactless smart cards over the world

There is a lot of smart system over the world. In order to know more about the other smart card system, the following will investigate four other systems over the world. So as to see the successful reason that makes the Octopus Card systems to be a world prized system. Moreover, we can see how the Octopus Card can be improvement. The detailed information of each card will be shown on the list of table, table 2 on page 28.

6.1.1 Shen Zhen Tong in Shenzhen

Shen Zhen Tong (深圳通 in Chinese) is a contactless smartcard system used in Shenzhen, China. It is introduced in December, 2006 and developed by Shenzhen Modern Computer with cooperation from Octopus Cards Limited. It was first adopted by minibuses in Shenzhen, until the new system was introduced by Shenzhen Metro. The Shen Zhen Tong can be used on Shenzhen Metro, the public transportation, the taxi and the market jot. The circulation of Shen Zhen Tong is 1.6 millions. Shen Zhen Tong is not free for charge and it will have a monthly charge RMB $0.5. All the cards will deduct its value every month automatically.

6.1.2 EasyCard in Taipei

EasyCard (悠遊卡 in Chinese) is a contactless smartcard system used in Taipei, Taiwan. It is introduced in June, 2002 operated by Taipei Smart Card Corporation. The circulation of EasyCard is 10 millions. This card is using on the Taipei Rapid Transit System and on buses and other public transport services and car packing. Also, it can be used in the retail. However, use the EasyCard for the payment in retail should be applied before use. The precondition of application for the payment in retail is the card holder should have a credit card in local bank. And EasyCard will be linked to the credit card. The EasyCard will act as a small value credit card. Also, EasyCard can be acted as a library card and Student ID Card after the application.

6.1.3 Suica in Japan

Suica is the contactless smart card is available in Japan. It started to be used on November, 2001. The circulation of Suica is 20 millions. The card can be bought in the ticket machines. The Suica is designed for the payment in transportation initially.
However, nowadays, it not only acts as a ticket but also can be used to buy products in the shops. Also, Suica can be integrated in mobile phone. Therefore, the Suica holder can check the remaining value in the Suica through the mobile phone immediately and easily. Moreover, there are Suica carders for the computer and the notebooks integrated Suica card reader is available in the market, these computer users can check the remaining value in the Suica easily. They can also Suica for online shopping through the Suica card reader installed in the computer.

6.1.4 Yang Cheng Tong in Guangzhou

Yang Cheng Tong (羊城通 in Chinese) is the contactless smart cards which available in Guangzhou. It started to be used on December, 2001. The circulation of Yang Cheng Tong is 3 millions. It can be used for transportation including MTR, buses, taxi. Also, it can be used in car parking and some small amount payment. For some small amount payment, enormous of the retailers accept Yang Cheng Tong such as supermarkets, convenience stores. This card is also functional in some public facilities such as using in hospital and library. For the adding value system of Yang Cheng Tong, it is done quite poor. It is because the Railway stations’ ticket office will not provide the adding value services officially. Only the retailer will provide the adding value services. Therefore, the card holders are inconveniences in adding value. (Provided on the interview shown in appendix)

6.2 Comparison between Octopus Card and the other cards over the world

As we all know, all the things have both side. For Octopus Cards in Hong Kong, there are advantages and also disadvantage compare with the other contactless smartcards system. The detailed information of the comparison between Octopus and each card will be shown on the list of table, table 3 on page 29.

6.2.1 Strong sides of Octopus Card
6.2.1.1 The first successful smartcard system over the world

The Octopus Card is the first successful smartcard system over the world. Refer to table 3 on page 29, the Octopus system is introduced at September, 1997. However the other systems like Suica, EasyCard, Shen Zhen Tong, and Yang Cheng Tong are all introduced after 2000. Therefore, Octopus card are much more mature. A lot of problems of octopus card are solved. And also because of mature, some innovative ideas like use octopus cards for payment of retail can be employed much more early
that the others. So, the citizen is accustomed to use octopus card for all the small value payment in the daily life. It become cannot separate will HongKonger’s life because HongKonger using octopus for a long time.

6.2.1.2 The highest number of the card per citizen

The circulation of the Octopus card is high and number of the cards per citizen is the highest. Refer to table 3 on page 29, we can see the octopus card have the second high circulation and number of the cards per citizen is the highest. This means that the circulation is extremely high and the retail eager to add act as a octopus services providers to promote its company image. This will boost the octopus cards become a multi-functional cards. And more and more services can be used for octopus.

6.2.1.3 Octopus cards have no time limitation

The time limitation is absent for the octopus cards. Refer to table 3 on page 29; there are some time limitation for the EasyCard and Suica. The card holder cannot the store value after the time limitation. It is extremely inconvenience. However, octopus cards have not this kind of time limitations.

6.2.1.4 Octopus cards have no pre-application is required for retail payments

Octopus cards are not required to have a pre-application for retail payments. If we want to buy the thing by using Octopus Cards, we can just use it without any difficulties. However, for the EasyCard in Taipei, it need have pre-application for retail payments. Also, the precondition for this application is the card holders must have a credit card. This makes the EasyCard not easy to use.

6.2.1.5 Octopus Card has no rental charge

The Octopus card is free of charge. After you buy the card, the only charge is the deposit of the card. It can be refunded after the return of the card. However, the Shen Zhen Tong has a monthly charge. This will increase the expense of the card holders which will make the citizen uninterested the Shen Zhen Tong.

6.2.1.6 Octopus Card is easy to return

Octopus Cards are easy to return. Octopus Cards have mature returning system.
Refer to table 2, the card holder of Octopus can return their card in any KCR East/West Rail and MTR Stations. All the remaining store value can be refunded. And there is no services charge if the Octopus Cards is used at least three months. All the deposited money can be refunded if the card has not been broken. But the other system like Shen Zhen Tong, EasyCard and Yang Cheng Tong will have some problems on returning of the cards. For example, not all the remaining value can be refunded; there is some services charge; only the customers’ services centre can process the refunding.

6.2.1.7 The only smart card system in the city

Octopus is the only smartcard that can be used in most vehicles and railways currently. However, Suica now is only available in JR East Japan. It can be used in some areas such as Tokyo. The citizen cannot travel to some place by just using one card. However, Octopus covers the most areas in Hong Kong and the citizen can use one card to travel within the whole Hong Kong. It is much more convenience.

6.2.2 Weak sides of Octopus Card
6.2.2.1 Not integrated with public service

Octopus Cards is a card for the payments and some personal identifier. However, it cannot be integrated with some public services like integrated with the library card. But the EasyCard in Taipei have this kind of functions. Taipei citizen can their own “Octopus” to borrow the books form any Taipei public library and also borrow the book in the municipally established nobody library with self-service. These concepts of multi-purpose functions are worth to learn. It is because the main goal of a multi-purpose card is to reduce troubles and the massive cards user should bring.

6.2.2.2 No card reader for personal usage in the market

Octopus cards have not the card reader for the personal usage available in the market. This makes the user not easy to check their cards’ balance. And also the other additional services cannot be used in the home. For example, Suica in Japan have the card reader for the home user. Therefore, Suica user can use the card reader connected to the Computer to use the Suica card for the payment of online shopping.
6.2.2.3 Not integrated with mobile phone

The Octopus Card has not integrated to the mobile phone. So the card holder of Octopus card cannot check their cards’ balance through the mobile phone. But the Suica in Japan can be combined with the mobile phones. If we install the Felica chip in the mobile phones, the phones can act as the Suica. That means we do not need to carry the mobile phones and Suica independently at the same time. The balance of Suica can be checked on mobile phone directly.

7. Future development of the Octopus

The main future plan of Octopus which designed by Octopus Holdings Limited is to increase their global market share. First of all, they would like to start from mainland market. Sheng Chung Mass Transit Railway has already made a contract with Hong Kong Mass Transit Railway about the automatic charges system. Now, they just need to concern about the exchange rate, then the Octopus Card can then use in the Sheng Chung Mass Transit Railway.

At the moment, the Octopus Card Company also connects with the similar company providing smart card in Macau, Japan and Singapore. The Octopus Card Company is seeking the opportunities to make the Octopus Card to be the one of first international e-money system.
8. Suggestion for improvement of the Octopus Card

8.1 Increase the type of identities for personal Octopus Card

The Octopus Card may increase the type of identities for personal Octopus Card. The Octopus Card can store many identities for the user such as identifies for the student. Octopus Cards may provide a new identity for storing the frequency of buying the things in some kind of shops. So that, the shop can identify the card holder is a frequent customer or just a normal customer. The corresponding action can be given to the different kind of customers. For example, the VIP membership or the related function of VIP can be integrated to Octopus Cards, so that the customers can save time on finding the VIP cards.

8.2 Integrate with mobile phones and provide the reader using in home

As the octopus card have not the integrated with the mobile phone and have not provided the card reader to install in the personal computer for the home user, we suggest octopus provide this kind of services. So, the card holder can check their balance, their record immediately. Also, the online shopping services can be imported by providing the card reader for the personal computer. These actions will solidify of Octopus cards’ the top position over the world.

8.3 Improve money stored limit

The limit of the stored money in octopus should be widening. As the upper limit of money in Octopus Card is only $1000, it is impossible to add $1000 or above money to the Octopus Card. This caused inconvenience if the Octopus Card is used for payment of more than $1000. Also, if the users want to add more than $1000 in order to reduce the frequency of re-value. Therefore, it is necessary increase the upper limit the Octopus Card. On the other hand, the Octopus Card also has a lower limit. When the customers buy things at supermarket for a certain amount of money, they may not use the card if the card does not have enough money left. This lower limit should be increased to the maximum price of the Octopus Card. For example, if the price of Octopus Card is $50, the maximum lower limit should be also $50.

8.4 Increase services provider to accept Octopus Cards

To improve Octopus Cards system, we need to increase the number of services provider continuously. Nowadays the octopus can be accepted in many different
aspects like transportation and retails. However, only the big-group retailers can provider the Octopus Payments system. It should be improved. Octopus Holding Limited should encourage the small retailer to install octopus payments system. So that, the cards holders can use the octopus everywhere.

8.5 Improve the revalue system of Octopus Cards

The revalue system of Octopus Cards should be improved. Octopus Cards can be used in many payments in the retails. However, not all of the shops like fast food shop, MIX and Cake shop, A-1 Bakery can accept revaluing the Octopus Cards. It should be improved. The Octopus Holdings Limited should replace this kind only “payments Octopus Cards processors”. Therefore, cards holders can revalue the Octopus Cards easily.

8.6 Use Octopus internationally

The regions that can use Octopus for the payment should be widening. Octopus Card is successful in Hong Kong. If can be used around the world, it would be extremely convenience. It is really convenience especially for the business travelers. An international Octopus Card can save time for the frequent travelers since they need not exchange the money anymore. Travelers can store foreign money into the Octopus Card. If the countries do not accept the Octopus Card, an octopus shop should be available at the airport so that the traveler can take the money from their Octopus Card.

8.7 Improve security system

The security system should be improved. Since the Octopus Card is integrated an enormous of functions like payment and access control. It should be guaranteed that it is safe for the card user. The octopus can add the fingerprint identify system just similar to the HKID\(^4\) card. When the payments exceed certain amount of money, the user’s fingerprint should be identified before the payments are made. On the other hand, some hackers are trying to crack the Octopus Cards security systems before. If the security systems is broken, the economic lost cannot be estimated. Therefore, the security system should be improved or the authorization system should be changed frequently. So, the hackers cannot crack the Octopus Cards security system easily.

\(^4\) Hong Kong Identity Card
9. Conclusion

To conclude, Octopus Cards used one of the most advanced technology-----RFID. This technology allows octopus card becomes a contactless smartcard. It also makes a huge success in Hong Kong market too. The Octopus Cards system is so successful in Hong Kong due to several reasons such as discount allowed, convenience, widely used. The success in Hong Kong also makes the Octopus Cards leading the world. After the issuance of octopus card in 1997, many other nearby countries and districts also start to publish their own contactless smart card. The Hong Kong Octopus card had lead to a new trend of doing transaction in the world. However, if we compare the Octopus Cards with the other countries’ smart card systems, we found that Octopus Cards have weak sides in some areas. For example, octopus card cannot integrate with the public services and also no card reader and integrated octopus card in mobile is available in the market. In order to make Octopus Cards system can be more success in Hong Kong or even over the world, we suggest the a few methods or technology to improve the Octopus Card systems. For example, To improve the money store limit and add some innovative ideas into the use of Octopus Cards.

All in all, we are all proud that Octopus Cards is used in Hong Kong and it brings a lot of convenience to our life and make a good reputation of Hong Kong to all of the world.
10. Reference


[23] 聯想日本將可用手機乘火車 電腦廣場, 1st March. 2005: A82
[26] 九鐵總裁北上商討有突破八達通將可搭深圳地鐵 蘋果日報, 2nd October, 2007: A15
[27] 深圳通” 如何才能通深圳 深圳商報, 27th July, 2007
[28] 借鑒香港 “八達通” 經驗方便市民出行 深圳特區報, 24th July, 2007 深圳新聞
[29] 八達通變生活需品 電子貨幣攻港成功路 19th July, 2006 星島日報:E10
Figure:

In order to know more about the time difference between using single ride ticket and octopus card to for the payment of transportation. An inspection on the KCR West Rail station has been done. Three things have been investigated, the time for using octopus cards to go inside the paid area, the time for buying single ride ticket, the ratio of people between using octopus card and single ride tickets. All these inspection are done on the KCR West Rail Long Ping Station near the Exit B at the time 3p.m.to 4:30p.m. 27th October, 2007. The results are the following:

1) **The time for buying single ride ticket:**

![The time for buying single ride ticket]

Mode time for buying single ride ticket: 16-19 seconds

2. **The time for using octopus cards to go inside the paid area:**

Because the time for using octopus cards to go inside the paid area is very small and different to measure. We can just talk a movie and count the time for the process octopus cards to go inside the paid area. And the result is 0.3 second.
3. **Ratio of people between using octopus card and single ride tickets**

No of people using Octopus Cards: 98%
No of people using Single Ride Ticket: 2%
## Table 2  The summary of the different Contactless smartcard system:

<table>
<thead>
<tr>
<th></th>
<th>Octopus Cards</th>
<th>Shen Zhen Tong</th>
<th>EasyCard</th>
<th>Suica</th>
<th>Yang Cheng Tong</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Card Type</strong></td>
<td>Contactless</td>
<td>Contactless</td>
<td>Contactless</td>
<td>Contactless</td>
<td>Contactless</td>
</tr>
<tr>
<td><strong>Place can be used</strong></td>
<td>Hong Kong</td>
<td>Shen Zhen</td>
<td>Taipei</td>
<td>East Japan</td>
<td>Guangzhou</td>
</tr>
<tr>
<td><strong>Circulation</strong></td>
<td>15 million</td>
<td>1.6 million</td>
<td>10 million</td>
<td>20 million</td>
<td>3 million</td>
</tr>
<tr>
<td><strong>Types of Card</strong></td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>Transportation</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Retail</strong></td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Others Usage</strong></td>
<td>Student ID Card</td>
<td>Leisure facilities</td>
<td>7-Eleven</td>
<td>Library Card</td>
<td>Online Shopping</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Car Park</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Student ID Card</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Services</td>
<td></td>
</tr>
<tr>
<td><strong>Monthly Charge</strong></td>
<td>No</td>
<td>Yes, RMB $0.5</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Time Limitation</strong></td>
<td>No</td>
<td>No</td>
<td>2 years</td>
<td>10 years</td>
<td>No</td>
</tr>
<tr>
<td><strong>Special Feature</strong></td>
<td>Octopus watch</td>
<td>No</td>
<td>Library card</td>
<td>Card reader</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Octopus mobile</td>
<td></td>
<td></td>
<td>Integrated with</td>
<td></td>
</tr>
<tr>
<td></td>
<td>phone cases</td>
<td></td>
<td></td>
<td>mobile phone</td>
<td></td>
</tr>
<tr>
<td><strong>Deposit (HKD)</strong></td>
<td>$50</td>
<td>$41.86</td>
<td>$24.05</td>
<td>$34.43</td>
<td>$31.34</td>
</tr>
<tr>
<td><strong>Maximum Stored Value (HKD)</strong></td>
<td>$1000</td>
<td>$523</td>
<td>$2 405</td>
<td>$1 377</td>
<td>$523</td>
</tr>
</tbody>
</table>

Compiled by CHOW, Man Kwan 06048725A
<table>
<thead>
<tr>
<th></th>
<th>Octopus Cards</th>
<th>Shen Zhen Tong</th>
<th>EasyCard</th>
<th>Suica</th>
<th>Yang Cheng Tong</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Red = ☹</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulation</td>
<td>15 million</td>
<td>1.6 million</td>
<td>10 million</td>
<td>20 million</td>
<td>3 million</td>
</tr>
<tr>
<td><strong>Green = ☻</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usage</td>
<td>Retail</td>
<td>7-Eleven</td>
<td>Taxi</td>
<td>Taxi</td>
<td>Taxi</td>
</tr>
<tr>
<td></td>
<td>Student ID Card</td>
<td></td>
<td>Library Card</td>
<td>Retail</td>
<td>Retail</td>
</tr>
<tr>
<td></td>
<td>Leisure facilities</td>
<td></td>
<td>Car Park</td>
<td>Online</td>
<td>Online</td>
</tr>
<tr>
<td></td>
<td>Self financed</td>
<td>Services</td>
<td>Retail (Needed apply before use)</td>
<td>Shopping</td>
<td>Shopping</td>
</tr>
<tr>
<td>Time Limitation</td>
<td>No</td>
<td>No</td>
<td>2 years</td>
<td>10 years</td>
<td>No</td>
</tr>
<tr>
<td>Monthly Charge</td>
<td>No</td>
<td>Yes HKD $0.523</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Place for Returning cards</td>
<td>All MTR/ KCR</td>
<td>3 customers</td>
<td>All Metro</td>
<td>All Railway</td>
<td>3 customers</td>
</tr>
<tr>
<td></td>
<td>Station</td>
<td>services centre</td>
<td>stations</td>
<td>Stations</td>
<td>services centre</td>
</tr>
<tr>
<td>Value can be refunded</td>
<td>All value can be refunded</td>
<td>Only maximum HKD $52.3 can be refunded</td>
<td>All value can be refunded with HKD $4.81 services charge</td>
<td>All value can be refunded</td>
<td>90% value can be refunded</td>
</tr>
<tr>
<td>Special Feature</td>
<td>Octopus watch</td>
<td>No</td>
<td>Library card</td>
<td>Card reader</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Octopus mobile phone cases</td>
<td></td>
<td></td>
<td>Integrated with mobile phone</td>
<td></td>
</tr>
</tbody>
</table>
Appendix

Transcript of the interview:

Interviewee: John Chan (A person that always use Octopus Card and)

Date: 5th November, 2007
Time: 4:30p.m.
Venue: 3/F, Hong Kong Community College, Hunghom Bay.

羊城通在那裡購買的？
羊城通是在地鐵站內的售票處購買的。

羊城通的使用方式是否與八達通相類以？
是的，它們使用方式基本上是沒有分別的。

羊城通是可以用作學生證的，請問你知道如何申請嗎？
我不知道。

你知不知道羊城通有一類叫「聯名卡」的卡種？
我不知道。

羊城通的客戶服務中心多不多？
不多。

請問羊城通是如何增值呢？
羊城通的增值方法是很奇怪的，地鐵站的客戶服務中心不可以增值的，需要到站內其他店舖才可以增值，而且指示不清晰，往往需要詢問途人才可以知道到那裡進行增值，十分不方便。

退卡手續是否很煩複？
我不知道，因為我未曾試過退卡。

羊城通的普及程度如何，若相比香港八達通，相者普及程度有沒有分別？
羊城通的普及程度相比香港八達通為差，並不是太多人會使用羊城通。

多不多零售商（例如：百佳超級市場，7－11便利店）會採用羊城通作爲收費系統？
不多，相比香港八達通，零售商接受羊城通作爲收費系統的店舖少得多，就算7－11便利店接羊城通作爲收費系統也並不是每一間7－11便利店可以使用羊城通。
知不知道的士可否使用羊城通作為繳費系統？
羊城通的士可以作爲繳費系統？！我不知道，我從未見過。
羊城通是否可於區內所有交通工具之上使用？
是的，以我所知，所有交通工具都可以使用羊城通。

你個人認爲羊城通與八達通相比，羊城通有甚麼好處及壞處？
我認爲羊城通相比八達通，羊城通沒有更好的地方，反而更差的地方便有，例如，不普及，配套不足，增值麻煩等。