CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

After the World Wide Web (WWW) or the HTTP, today's with the advances in the mobile technologies, many companies have been affected by the rapid move to mobility, as devices, connections and applications proliferate. With billions of mobile phones now being used throughout the world (Prensky 2004), mobile connections are achieving true broadband capability, making it possible to send significant data and content to end users. Mobile device capability and broadband connectivity has intensified end user demand for true enterprise class applications for their increasingly mobile lifestyle. For instance, many companies today deploy limited mobile applications to these mobile devices or smartphones primarily email service and this is about to expand dramatically in the near future. Undoubtedly, mobile devices especially the mobile phones are expected to be the next new megahit after the Internet, and the mobile content market will become a large industry. Internet magnates such as Google, Yahoo and Microsoft are fiercely competing for a larger slice of the mobile phone platform pie, which is commonly perceived as an extension of the Internet market. Hence, more and more parties are beginning to explore the mobile content market. All these phenomena tend to show that the mobile content market has been developing quickly and is beginning to enter into a prosperous phase (Xu Peng 2007). Michael Wolf from ABI Research also pointed out that ultimately, the long term trend away from native application to web-based application, the web
browser and web services will be increasingly important components in the mobile environment. The mobile content management solutions are depends on the using of the right applications architecture and technology. This chapter addresses some of the useful technologies that are referenced in this research study. After comparing some of the related system architectures, a system architecture for MCMT prototype application was proposed which is shown in Section 2.5.

2.2 Overview Of Mobile technologies

The mobile phone or the mobile terminal which meant for communication those days have gradually transformed from being a communication tool to becoming one’s lifestyle. Let us re-phrase it as mobile phones have been playing an important role in everyone’s life and day-to-day works. Ten years ago, mobile phones were just black-and-white basic mobile phones providing only voice communications and text message editor to instantly connecting people through a series of mobile connections that reach the people even to the most remote areas of the world. Colour-display mobile phones with WAP browser, multimedia mesaging service (MMS) appeared on the market five to six years ago. At present, mobile phones equipped with entertainment components such as music, media streaming, photo taking, HTTP browsing and more functionalities in incleded to fulfill increasing requirements from consumers.

Futhermore, the fast development of mobile networks from 2G to 2.5G and latter 3G has resulted even more efficient bandwidth for data transmission. Nowadays, mobile content include media streaming, music, pictures and images, games and e-magazines
are made available for mobile devices such as personal digital assistant, smartphones and other mobile devices like laptops and tablet PC.

Mobile technologies make our life on the go easier, more portable instead of being tied to a desk or using a the fixed phone line to make a phone call. Apparently, our day-to-day communication, entertainment, relationship and travel are a few lifestyle improvements made possible with mobile technologies.

Regardless of gender, age, nationality nor economic status of people can enjoy mobile technologies. It is not necessary to subscribe for expensive Internet connection or hook up to broadband access in order to get communicated or information sharing.

Mobile devices can be connected to mobile network or to the Internet while on the go via different wireless protocol such as bluetooth, Wi-Fi (Local Area) or usually known hot spots, broadband (Wide Area), Virtual Private Network (VPN), WiMax, General Packet Radio Service (GPRS) and so on.

Table 2.1 below shows the differences among personal digital assistant since year 1998 till present.
Table 2.1 Personal Digital Assistant comparison for the period of year 1998 to year 2008

<table>
<thead>
<tr>
<th>Type</th>
<th>Palm OS</th>
<th>PocketPC</th>
<th>Smartphone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptions</td>
<td>Palm devices use the PalmOS. Input is through a stylus and 5 buttons. There is limited OCR built-in. Users tend to emphasize the speed and efficient, if sparse, features offered.</td>
<td>PocketPC devices use a limited version of WindowsCE. Similar in size to Palms, they also rely on a stylus for operation. More feature rich than Palms but burdened by larger and slower OS.</td>
<td>Smart phone with QWERTY keyboard or touch pad as data input and navigation. Powered by powerful processor. Users can view emails, attachments and graphics, browse the web and run application effortlessly.</td>
</tr>
<tr>
<td>Model</td>
<td>Handspring Visor Deluxe</td>
<td>Palm m505</td>
<td>Compaq IPAQ H3150 (H3135)</td>
</tr>
<tr>
<td>Color</td>
<td>160x160, 4-bit greyscale</td>
<td>160x160, 16-bit color</td>
<td>240x320, 4-bit greyscale</td>
</tr>
<tr>
<td>Memory</td>
<td>8 MB</td>
<td>8 MB</td>
<td>16 MB</td>
</tr>
<tr>
<td>Processor</td>
<td>16 Mhz DragonBall</td>
<td>33 Mhz DragonBall</td>
<td>206 Mhz StrongARM</td>
</tr>
<tr>
<td>OS Platform</td>
<td>Palm OS 3.1h</td>
<td>Palm OS 4.0</td>
<td>Windows CE for Pocket PC</td>
</tr>
<tr>
<td>Speaker</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Audio output</td>
<td>No</td>
<td>No</td>
<td>Headphone jack</td>
</tr>
<tr>
<td>Microphone</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Smart phone with QWERTY keyboard or touch pad as data input and navigation. Powered by powerful processor. Users can view emails, attachments and graphics, browse the web and run application effortlessly.
<table>
<thead>
<tr>
<th>Expansion</th>
<th>Proprietary Springboard modules.</th>
<th>SD / Multimedia Card (MMC) Slot</th>
<th>Proprietary Expansion Packs add CF or PCMCIA card</th>
<th>Compact Flash (CF) Card Slot</th>
<th>Built in 16MB SDRAM</th>
<th>Mini SD Slot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery Life (manufact. est.)</td>
<td>2 months</td>
<td>3 weeks</td>
<td>14 hours</td>
<td>8 hours</td>
<td>4 hours</td>
<td>5 hours</td>
</tr>
<tr>
<td>Battery Type</td>
<td>3 AAA</td>
<td>Lithium polymer</td>
<td>Lithium polymer</td>
<td>Lithium Ion</td>
<td>Lithium Ion</td>
<td>Lithium Ion</td>
</tr>
<tr>
<td>Sync to</td>
<td>PC</td>
<td>PC</td>
<td>PC</td>
<td>PC</td>
<td>PC</td>
<td>PC</td>
</tr>
<tr>
<td>Sync method</td>
<td>USB</td>
<td>USB</td>
<td>USB</td>
<td>Serial</td>
<td>USB</td>
<td>USB</td>
</tr>
</tbody>
</table>

Sync method: USB, Bluetooth & Wireless Network
Nowadays, the mobile content is important, he or she can use his or her mobile phone to access emails, make information queries, download songs or access to various online applications like online games and so on with a touch of their finger at the fastest possible speed regardless of where they are. By offering these mobile content and mobile services to the subscribers will actually make their lives more interesting and fantastic. In comparison with the Internet, table 2.2 below shows the different between web-based application and mobile-based application.

Table 2.2 : The fundamental different between web-based and mobile-based applications

<table>
<thead>
<tr>
<th></th>
<th>Web-based</th>
<th>Mobile-based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer-based</td>
<td>Computer-based</td>
<td>Mobile-based</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>Bandwidth</td>
<td>Wireless, 3G, Bluetooth, GPRS</td>
</tr>
<tr>
<td>Media-Riched</td>
<td>Media-Riched</td>
<td>Lightweight</td>
</tr>
<tr>
<td>Latency</td>
<td>Latency</td>
<td>Anytime</td>
</tr>
<tr>
<td>More Formal</td>
<td>More Formal</td>
<td>Informal</td>
</tr>
<tr>
<td>Situated Situation</td>
<td>Situated Situation</td>
<td>Anywhere</td>
</tr>
</tbody>
</table>

The web application are web portals that allows users to access a variety of multimedia information via a personal computer, it could be either a desktop, a notebook with standard Internet browser. The graphical user interface components provide the user the information that they are looking for by performing site navigations. The user is also able to enter data through a data input window appeared in which the relevant parameter could be entered in some of the web based applications in ordered to have some information returned as requested by the user using a wired data transfer. Whereas, the mobile-based
applications are approaches to support user using wireless Internet (WAP), Bluetooth functionality, General Packet Radio Service (GPRS) and third generation mobile phone standards and technology (3G) network connectivity to transmit data or a variety of multimedia information such as text, audio, images and video. Data can be entered using numeric keypad or touch pad of mobile phones for interactive communication and information exchange anytime and anywhere.

There are some advantages of mobile technologies in terms of the following:

- Telecommunicating
- Information sharing
- Time saving
- Freedom of movement
- Improved customer service
- Improved productivity
- Make decision fast

Mobile technologies provide wireless communication systems enabling not only voice communication but also information sharing regardless of where and when and what an individual actually up to. It is also an enabler for some of the institutions or companies requiring improved customer service, productivity and teamwork among companies’ mobile workers in order to serve their customers globally faster and make quicker decision since the information is made available immediately.
There are some down sides of mobile technologies like cost, there was a study conducted by Nokia on total cost of ownership of mobile communications including hand phones, taxes and services for low income people, affordability is an important factor in bringing inclusion to people living on low incomes across the eighty emerging markets in the study. The other down side of mobile technologies could be the distraction due to the impact of mobile technologies based distraction such as using of mobile phones, route navigation system, and email or short message service (SMS) text messages on the road. These are the activities that distract the driver’s attention while driving. The development of mobile technologies like mobile phones make the communication between people and people easier and faster, though the disadvantages brought along with this fast grown technology not only influenced people personally but also the community. Many scientists believe that mobile phones do have radiation that may cause the users to have different symptoms such as headache, earache, unclear vision and even cancer, however these problems are still under research phase.

2.3 Content Management

Content management is used in the process of organizing, managing, storing and publishing of content such as body text, images and some multimedia resources. There is a list of content management system in the current market. For instance, web content management, digital asset management, enterprise content management, website management and etc. The benefits are described in the following (KM World April 2007):
• Reduce the cost

• Reduce the paper storage

• More environmental friendly

• Provide easier track content and versioning

• Improve control over content or documents

• Provide reliability over content or documents

• Easy and faster access to content or documents

• Eliminate redundancy and documents misplaced

• Reduce the paper handling and error prone manual processes

• Provide improve efficiency with the ability to identify bottlenecks

• Provide security over content or documents access and modification

• Provide online access to content or information that was early only available on papers.

By looking at all the benefits stated above, the purpose of this dissertation is to develop a prototype application which is with the ability for storing, retrieving and dynamically synthesizing educational modules to meet each users’ goals. Basically, the content will be broken into small, independent multimedia modules. These will be stored and retrieved using a database management system and other technical aspects, its language and technology requirement will be elaborate more in details in chapter chapter 4 and chapter 5 under system analysis and system design respectively.
Content management is a combination of wide variety of technologies and components which can be categorized as below (Wikipedia cited):

- **Capture** – This category is made up with functionalities and components to generate, capture, prepare and process all analog and electronic information. This captured component is usually called as “input”.

- **Manage** – The manage component is mainly use for information processing and management which may be incorporate the use of database for information retrievals and administration or even for access authorization usage. For instance, records management, workflow or business process management, document management and collaboration.

- **Store** – Store component is usually used for information storage which is not required to archive yet and it is popularly known as repositories or database management system.

- **Deliver** – This component is used to present information from the earlier mentioned components like “manage”, “store” and “preserve” components. It comprises 3 functions and media that are the transformation technologies, security technologies and distribution mainly used for output layouting and formatting. For instance, publishing presenting information for distribution and publication on mobile devices like smart phones, PDA and others.

- **Preserve** – This component handles the safe storage of less frequent use or unchanging information. This is suitable for long term electronic archiving for information which is not required for frequent access or processing and can be
kept in optical disk, SDLT backup tape, hard disk or even stored in storage networks like Network Attached Storage (NAS) and Storage Area Networks (SAN) with protection against manipulation and erasure and etc.

Apart from the above features, content management can be used to manage both structured and unstructured content. With this, organizations like either a business sector or governmental agencies can meet their business goals more effectively by increasing profit or improving the efficient use of budgets, serving its customers by gaining the competitive advantage and improve the responsiveness.

2.4 Hypermarket Stores

Hypermarkets are stores larger than 8,000 square meters (Wikipedia cited) that sell both department store merchandise and groceries, similar to Wal-Mart supercenters. The global chains Carrefour, Giant, Makro, and Tesco (the sequence is strictly in alphabetical order) operate hypermarkets in Malaysia. One of the journals that focused on the seven groups of interviews actually believed that Internet grocery shopping is advantage compared to conventional grocery shopping in terms of convenience, product range and price. Disadvantages, which could act as mental barriers, are for instance, the risk of receiving inferior quality of goods and the loss of the recreational aspect of grocery shopping (Ramus & Nielsen, 2005).
Even though online grocery shopping gives access to wide range of products from all over the world, most of the consumers still believe physically experience the product especially the food products that are often perishable set the natural limits on the realistic range of products to choose from. Furthermore, the Internet transactions could sometimes resulting in annoying waiting times, hung and crash down and the like caused by technical systems. One of the interview results show that to the families of some participants, the conventional grocery shopping functioned as a social, family event where everyone in the family was able to willing to participate.

Thus, here comes the idea of developing the MCMT prototype application for hypermarket storewide environment in Malaysia. The retailing in Malaysia report (Euromonitor International 2008) offers insight into key trends and development affecting this industry reported that Malaysian consumers are increasingly making their everyday purchases through hypermarkets either from Carrefour Hypermarket, Giant Hypermarket, Tesco Hypermarket (the sequence is strictly in alphabetical order) or from other retailing stores available being attracted by their wide range or product and low prices on product items. Therefore, MCMT prototype application will probably able to provide the consumers with an alternative to make their conventional grocery shopping trip to hypermarkets a convenient, more interesting and fun recreational experience.
2.5 System Architecture Of MCMT Prototype Application For Hypermarket Storewide Environment In Malaysia

After reviewing of the documents like journals, conference proceedings, technical papers, the common selected system architecture for MCMT prototype application is a client-server model which is exploiting the standard Internet and www protocols (Gamper et al 2002). Mobile technologies integrates with the content management system will help to deliver the development of MCMT prototype application in Malaysian hypermarket storewide environment efficiently in order to assist hypermarket shoppers in retrieving or downloading information of a certain range of products easily by clicking a few buttons and more importantly less hassle and manual works since content management is an emergent and yet fast growing area of mobile technologies that have been observed in. Basically, the system architecture of this MCMT prototype application in hypermarket in Malaysia will look like this:

![Three-tier system architecture](image)

Figure 2.1 : Three-tier system architecture
The three tier architecture is used when an effective distributed client-server design is needed and provides increased of performance, flexibility, maintainability, reusability, and scalability, while hiding the complexity of distributed processing from the user. Each tier is explained in detailed as below (Schussel 1996, Eckerson 1995):

### 2.5.1 Client or Presentation Tier

Refer to Figure 2.1 shown above, in this tier, the users are able to connect to the database server via the web browser and web server mechanism from remote location by using wireless devices like PDA, smart phones and other compatible digital devices in a user-friendly manner.

### 2.5.2 Application Tier

In this tier, it comprises of web server and its application logic. XML based application can be developed in this middle layer without affecting client and database layer of processing and manipulation of data. Application logics can be properly interfaced with web server in this tier too. In this case, Apache web server would be selected as it is able to provide management of services that are shared by multiple applications.

### 2.5.3 Data Tier

This is the data service layer, it is mainly dealing with data storage in database server persistently. Data tier can be accessed via the application layer and presentation layer by the users.
2.6 Advantages Of Three-Tier System Architecture For MCMT Prototype Application

Basically, the advantages of having the three-tier architecture are as below:

- **Interactivity**: This MCMT prototype application should provide means of communication for end user and allow for feedback that will be given considerations for near future improvement.

- **Unobtrusiveness**: This enable the end user to capture situations and retrieve information required without any technology obtruding on the situation.

- **Availability**: This MCMT prototype application should be available anywhere for fast retrievable and it should provide seamless communication inside the building in this case, in the hypermarket environment.

- **Usefulness**: It should be suited to everyday needs for communication and reference. The application’s usability shall include functionality, effectiveness, efficiency and desirability.

- **Suitability**: The content should be corresponding to the specific needs of customers or the shoppers by enhancing their shopping experiences.

- **Easy to use**: It should be intuitively easy to use by consumers with no computer knowledge or experience.

- **Reusability**: Referred to the design features of a piece of mobile content management application that provides and enhances its suitability for reuse.
- **Mobility**: Communication and connectivity happened with the use of mobile devices accompany us in every moment in our every-day life and anywhere.

- **Flexibility**: Its ability to easily to start the communication session at anytime and follow his or her own progression according to personal needs.

- **Manageability**: The concerns are easy to manage and ease the administration works with the features of content management for the portable activities.

- **Maintainability**: The ease of MCMT prototype application component that can be easily modified to correct system faulty in order to have better performance or adapt to a changed environment.

- **Scalability**: This is referring to the desire of MCMT prototype application which has the ability to either handle growth or enlargement in a gracefully manner.

### 2.7 Proposed Framework And Discussion

Figure 2.2 shown in next page is a proposed framework for the development of MCMT prototype application for hypermarkets in Malaysia. It contains a mobile and wireless environment for shoppers which is supported by the information communication technology (ICT) policies and guidelines. Basically, the purpose of ICT policies and guidelines is in place to ensure that users who use ICT services like wireless, messaging and so on in accordance with hypermarket business objectives and values. The policies also intended to set out best practice for communicating, storing and retrieving of
information. Protect the security of information held on systems and limit the opportunity for fraudulent use of technology.

In current hypermarket environment, the consumers are able to get the assistance either through the customers service personnel or doing the price checking by scanning the bar code sticker of the product using the price scanner kiosk which is less interactive and not mobile. With the mobile and wireless communication infrastructure like MCMT prototype application for hypermarkets in Malaysia put in place, the mobile devices users will have an additional option to use their mobile devices like PDA or smart phones to gain access to the MCMT’s content management like browsing the shopping catalogues, product inquiry service, viewing the promotional items and more just a click away. The MCMT prototype application helps the hypermarkets in Malaysia to increase their competitive edge and profitability position by gradually mobilized their business processes, deliver efficient customer service, improve productivity and overall efficiency and effectiveness.
2.8 Discussion On Strengths Of MCMT Prototype Application For Hypermarket Storewide Environment In Malaysia

The current research was initiated by the quick growth of mobile technologies which is promising a new revolution that might be comparable with the web. Applications of mobile technologies are diversifying. The forecasts are (Steinberger 02) that by 2004 about 63 millions handhelds will be sold, and that approximately 38% of them will be smart phones, integrating PDA functionality with features for communication. And the
forecasts are already getting true (Scott 02), according to DoCoMo more than 37% of Japanese population owns Internet-capable phones. Advantages of MCMT prototype application as viewed from multiple perspectives are listed as below:

- **Location and time independence**: Consumers with mobile devices connected to a wireless network in the hypermarket storewide environment at anytime and at any corner of the store could get access to the store product information and assistance by performing a few clicks at their mobile devices.

- **Speedier service**: Many hypermarkets businesses are still heavily reliant on paper-based processes. With MCMT prototype application, the consumers as well as the employees are able to have access to information and work with the information, analyze data on the fly and capture additional information if required. For example, using the product search function provided by MCMT to search for the product items that the customers want instead of approaching and waiting for the store assistant to attend to them.

- **Better usability and ease of use**: The MCMT prototype application ergonomy should be designed by keeping in mind that the service should be compatible to majority of the smart phone devices currently available in the market, simple and easy to use.

- **Integration into the business operational work**: The MCMT prototype application equiped the hypermarket businesses with less costly, more efficient approach to replace outdated, inefficient paper-based day-to-day business processes by automation and mobilization.
• **Enhanced reputation or image**: Automate and mobilize hypermarket business processes, empowered the frontline staff productivity, deliver superior customer service to enhance the reputation or image of the hypermarket.

• **Increased accuracy**: Reducing errors and improve data accuracy by eliminating data-re-entry and duplicated data with MCMT’s ability to integrate with back office system. For example, new or updated product price would be reflected to consumers easily without any delay.

• **Cost reduction**: MCMT prototype application reduce costs. The costs of printing and distribution of paper catalogues is now replaced with this mobile content management system that could reduce the hypermarket’s operating cost and increase competitive position.

That means we should begin by enumerating the different ways such as these mobile devices can help us in improving the Malaysian hypermarket consumers’ experiences. The system should enable the consumers to do at least the following by a few clicks away.

• View the online catalogues
• View the promotional product items
• Check the price for a product item
• Perform product item search
• Check the availability of a product item
• Virtual store assistant service
By doing this, the hypermarkets have less worries on whether the distribution of paper catalogues or booklets have actually reached their customers by introducing online product catalogue. This helps to reduce the printing and distribution costs of paper catalogues. Provide customers with latest product and store information from the well managed database like product price, product availability just a click away anywhere in the hypermarket. With all these features in place, apparently it will help the hypermarket to operate efficiently and improve customer service by replacing the current manual, outdated and paper-based processes with this proposed mobile content management system that is the MCMT prototype application for hypermarket storewide environment in Malaysia.

2.9 Discussion On Limitations of MCMT Prototype Application For Hypermarket Storewide Environment In Malaysia

Although there are numbers of research directions that try to help reaching the goals of a better mobile content management generally does have some limitations and this limitations are directly impact the development of this proposed MCMT prototype application for hypermarkets storewide environment in Malaysia. Most of the negative perceptions were actually related to the technical shortcomings of the technology. For instance, unreliable transmission of data, system hung, system crashes, short battery life and the durability issue of the mobile devices. The key problems are dicussed as follow:

- The screens of the mobile devices are too small mainly talking about the small glass displays of the current mobile devices essentially limit how much
information could be presented at one time. The display information must be small.

- Most of the mobile devices found in the market are without keyboards but with scribble pads. This problem has been represented by the fact that presenting dynamic information on small devices was difficult specifically large displays again did not generalize well to small devices.

Therefore, based on the challenges above, the presentation of mobile content should be carefully designed by ensuring that content is suitable for use in a mobile context, clear and simple language is used and limit the content to what the consumer has requested.

The balance between pages and page scrolling are important factors during the design stage, if the pages are too lengthy, it may take unduly long time to load. On the other hand, if pages are too short, the user will need to make multiple requests in order to obtain relevant information. This can lead to unnecessary delay as each request takes time to complete.

By looking at these challenges, it is important that users’ consent should be sought and considerable during system design and development stage, so that users’ bad experiences of the web on mobile devices could be avoided.
2.10 Mobile Content Management System Products Reviews

2.10.1 Line Busting Mobile POS System by Global Bay

Global Bay Mobile Technologies, Inc is a leader in providing mobile applications, through their AccessPoint Mobile Information Management System software (APMIMS). APMIMS allows the creation, deployment, management and data analysis of manual tasks or processes into an automated mobile application. It consists of four main components, Application Builder that creates powerful applications, Management console that manages of users, forms and data, Synchronization Server that handles the data transport engine between mobile devices like handhelds and enterprise servers and Mobile Client that collects data on various mobile devices. These four components are interconnected but operate independently.

AccessPoint is the APMIMS’s application builder, it is used to design, develop, edit and deploy mobile application. The builder’s WYSWYG interface and menu driven structure support the development and updating of applications that utilize sophisticated scripting and logic by the business unit of their internal Information Technology (IT) resources. The content management of mobile applications is by utilizing this builder. Questions and data inputs are created from drop down Graphic User Interface (GUI). Specific properties and validation can be set, incorrect data entry error message can be defined, font size and colour, insertion of graphics, alignment of screen objects and so on.
The script wizard is also a GUI based functionality that allows any non technical user to create logic, manipulate control properties, for instance, the font, color, size, populate controls with value and more without every having to write a single line of code.

The Management Console of APMIMS allows administrator to manage form design, distribution and reporting through an easy-to-use web interface. Users are restricted or only allow to access to limited functions like access to data, view reports, run reports and so on based on user rights that is managed within the management console.

The Synchronization Server of APMIMS uses Java Database Connectivity (JDBC) technology and a standard SQL database access interface, enabling it to be compatible with third party applications and existing infrastructure. The synchronization server also includes alternative database support for further backend integration and support for XML feeds and other data output for reporting purpose.

The mobile client is supported on TabletXP, Mobile Operating System and additionally it can run COM components and support peripheral and data collection devices via Bluetooth and WIFI. Figure 2.3 and Figure 2.4 show the screenshots of APMIMS.

![Figure 2.3: Global Bay APMIMS Mobile POS system screenshot I](#)
Global Bay APMIMS provides quick access to customer information, look-up inventory, product and price information, track customer enquiries, process invoices and payables as well as capture credit card payments.

2.10.2 TrialStat Mobile ClinicalAnalytics Solution

TrialStat is a technology and services company that provides powerful, highly cost-effective, turnkey data capture and management tools for healthcare researchers and investigators. Historically, the company used paper-based processes to help institutions design the numerous forms and permissions needed to collect their data and to help them with the actual data collection and management that is the heart of the research process and which was necessary to allow them to analyze and report on their work.

TrialStat created its ClinicalAnalytics content management solution to improve upon the old paper-based methods. Initially, ClinicalAnalytics was designed as a web-based solution but because of that many studies involved researchers, nurses and other field
workers meeting with study subjects and collecting data in environments in which they had no internet connectivity, therefore TrialStat decided to mobilize the solution.

ClinicalAnalytics allows researchers to quickly and easily make changes to protocols, forms, sites and investigators; improve the quality and accuracy of the data collected; image-based data capture such as digitized x-ray and photos; configure and deploy their studies quickly; examine data at any time throughout the course of study and reduce study costs.

Study designers create data collection forms, design rules, script logic and validation requirements and rendered them to mobile devices.

2.10.3 CyberAgent Anywhere Real Estate Agent On Mobile

CyberAgent Anywhere (CAA) has incorporated the most commonly used functionalities of the web-based application, CyberAgent package into an online application. It is extremely helpful for agents and agencies who wants to manage and list their data from any platform with an internet connection, anywhere and anytime on a PDA.

CAA consists of three components. They are Agent Manager, Contact Manager and Property Manager. All these three modules explain how content management helps the agents and agencies on administering, cataloging and publishing properties on mobile devices. It also provides each agent with his own interface, enabling every agent to add and modify their own properties and contacts.
The Agent Manager is used to capture detailed information regarding agent. A photograph of the agent can be imported for updates to the Internet. The Agent Manager is able to keep track of the value of each agent to the agency regarding listings, buyers, sellers and sales. All agent information in the agency is kept in the database.

The Contact Manager helps to keep a database of all the clients you are currently dealing with as well as those who has already bought or sold properties from an agent. Quick view at the properties the clients have listed with an agent and what properties the clients had viewed.

The Property Manager enables the agent to manage property for sale and previously sold, activate or deactivate Internet listings with immediate effect, keep track of “On Show” and “On Special” properties and list them on the website and many more.

CAA has different level of user access. The office or the adminstrator level access to all properties, clients and agents for the agency. The agent or the user level access enable agent to manage their own properties and clients. The franchise level access is the access to all activities in the group.

CAA provides real estate agents and agencies with dynamic user interface, featuring customized search facilities and information pertinent to their marketing strategies. Figure 2.5 shows the CyberAgent Anywhere Agent login screenshot and figure 2.6 shows a screenshot of view properties function.
Nevertheless, each product of mobile content management applications in the market has their strengths and capabilities. Based on these three reviews, mobile content management application has proven useful to organize content on mobile devices. It depends on how mobile content management application is being utilized.
For the development of MCMT prototype application, questionnaire is used to get requirements and feedback from users, it is important to know users’ opinions and suggestions about proposed MCMT. Table 2.3 shows reviews and comparisons between MCMT and other products of mobile content management applications.

<table>
<thead>
<tr>
<th>Features</th>
<th>Global Bay Mobile POST</th>
<th>TrialStat Mobile ClinicAnalytics</th>
<th>CyberAgent Anywhere</th>
<th>MCMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Server / Programming Language</td>
<td>AS 400 / Java</td>
<td>C/C++, Java, Visual Basic</td>
<td>Sun Java</td>
<td>Apache / PHP</td>
</tr>
<tr>
<td>Database</td>
<td>SQL, DB2, MySQL, Oracle</td>
<td>SQL</td>
<td>Oracle</td>
<td>MySQL</td>
</tr>
<tr>
<td>Login History</td>
<td>Yes</td>
<td>Unknown</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Content Search by keyword</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Content Search by Search Tree</td>
<td>No</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Yes</td>
</tr>
<tr>
<td>User Access Group</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Upload Image Content</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Administrator Management Console</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### 2.11 Summary

In summary, this chapter presented a literature review of this research title and described the characteristics and features of wireless and mobile technologies learning, content management and hypermarket in Malaysia. This will be served as the foundation for the development of mobile content management tool for hypermarkets storewide in Malaysia. The success of MCMT depends on the content created in the prototype application and cultural environment in the organization.