

FUNCTIONAL REQUIREMENTS OF MOBILE APPLICATION FOR FISHERMEN

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Universiti Utara Malaysia

2013

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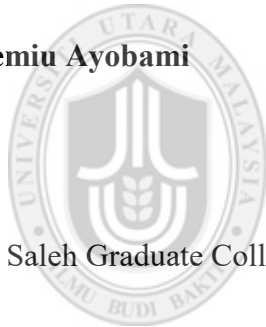
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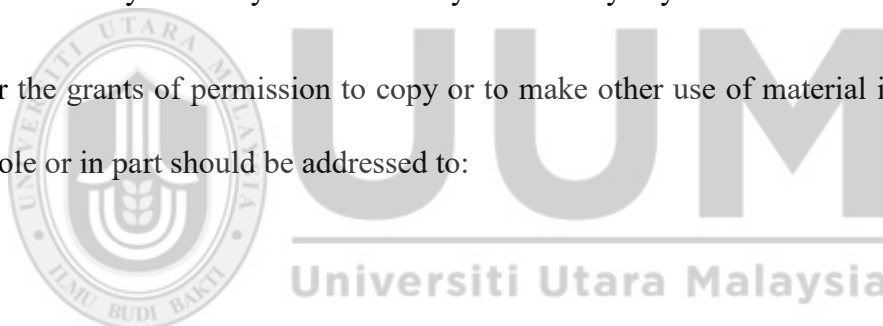


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DEDICATION

I dedicate this research project report to all who are losing hope or have lost hope in becoming great in life because of trials and tribulations.

They must revive the hope, and believe that breathing in and out as a living human must continuously re-kindle the light of hope. Believe in yourself, set your goal, work as if you will not pray, and pray as if you will not work.



ABSTRACT

Generally, un-usable information technology products and its unacceptability have been traced to the inability of the tech products to meet the needs and desire of the users, for whom the products are provided. And specifically, the Malaysia government has been recording same users neglect on information technological infrastructure provided despite huge amount of money invested on the ICT project, most especially for the rural dwellers. The major reason of this users' unacceptability have been traced to lack of proactive users' requirements gathering as expected to be part of the product development process. To address this in the intending development of mobile application for fishermen; who are also members of the target group to be provided mobile technologies by the Malaysian government; this study aims to validate the functional requirements of mobile applications for fishermen using a Qualitative-biased users' participatory design methodology which included a prototype development process. The result of the study shows that ability to get weather updates, real time market price and general fishing tips are validated functional requirements of a mobile application centered to be used by fishermen.

Keywords: user-centered, mobile application, functional requirements, fishermen

ABSTRAK

Secara umumnya, banyak produk-produk teknologi maklumat (IT) yang dibangunkan tidak mencapai tahap kepenggunaan dan tahap keberkesanannya terhadap pengguna-pengguna, mungkin disebabkan tidak memenuhi kehendak pengguna atau alasan lain.

Khususnya kepada kerajaan Malaysia, walaupun sejumlah wang besar telah dilabur kepada projek ICT, terutamanya kepada penduduk luar bandar, namun masih ramai pengguna yang mengabaikan infrastruktur teknologi maklumat (IT) yang telah disediakan dan cuba dibangunkan untuk kemudahan bersama.

Sala satu faktor utama yang menyumbang kepada perkara diatas berlaku adalah kurangnya cara yang efektif dan proaktif dalam mengumpul keperluan dan kehendak pengguna seperti mana yang difahami bahawa proses pengumpulan maklumat dan keperluan adalah prosedur yang penting dalam membangunkan sesebuah produk.

Untuk mengatasi perkara ini, dengan adanya pembangunan aplikasi mobil untuk para nelayan yang mana merupakan salah satu kumpulan target untuk teknologi mobil oleh kerajaan Malaysia; kajian ini adalah untuk mengesahkan keperluan berfungsi untuk mobil aplikasi bagi para nelayan dengan menggunakan kaedah kualitatif yang melibatkan penyertaan pengguna yang juga melibatkan proses pembangunan prototaip.

Hasil keputusan kajian ini menunjukkan pengemaskinian cuaca, harga pasaran, dan tips umum untuk menangkap ikan adalah keperluan berfungsi bagi pembangunan mobil yang akan digunakan oleh nelayan.

Perkataan-utama: tumpuan pengguna, aplikasi mobil, keperluan berfungsi, nelayan

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CHAPTER ONE

INTRODUCTORY PART OF THE STUDY

1.0 Introduction

This chapter serves as the introductory chapter to the entire research study contained in this thesis, thus consists of the background of the study which explains where the study specifically stemmed from, the motivation of the study expressing what brought about the researcher's interest on a general overview, and specifically the problem statement that narrowly pointed to why this study is conducted. Also included in this chapter are the research objectives, research questions, the scope of the research expressing the research coverage, and the significances of the study which highlights the deliverables of this research. In conclusion is a summary that expresses the summarised content of areas covered in this chapter.

1.1 Background of the study

The emergence of internet and its usage for communication and information sharing purposes has undoubtedly brought a sharp shift and enhanced productivity in all human endeavours especially in the academic, business, management and entertainment activities, and it has been indeed utilized to meet up with the global demand, maintain international connectivity, and remain competitive in the fast-changing business world. In its inception, computers are

the known devices used for the main activities of communication and information, with aid of some embedded applications and programs like Microsoft Word, Notepad, Window Media Players, internet explorer which is the application that connects each computer to the internet; amongst others. However, the rapid growth of technology has increased the number of internet users and its usage make the location-restriction a constraint that must be overcome, thus lead to the innovation of different mobile devices like laptop, personal digital assistants (PDAs), ipad, palm tablet, and mobile phones.

Ho and Syu (2010) asserted that mobile device usage which has become an inseparable action from human activity is engineered from mobile communication, and following the developing trend of the internet, the users of mobile devices explores the internet to communicate to one another, link mobile software stores, access needed ones and download, and perform their respective interested activities without necessarily being on their desktop or their respective homes. The current statistics showed that 60% of the world population uses one mobile device or the other with varieties of usage purposes, and utilize diverse application through it (Stoke, 2011).

Though some demographic factors and societal social factors affect the rate of the mobile application usage from one geographical location to the other (Ho and Syu, 2010), it is noteworthy that its usage cuts across all societies and spheres: old and young, educated and illiterates, urban and rural dweller, bureaucrats and business men; while their interest, attractive embedded features and gratification depend on their motive of using the mobile applications (Gebauer, 2008). It is the users' interests that make up the users' requirements, and the cause of meeting these needs poses challenges to the software developers, mobile application developers, and information systems analysts in their pursuit of meeting the unlimited needs of the diverse mobile application users.

Also, Cha et al. (2009) informed that the plight of the challenges of mobile application developers is not only about the need to meet users' requirements in view of the designed content and information to be accessed using the application but also extended to interoperability and mobility of the mobile application which are determined by the wireless networks and device platform used by the network carriers. It is in this light that mobile application developers take cognisance of developing applications in an integrated environment that is of open standard where all vendors can harmonise their operationability of their products and make it interoperable and universally standardised. This is an attracting though challenging research area for better operation of mobile application.

From the users' experience perception of information system which is the area where this study majorly leans, the affective feelings of the products' users resulting from the acknowledgement of the user-centeredness of the information system is an accomplishment, and said to be a pointer to users' friendliness of an information systems; including mobile application. Kourouthanasis et al. (2007) in this regard posited an enhancement of user experience through an innovative idea of pervasive information system, described as a new means that is capable of accommodating user needs and wants when they are desired, and aid in the provision of means of interaction that result in new users' experience. This and many other stances amplify the importance of user-centred design with a directional focus on the content suitable for the users' experience.

In the light of the foregoing, the information content of the mobile application as an example of information system is duly achieved to be user-centred when the users are involved in the design process, and thus makes it unavoidable for a research phase that inquires from the prospective users about the type of information they access frequently and needed most

importantly, and their preferred interest in the cause of using software systems and mobile application generally.

1.2 Motivation of the study

On a general note, having understood the indispensability of using mobile applications; ranging from its educational and informative purposes, bridging communication gap, and as business enhancement tool in this present technological age, it becomes necessary for both theoretical and practical purposes to expedite researches that will contribute to the development of more users-centred and user-friendly mobile applications and information system. Precisely, this study is motivated from the findings of previous studies and researches which uncovered that (1) user-perceived technology maturity is a critical factor that explains and predicts the use of mobile technology; (2) mobile technology have to be available in a varieties of use-situations; (3) users require basic functionality that is related to their communication and productivity trend, most especially to support non-routine and supervisory task; and (4) mobile technologies have impacts on the users' job performance and personal lives (Gebauer, 2008).

Hellstrom (2010) also asserted that basic mobile phone is a tool that supports economic development by encouraging entrepreneurship and innovation, and pointed that the notion that mobile applications are tools of alleviating poverty is increasingly becoming mainstreamed, and precisely outlined that among the observed usefulness of mobile application from the study conducted in East Africa is that farmers can get access to market prices through mobile applications. Studies done by the Millennium Villages Project to assess the impact of mobile connectivity on the Millennium Development Goals in Africa, and that

of the Rural Telecommunication Project of United Nations-International Telecommunication Union have brought to the lime light, the introduction of mobile network to influence human development and emphasising its occupational implication (Williams & Durrance, 2010). These afore-listed reasons emphasised the need for an enhanced mobile technology that will continuously cater for the need of rural community dwellers in view of enhancing their job performance, and in this respect, farmers are to be taken importantly because of their socio-economic contribution. In the same vein, the digital divide being an experiencing draw back in rural telecommunication infrastructural provision has also attracted research interest in the present days (Williams & Durrance, 2010); rural communities' dwellers who are majorly farmers and low-income earners are needed to be provided a first-hand mobile technologies, underscoring the fact as pointed by Gebauer (2008) that mobile technologies have impacts on the users' job performance and personal lives. This study is equally centred towards bridging the rural digital divide by considering how rural communities-based fishermen will optimise the usage of mobile technologies in order to positively improve their businesses, job performance and daily life experiences.

On the final note, in order to achieve user-centred mobile applications that will undoubtedly address the issues highlighted above, the collection of the users' needs must be actively made, on this was Elizabeth & Sanders (2002) underscored the need to align with the paradigm shift from user-centred to participatory design approaches. Though the duo are dependent of each other since they are both users-dependent, but the significant difference lies in designing for users which explains user-centred design and designing with users which participatory design stresses. It is on this a gathering of users' requirement through the users' participatory method is prioritised, and posited to be achievable with reliable output.

1.3 Problem Statement

Mobile devices must have suitable applications that will meet the users' interest installed in order to satisfactorily be used and gratified by the users; ITU (2009) confirmed that in the bid to capitalize on the growing consumer demand, handset manufacturers and mobile network operators are making mobile operating system and mobile apps available in accordance with the diverse need of the consumers. While in the specific case of fishermen's applications, India Public Safety as a result of teeming challenges of being a fish exporting country; and being hit by the tsunami that affected the fishing coastal, Fisher Friend was developed by Astute Systems Technology in 2007 for the tsunami-affected Tamil Nadu region of India to help them in getting access to helpful information like weather conditions, places to and not to fish, and give updates on the market prices. It is noteworthy that the adoption of the developed application called *FisherFriend* helps the fishermen to feel safer in water, increases their fish catching rate, and thus improved their daily revenue (QWRI, 2011). While Malaysia, being an emerging exporter of fish is yet to have such application.

Furthermore, Malaysia being in the fore front of economic development had identified the significance of information empowerment of her citizenry especially in bringing the digital divide, and in this respect spent Rm400 millions on ICT project of Telecenters targeting youth, children, women, farmers, the minorities, SMI, rural communities and the elderly. However, the youth and children are the only two classes of persons that have been using the facilities provided among the nine targeted, and the study conducted to ascertain factors responsible for this under-utilization identified lack of information gathering about the users' needs as one of the hindering factors (Malaysia Economic Planning Unit). This also informs why gathering information about the fishermen's needs before developing the application that is aimed to improve their job performance is necessary; and owing to the fact the fishermen are one of the groups that are yet to fully utilize the ICT technologies.

Looking from the usability issues in information system development, gathering users' requirements have been identified as an indispensable step in application or information system development process, and failures in users' adoption and satisfactory usage have been traced to the neglect of this stage by many software engineers and system developers (Tullis & Albert, 2008; Shneiderman & Plaisant, 2010). Also, the newness of this fishermen-friendly application, its emerging trend, and the observation that limited researches have been carried out to comprehensively understudy the farmers' requirements in the development phases of these mobile applications necessitate the need to fill the research gaps.

1.4 Research Questions

The central question that this study answered is that:

What are the functional requirements of a mobile application for fishermen?

Another important question that this study answered is that: What are the functional requirements validated by the interviewed fishermen?

1.5 Research Objectives

The central objective of this research is identifying the type of information that is needed to be assessed by the fishermen using mobile applications. However, another sub-objective is providing a prototype that will validate the elicited functional requirements.

1.6 Significances of the Research

This research stemming from the field of information systems is highly linked to requirement analysis and usability engineering, principally targeting the actualization of a user-centric mobile application for the usage of fishermen. The outcome of this research produced a prototype to be used as a starting point to the actualization of a fully functional mobile web application, help mobile web application developers in identifying the key needs of fishermen in the usage of mobile applications, and the needed information to be assessed by this set of users through mobile web applications. Theoretically, it also added to the explanation of technology usage theories, usability issues and other human computer interaction concepts, most specifically when developing applications for fishermen, and also formed an added literature to the specialization of users' experience in information system development.

1.7 Scope of the Research

In information systems development, as evident in previous development project report papers, usability books and users' requirement handbook, users' requirement encompasses users' interface requirements, security requirements, data requirements, process requirements, and information requirements (Shneiderman & Plaisant, 2010; Respect Consortium, 1998), though the prototype to be achieved will adapt its all encompassing users' requirement from past projects where necessary and appropriate, but this study will specifically focus on information requirement which is operationalized in the context of this study as all the types of information that the users; the fishermen are willing to access using the downloadable mobile web application as its final deliverable.

The choice of information requirement as the functional users' requirement type is given preference because developing the mobile web application for fishermen specifically is still in its emerging trend, thus information requirement that will firstly interest the usage of the application must be attended to before considering other types of the users' requirements. This requirement type falls under the category of the functional requirement as stated, because they consist of the primary functions and tasks that the application must capable of doing. Also, the mobile web application will be the appropriate mobile application to work with in this study because of the application's task to call function on other server-side applications in order to achieve its optimal functionality. The prototype is developed using Java language on J2ME because of the possibility of achieving the intending mobile web application both at the client and server side, with a simple GUI design since the prospective users are living in primitive communities who ordinarily will not fancy or find it difficult to operate sophisticated and complex application.

The prototype-aftermath data gathering in this study to finally elicit the users' requirement is from the fishermen of Kuala Kedah, being the fishermen community close to the researcher. Having established this study's link to community informatics, the community of fishermen is chosen as a result of their driving effect on the nation's economy; their interest in the rural digital divide project, while the concise nature of this study, though to-be-richly done is because of the time limitation of the researcher.

1.8 Summary of the chapter

This chapter as an introductory chapter to the study presented in this thesis explains the revolutionary emergence of mobile devices to solve the location-restriction challenges brought by desktop PCs, and stresses the indispensability of mobile applications which are diverse in nature, and expected to be demanded for and subsequently used in respect to their purposes. Therefore, the economic implication of using mobile technologies is brought to the limelight and the need for fishermen being one of the special groups in the ongoing Malaysia ICT empowerment project to be catered for.

The research study posed its research questions and objective pointing to the functional information requirement that a suitable mobile application must achieve to meet the most pressing need of the intended users, which are the fishermen, and the scope discerning the covering part of the study was highlighted, with emphasis on the final deliverables of the research which are said to be a prototype capable of being a starting point for future research and blowing to full functional application, and an elicited functional requirements that mobile application developers can reliably work on in future project of developing useable mobile application for fishermen.

CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

This chapter entails the past scholarly works that illuminate the body of knowledge that this study represents. It is subdivided into five subheadings: 1. Mobile application; to explain what mobile application is, its distinctive characteristics and types, and information about mobile application vendors, 2. Requirement engineering; bringing to the limelight the analytics involved in categorizing the functional and non-functional requirements of an information system, 3. User-centred design; where the preference in designing system for users, and not only functionality is emphasised, 4. Past related works; where the outcomes of previously done related works were reviewed, and lastly 5. Theoretical background; where the study's foundational and supporting theories were explicitly explained.

2.1 Mobile Applications

Mobile devices; or what can also be called handheld devices like mobile phones, tablets, personal digital assistants (PDAs), or enterprise digital assistants need mobile applications for optimal usefulness and service delivery (Ho and Syu, 2010), they are simply defined as add-on software for handheld devices with most popular ones being games, social networking, weather and travel information and maps. Mobile applications are to be taken as the utility software packages that enhance full functionality and the mobile devices' ability to

meet diverse users' needs, mobile apps as succinctly called are either pre-installed on mobile devices during the process of manufacturing or they are downloaded by users from mobile software distribution platform which could be either be free or to be procured. The developing trend experience in the interest of mobile devices users in their demand for mobile applications has indeed increased the global mobile market; having the varieties of applications that can run on this mobile device to perform obliged task for the users (MMA, 2008).

The proliferation of mobile application in the computing technologies products world cannot be over-estimated, as ITU Alert (2009) reported that up to 1.5 billion application downloads was experienced in the Apple's App store, with a variety of downloaded apps which are mostly critical to commercial usage, and this has brought handset manufacturers and the mobile network operators to be sensitive in responding timely to the consumers' demands as the situation arises. On the same hand, Ghauri (2011) added that the evolving trend of mobile computing technologies which has got to the experience of smart phones with touch screens navigation has left the question of whether any field or any section of the society need it, but rather how it will be used. It stresses the inevitability of mobile phones usage and the adaptation to the emerging developing trend by the users and proactive response on meeting the users' need by the manufacturers and the vendors.

The expansion in the mobile application market has posed serious challenges to application developers, content providers and the advertising entrepreneurs; being in the pursuit of moving with the rapidly changing mobile market world so as to continuously be relevant in the business world by promptly responding to the needs of the users. The global scaled mobile application world consists of Apple App Store, Google Android Market, Microsoft Market, RIM Black Berry, Nokia OVI store and so on, while some other medium scale software entrepreneurs in their positive realms have also been establishing their own mobile

software and application stores so as to give mobile users the chances of having access to more choices (Ho and Syu, 2010). It is this call to responding to the unlimited demand of the users and the rapidly growing mobile technology world that has induced researchers, professionals and entrepreneurs to the need for some functions and specific-users centred mobile application like menstruation/ovulation period alert for the adolescent ladies, soil testing and aqua-friendly application for farmers, to mention just but few.

Cha et al. (2009) posited that mobile applications is of additional features than much known wireless applications and the stationary applications, with a description that developing wireless applications have to be done in line with the context of wireless device and wireless network, where as mobile application's development takes into interoperability and mobility into consideration, and thus affect the choice of platforms for its development. It is however pointed out that it is the middleware-based architectures that are closely related to the context handling like context gathering, content delivery, and context analysis and context composition.

Unhelkar & Murugesan (2010) further enlightened the mobile applications' challenges in the face of emanating enterprise features like location independence, contextualization, and personalization. And to solve this, a six-layer enterprise of Mobile applications Development Framework was provided in view of offering a systematic and all encompassing solution to mobile application development and its maintenance. The taxonomy of the enterprise framework was given as mobile broadcast (m-broadcast); a category where its members applications primarily broadcast different content to a large group of users, mobile information (m-information); the applications here present users-requested information, mainly through a unidirectional flow, mobile transaction (m-transaction); this provided an extended feature from just information provision to the set of applications that facilitate transactions and execute, and also is mobile operation (m-operation); which are applications

that primarily support businesses' operational aspects that do not necessarily involve direct involvement and interaction with customers and clients, and lastly is mobile collaboration (m-collaboration) which fosters collaboration among the enterprise employees and their various functional units. In accordance with the scope of this study, the mobile application centres on the fishermen to be developed falls within the m-information category because it characterises user-sought information about events, services, products, promotions and prices.

The inherent challenges in mobile applications development are broadly categorised into three; namely: the devices and platform which emphasises the devices on which the mobile application is displayed and receive data, as the developers focuses on usability issues like one-touch navigation, and facilities to sensibly display data. Other mobile application development challenges are the user location, usage, and content, and also is the dynamism involved in communication and networks, this underscores the essence why mobile application development considers the bandwidth of mobile communication networks and systematically caters for the possible network interruption in the communication process (Murugesan & Venkatakrishman, 2005). While a due cause of addressing these challenges prompted Unhelkar & Murugesan (2010) suggestion of Mobile Applications Development Framework (MADF), with its six layer provision comprise the communication, information, middleware and binding, applications, presentation and the security layers.

2.2 Wireless Client-Server Architecture

Wireless Client Application – Server Architecture describes the components that make up of the environment in order to deliver it's the services it was designed for. Wireless computing is an extension of computing infrastructure to another new set of classes of devices so as to

access information and services and promptly delivers the users-wanted information from the mobile device of their choice. It delivers applications in multiple markup languages like HTML, HDML, cHTML, WML, VoiceXML, SMS, and XMPP.

It is important to note that such indicated Client Server Wireless Environment must comprise content or service provider application, application server wireless, wireless service provider, Gateway (e.g. WAP, SMS), and a wireless device; serving as the client (Wu and Zheng, 2006). Figure 2.1 below shows the Client Server Wireless Architecture.

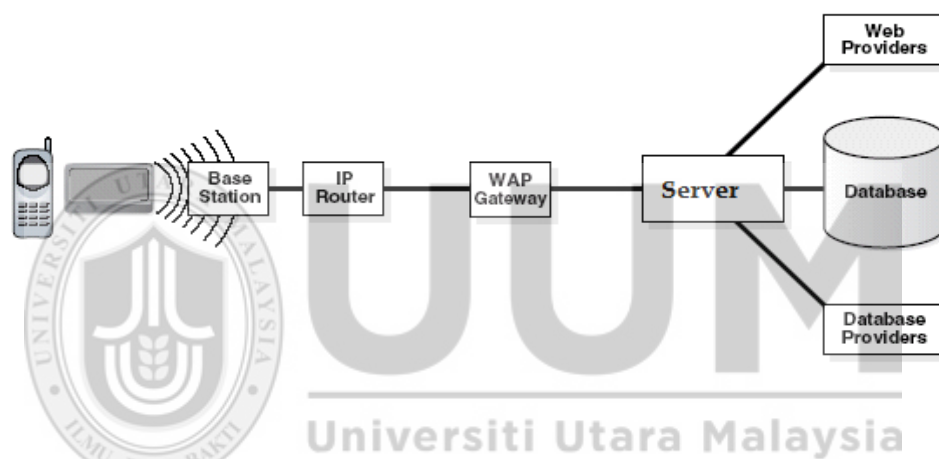


Figure 2.1: Client Server Wireless Architecture (Source: Oracle Application Server Concept).

The sequence of the procedural steps is that when the user requests wireless service such as SMS which is the main service characterised in the design of this study, the wireless device connects to the gateway by passing the uniform request location (URL) of the service requested, then the gateway collects the profile of the device such as device ID, profile of the user agent from the wireless network or subscriber ID. The gateways thus submits the URL to the Server application which in turn normalises the request and then forward it to the target URL, and also takes the response from the target URL, do the transformation and send back

to the markup language of the requesting device (Client). The gateway finally sends the response form the server application to the device.

In this study, the delivery of SMS as a service after the corresponding request is made by the users through the mobile application is a design requirement that must be fulfilled at the server side of the architectural model, while data providers in the circumstance are corporate agencies, organisations or government ministries that are custodians of data that are of use in responding to the users' requests. The Malaysia Ministry of Environment and Department of Irrigation and Drainage are in best position of feeding the weather related data, while the Malaysia fish sector and other allied agencies handle the fishing tips and real market price data feeds.

2.3 Requirement Engineering

Generally, in the development phases of every software or information system, a phase of requirement engineering or requirement analysis is expected to be undertaken by a system analyst who is a member of the software development team for an accomplishment of functional software.

System requirement engineering is the systematic process taken to discover the purpose of the system, through the intending product's stakeholders' needs, and thus document this in a form that is presentable analytically for communication purposes within and with out the software development teams, and subsequently for implementation (Nuseibeh & Easterbrook, 2000); the stakeholders are probably the clients to the software development company or engineer, the end users or the development team members. Zave (1997) in a clearer definition stated that requirement engineering as a branch of software engineering is concerned with the reality by identifying the functions and constraints of a software system, its relationship in

determining the precise specification of the software behaviour. In this regard, requirement engineering must answer the question of what motivated the development of the software system by precisely representing the 'why' and 'what' of the system, and also the defining precisely what the developers are expected to build with the provision of precise specification.

In the system requirement analysis phase, the users' interest is taken into consideration together with the input of software engineering standard in order to categorise all the evolved requirements broadly into functional and non functional requirements with respective tag of priority and its executable pre-condition and post condition as the analysis posits. Each of these requirements is assigned to be mandatory or optional, with or without an attached pre condition or post condition, having being in compliance with the analysis and design of the software development team. Nuseibeh & Easterbrook (2000) asserted that requirement analysis could necessitate a concerted interdisciplinary effort and action research so as to foster an actualisation of a useable, user-friendly and user-centred system or application design.

2.4 User-centred Design

Principally, the purpose of a well done requirement analysis phase is to achieve a user-friendly system by being user-centred in the process of developing the system. The users' acceptance of any technology lies majorly on how it meets their behavioural intention (Davis et. al, 1989) which is largely determined by the extent at which the technology meets the desired needs of the users.

It is observed that in the early years of software development, text editors and the applications were developed solely by the technically oriented programmers without any attached importance to the users' interactionism with the system, and since most of the then users of computers are technical personnel, their interest lies in the principally functionality of the system, however the present age of computer and software application usage has shown that users are interested in accomplishing different task via the software application, and since they may not necessarily be of computer science background, usability issues and need to enhance human computer interaction have been given attention in order to make its usage enjoyable to all and sundry (Shneiderman & Plaisant, 2010).

Shneiderman & Plaisant (2010) further posited that in a user-centred design, user behaviour studies must be done; the design must take the users' environment into cognisance, and achieving this is through a collection of user requirement information or a reflect on an improvement from the present users' experience of a similar system in case there is, high-fidelity prototypes are suggested as a key process of eliciting user requirement. This phase is highlighted as the first of all the four pillars of a successful user-centred design process. Also, the diversity enshrined in human personality is further evident in the unavailability of a single taxonomy of the user personality types, thus necessitate user behaviour studies to ascertain the distinct personality variables like cultural, racial, or linguistic background in a user-centred design process (Marcus & Gould, 2000).

2.5 Past Related Works

It should be noted that development of mobile application for fishermen usage is a new trend in the software and application development circles, with the oldest project credited to the

mobile fishing project in India, then followed by pockets of others ongoing fishermen-centred application projects.

Inquirer Technology just recently reported a mobile application developed for government's flood and for weather forecasting, particularly to warn fishermen of any looming dangers in the weather so as to guide their fishing job, and eradicate the risk involved in fishing in poor weather (Inquirer.net, 2012). The application is designed Rolly Rulete; a Pilipino is to help fishermen in Philippines in navigating the coastal communities while sending warnings and alerts to fishermen at sea. This application has come to serve as a more convenient source of information gathering for the fishermen, posed to be better than the initial reliance on television and radio. However, the sophistication of the application and its sole compatibility with android smart phones, and tablet computers has limited its accessibility and usage by the fishermen in Philippines, owing to the fact that majority of these fishermen cannot operate on complex applications.

Mallalieu & Sankarsingh (2012) in their study proposed a conglomerate of a set of mobile applications called mFisheries; designed for the fisher folk of Trinidad and Tobago with a specific one that centred on enhancing fishing chances and associated issues called GFNF (Got Fish, Need Fish). The mobile applications collectively are expected to be used to advertise catch availability to wider public of fisher folk, indicate fish procurement need based on species and quantity, to facilitate contact information between interested parties, and display the real time prices of fish by type and market.

Qualcomm (2007) as shown in their report developed a brew-based mobile application in conjunction with other tech giants for the fishermen in Tamil Nadu and Puducherry villages in India. This mobile application is mainly to check weather information, and water safety information, and also the real time market price and to receive information about locations of

fishing areas. The observed constraint as shown in the application functionality is its constraint on operational ability on numerous mobile phones operating system format, especially the most used one. The mobile application is in-built with the mobile phone that guarantees its workability, and the users are provided the mobile phones with in the in-built application for its usage.

2.6 Theoretical Background

For the purpose of research, practice centralization and insight to the developing concepts and purpose of this study, this study will lean on some interdisciplinary theories and adopted elements of models that emphasise the importance of human sense of benefitting in all what he invests his time and resources in, the usability models that underscore the purpose of effectiveness in the information system product delivery so as to foster quality product delivery.

In support of this is the theory of reasoned action (TRA), which will serve as the theoretical guide in the construction of the data collection instrument to be used, it posits that individual behaviour is induced by the behavioural intentions, while these intentions are function of an individual's attitude towards the behaviour and susceptible subjective norms that warrant the performance of the behaviour. This explains that any behavioural action is determined through an assessment of one's belief regarding the consequences, and the evaluation of one's desirability of the aftermath consequences (Fishbein & Ajzen, 1975). This evidently argues that the fishermen desirability to finally use any developed mobile application for its cause will be in favourable evaluation of the aftermath consequences

Notably, TRA is the adapted theory of Technology Acceptance model (TAM) (David, 1986); both of strong behavioural elements that delimit the intention to act, and in avoidance of any unconscious habit that will limit the freedom to act, and most importantly is the determining factor of perceived usefulness of any technology in its actual usage. Attitude towards Act or behaviour and subjective norm are the predictive element of the model to result in the behavioural intention, and finally to the behaviour of the usage. It is thus evident that before any system, software program, or mobile application will be considered used, it must be seen useful by the users, and the best way of ascertaining what the users will find useful is by investigating their needs. Figure 2.1 below gives the adapted underpinning model for this study.

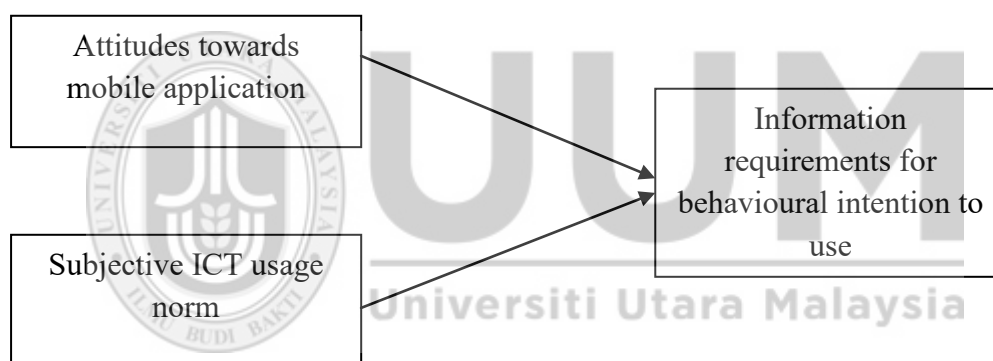


Figure 2.1: Research model (Adapted Fishbein & Ajzen, 1975).

2.7 Summary of the chapter

This chapter entails the review of scholarly works that discussed issues and concepts that this study majorly leans on, firmly establishing the root of this research study in its associated bodies of knowledge; such as: mobile computing, requirement engineering, users' experiences and usability engineering. In respect to this, this chapter brings the past findings, contributions and justification of the subject matter under discuss into the limelight under sub

headings of mobile applications where mobile application, its operationability and scope of performance were discussed, requirement engineering; digging further to the area of expertise which does thorough analysis of what the information system stands to accomplished in view of some appropriate conditions, users' centred design that stresses the importance of making information systems product to be user-centric by direct involvement of users in the development stages, past related works where the review of similar projects that have been carried out with keen emphasis on the limitation that the present study wants to bridge. And lastly, the theoretical background that gives the backing theories of the study was touched with all its inter-connected fields; ranging from psychology, human computer interaction and information systems



CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter consists of the explanation and justification of the serial and sequential steps used as a methodological framework to address the problem, and the answer the questions pointed out earlier in this study. The overview of the methodology is firstly given, and then each and every method used at their respective stage was explained with justifying facts as regards its appropriateness and fulfilling criteria.

3.1 Overview

This study is conducted using a set of outlined and sequential procedural steps employing Users' participatory design strategy; a qualitative-bias design research method, by involving the users directly in the design process so as to bring more accurate information about the tasks to be performed by the intending application (Shneiderman & Plaisant, 2010). Elizabeth and Sanders (2002) posited this as a shift in a perspective paradigm in the design edge by laying more emphasis on designing with users over the much known designing for users approach. In the same vein, one of the previously conducted users' requirements studies; Electronic Health Records systems developed to be providing sources for clinical researches by eClinical forum, 2008 reported that users' requirements documentation is a criteria to

actualize functional model, the documentation was done through a fostered discussion with the stakeholders, and their comments were received and reviewed. Also, Hawley et al. (2008) in their design of an innovative assistive technology device incorporated the users in its users requirement gathering process by conducting interviews for focus groups due to the fact that the intending system will be used by different types of groups defining their different and peculiar characteristics and needs, thus conforming with the mostly enumerated qualitative methods of gathering users' requirements: brainstorming, diary keeping, focus group interview, observation (Respect Consortium, 1998). In the light of this, a content analysis of online materials that shows the designed functionalities of previous application developed to attend to the fishermen's fishing predicament was done, and this formed the basis of a list of functional requirements that were involved in a prototype development. Rapid Application Development methodology was firstly used to develop a prototype which will be introduced fishermen, showing the tasks to be accomplished using the mobile web application, and this invariably serve as an insight for the fishermen, thus acknowledge the appropriateness of the task highlighted in the presented prototype, and further seek if there is other requirement that are not yet incorporated.

In users' centred design methodology, ethnographic approach, users' participatory method, and information system development from Grounded theory are enumerated methods expected to be utilized by any system and application developer that is aimed in realizing a user-centric product (Singh et al., 2004; Shneiderman & Plaisant, 2010), and these are stances of Qualitative research methods in information technology (Meyers, 1997). Figure 3.1 below presents this study's research methodological framework.

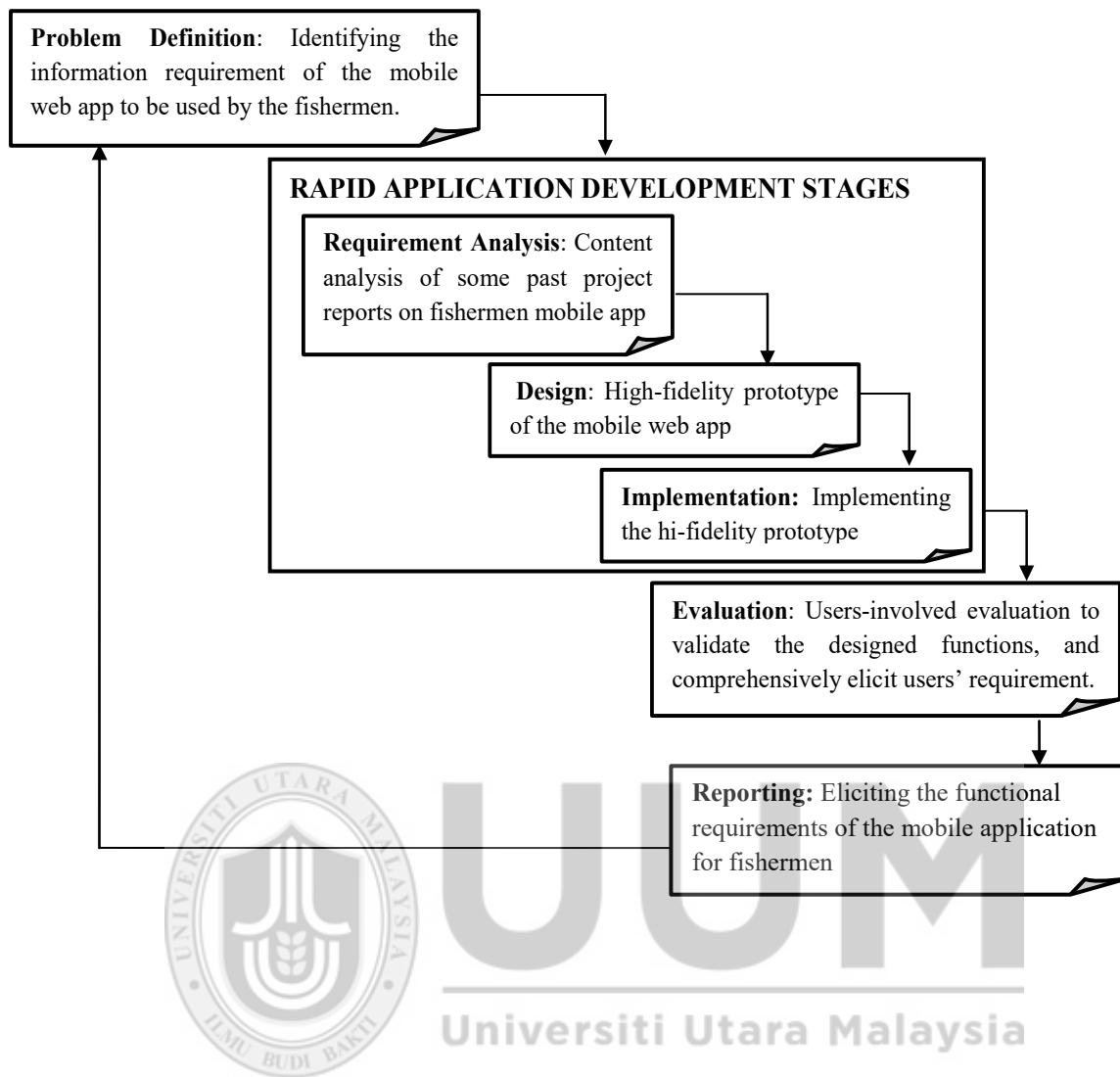


Figure 3.1: Research methodological framework

3.2 Problem Definition

The earlier stated research problem of this study as aligned with its research questions and objectives in chapter 1 defined the problem definition to be attended to by this study amongst other research deliverables. This is to know the functional requirements of mobile application for the fishermen.

3.3 Rapid Application Development

Hirschberg (2007) gave an overview of Rapid Application Development as a revolutionary software archetype in the '90s and still in the working phase of software development till date, though with an increasing trend of research and additional contribution. It was stressed that the outstanding essentiality in RAD is principally because of its structured approach for better, faster and cheaper products' delivery.

Casemaker (2000) in reference to James Martins defined Rapid Application Development (RAD) as an example of development lifecycle which results in much faster and quality results, with a maximum advantage of powerful development software compared to the traditional lifecycle, and RAD is further explained as a systematic approach to building computer systems with the assistance of Computer-Assisted Software Engineering tool and techniques, with user-prototyping and strict project delivery time, aligning with an output of a potent, tested, and quality productivity. It is further argued that the choice of RAD by organisations is borne out of its capacity to deliver important systems strategically within a very limited time with cost reduction and quality maintenance.

This study's choice of RAD as the suitable development lifecycle is basically because of the need to actualize a fast delivery software system output coupled with the fact that the intending prototype, being a versatile prototyping methodology. Vliet (2007) defined prototyping as a development approach for software and applications focusing on the building of the application within a very short period of time to suit the study's requirement with emphasis on the users' interface. The prototype will be the final output of this study to be assessed by the fishermen in view of validating the functional requirements of the

application. It is against this backdrop that the stages involved in the application development process are requirement analysis, design and the implementation stage to achieve the intended prototype. The inherent methods adopted in each of the listed stages for successful and objectives-compliant results are further explained below.

3.3.1 Requirement Analysis

Escalona & Koch (2004) submitted that the field of Requirement engineering which entails requirement elicitation and requirement validation tasks have become an emerging and matured field in software engineering and information system entirely, with an emphasis on web engineering towards the development of useable web applications. Firesmith (2006) pointed out that requirement analysis is not as cheap as non-professionals will want to place it, hence, requires a expertise in the pursuit of what the stakeholders want; called the requirement elicitation, studying the requirement to be understood; requirement analysis, and lastly is requirement specification which textually specifies what the system's requirements are in view of its categorization to functional and non-functional requirements.

The functional requirements are the imposed functions on the computing environment or information software system which must be accomplished compulsorily within the confines of the objectives of the system development; it defines the main and major functions that the software systems are designed for, while non-functional requirements are peripherals which are just included for systems' performance enhancement as perceived by the system development with or without the consent of the users (Kazmierczak, 2003).

As earlier pointed in the scope of this study, functional requirements of mobile application to be used by fishermen is the expected deliverable which will be validated by the users after being shown the mobile emulator prototype of the mobile web application. Therefore, in designing the prototype, the functional requirements to be incorporated are the extracted outcomes from the content analysis of the available materials that showed the basics of the functions to be accomplished by the intending prototype.

Content analysis has defined by Babbie (2010) is the study of recorded human communication, instances where these pre-recorded human communication are in form of books, magazines, web pages, poems, bullet in posting and so on. This is synonymous to what Finnegan (1996) in his section of the Open University collection on Data collection and analysis described as using documents, or documentary sources of data. Hence, the analysis of the content of these documents and pre-recorded human communication is done to extract the needed data for the purpose of the study.

In this study as posited, the web pages are taken as the unit of analysis (Babbie, 2010), then the content analysis of these web pages relating the previous related projects that centred on mobile applications for fishermen is done to deduce the functional requirements implemented in the said projects, with a tabular presentation of the assessed three (3) previous projects.

3.3.2 Design

At the design stage, the deduced functional requirements of the past previous projects as above illustrated is modelled through the standard diagrammatic representations using Unified modelling language (UML) notation. This study presents use case specifications, detailed sequence diagrams of the enlisted functional requirements, and activity diagram to illustrate and link the users' activities operating the mobile application.

3.3.3 Implementation

The prototype implementation is done through Java Micro Edition (J2ME) using Java programming language on the client side, the application that will request or call methods expected to be resolved and responded to by the server. And since the scope of this study in line with the earlier stated objectives is to present a prototype that is capable of being demonstrated to the fishermen in Kuala Kedah, the server application is on a PC local host and a SMS sending simulation is given to create an insight for the farmers what the functional application will represent.

3.4 Evaluation

This study recognises the need to validate the lists of the users' requirements introduced in the prototype developed, and get any possible new users' requirements after the fishermen have been well introduced to the developed prototype. The functional requirements included in the designed prototype are evaluated in terms of its precision as it affects the needs of the fishermen and the attracting functionalities in the use of mobile application. A semi-structured interview with open-ended questions was used as the mode of enquiry and data collection method, purposefully to validate the appropriateness of the elicited requirements from the content analysis of previous fishermen-centred mobile application developments projects, and used for the prototype development. Though very few projects have been earlier done centring on user requirements of fishermen in the development of mobile web application, the possibility of not yet knowing what the intending mobile application stand to deliver by the farmers is envisaged, therefore, the display of the prototype developed was

done to enhance a sense of judgement of what the real functional system stands to be when developed. The interview was conducted in Bahasa Melayu with the assistance of an interpreter to the researcher, and subsequently transcribed. The choice of semi-structured interview as the type of interview is to averagely guide the interview trend since the research has helping clues on the purpose of the interview (Creswell, 2009), with a non-probabilistic sampling method, drawing its convenient sample size of nine (9) from the fishermen's population of the fishermen village, located in Kuala Kedah, Kedah, Malaysia. This sampling and sample size decision of this study is borne out of its Qualitative characteristics (Marshall, 1996; Neuman, 2007; Creswell, 2009).

3.5 Summary of the chapter

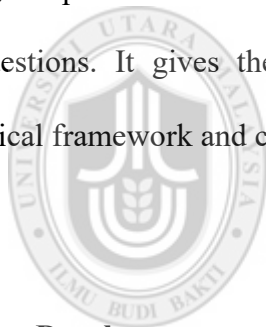
This chapter gives the methodological approach that is adopted in attending to the earlier pointed research problem of this study which is identifying the functional requirements of mobile application for fishermen. In achieving this, a sequentially arranged stages having Rapid Application Development (RAD) as the main development system are designed; comprising of the requirement analysis stage which is done through the content analysis of the accessible related past projects, the design stage which represent a standard notation using Unified modelling language (UML), the implementation stage where the prototyping phase and stimulating mobile emulator is shown with a SMS reception demonstrated, and lastly supported by an evaluation stage where the application prototype which is the output of the development phases is assessed by the fishermen in a bid to validate the designed functionalities in the prototype, and thus serve as requirement elicitation stage.

CHAPTER FOUR

PROTOTYPE DEVELOPMENT AND THE FUNCTIONAL REQUIREMENTS VALIDATION

4.0 Introduction

This chapter entails the outcome of the methodology as highlighted in the previous chapter (Chapter 3); adopted to attend to the raised research problem and subsequently answer the research questions. It gives the outcome of each of the phases shown in the research methodological framework and conclusively in relative to the overall objective of the study.



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4.1 Prototype Development

This stage encompasses the phases involved in realising the mobile application prototype; the requirement analysis, design and implementation, and which will subsequently be used to finally elicit the functional requirement that are found validated by the users.

4.1.1 Requirement Analysis

The content analysis of available related past project is done to extract the functional requirements that this present prototype will meet. Table 4.1 below shows the extracts illustrating the outcome of the content analysis.

	Author & Year	Product Description	Functional Requirements
1.	Qualcomm, 2007	A brew-based mobile application developed for the fishermen in Tamil Nadu and Puducherry villages in India.	To check weather information. To check water safety information. To check real time market price. To receive information about locations of fishing areas.
2.	Mallalieu, K. & Sankarsingh, C.V. (2012)	A proposed set of mobile applications called mFisheries; designed for the fisher folk of Trinidad and Tobago. However, the specific one that centred on enhancing fishing chances and associated issues is called GFNF (Got Fish, Need Fish).	To advertise catch availability to wider public of fisher folk. To indicate fish procurement need based on species and quantity. To facilitate contact information between interested parties. To display the real time prices of fish by type and market.
3.	Rolly Rulete, 2012	A mobile application operable on android and tablet computers; developed by a Philippine Graduate for fish farmers.	To check weather update. To give information about track of storms and intensity of rains.

Table 4.1: Extract of the functional requirements from the content analysis.

After due diligence study of the extracted functional requirements of the available previous related projects, the following user-centred functional requirements are adopted as being best fit to the scope of this study and precisely attend to the earlier outlined research objectives.

1. To request information about weather update (Mandatory);
2. To request information about real time fish market price (Mandatory); and
3. To request fishing tips for profitable fishing practice (Mandatory).

4.1.2 Design

The design stage of the prototype development process using RAD as adapted in this study will feature use case specifications, detailed general sequence diagram and the activity diagram to illustrate and link the users' activities operating the mobile application.

4.1.2.1 Use Case Specifications

1a. Use Case: Request information about weather update

b. Use Case Diagram: As shown in figure 4.1 below

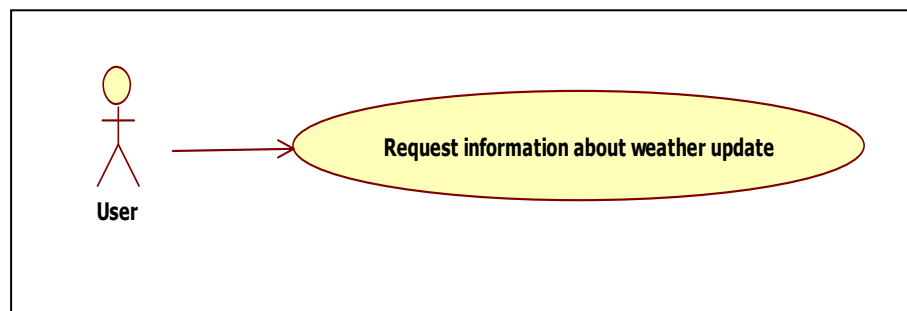


Figure 4.1: Use Case Diagram for Request information about weather update.

c. Brief Description: This use case is initiated by the user; it allows the user to request for weather update.

d. Pre Condition: The mobile application must have initialized.

e. Post Condition: The user must declare how often the information is needed and agree with the terms of the service.

f. Constraints: Internet connection is a pre-requisite.

2a. Use Case: Request information about real time fish market price.

b. Use Case Diagram: As shown in figure 4.2 below.

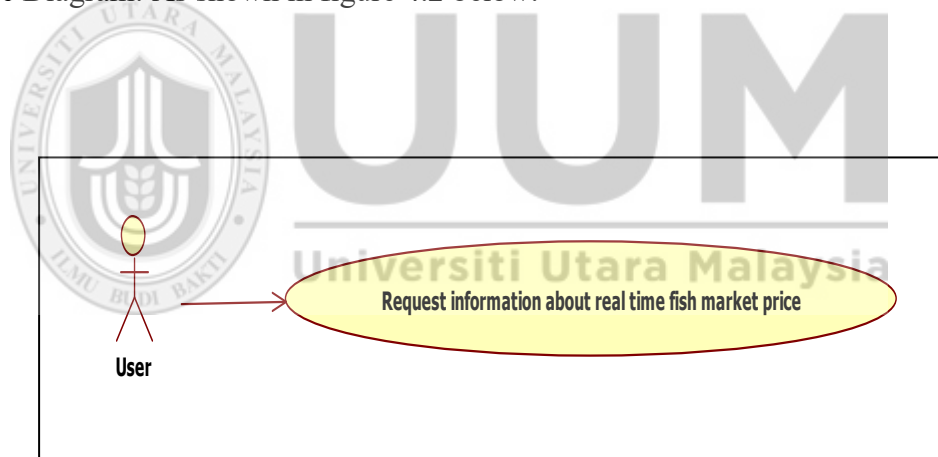


Figure 4.2: Use Case Diagram for Request information real time market price.

c. Brief Description: This use case is initiated by the user; it allows the user to request for real time fish market price.

d. Pre Condition: The mobile application must have initialized.

e. Post Condition: The user must declare how often the information is needed and agree with the terms of the service.

f. Constraints: Internet connection is a pre-requisite.

3a. Use Case: Request information about real time fish market price.

b. Use Case Diagram: As shown in figure 4.3 below.

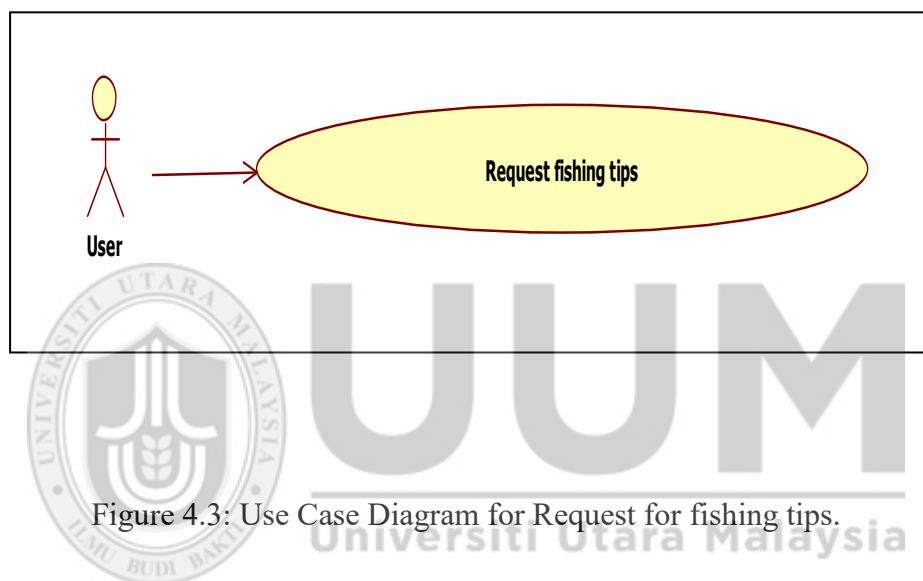


Figure 4.3: Use Case Diagram for Request for fishing tips.

c. Brief Description: This use case is initiated by the user; it allows the user to request for general fishing tips.

d. Pre Condition: The mobile application must have initialized.

e. Post Condition: The user must declare how often the information is needed and agree with the terms of the service.

f. Constraints: Internet connection is a pre-requisite.

4.1.2.2 Sequence Diagram

The general sequence diagram depicting the sequence of the system functionalities, system's objects interaction and linkage is depicted in figure 4.4 below.

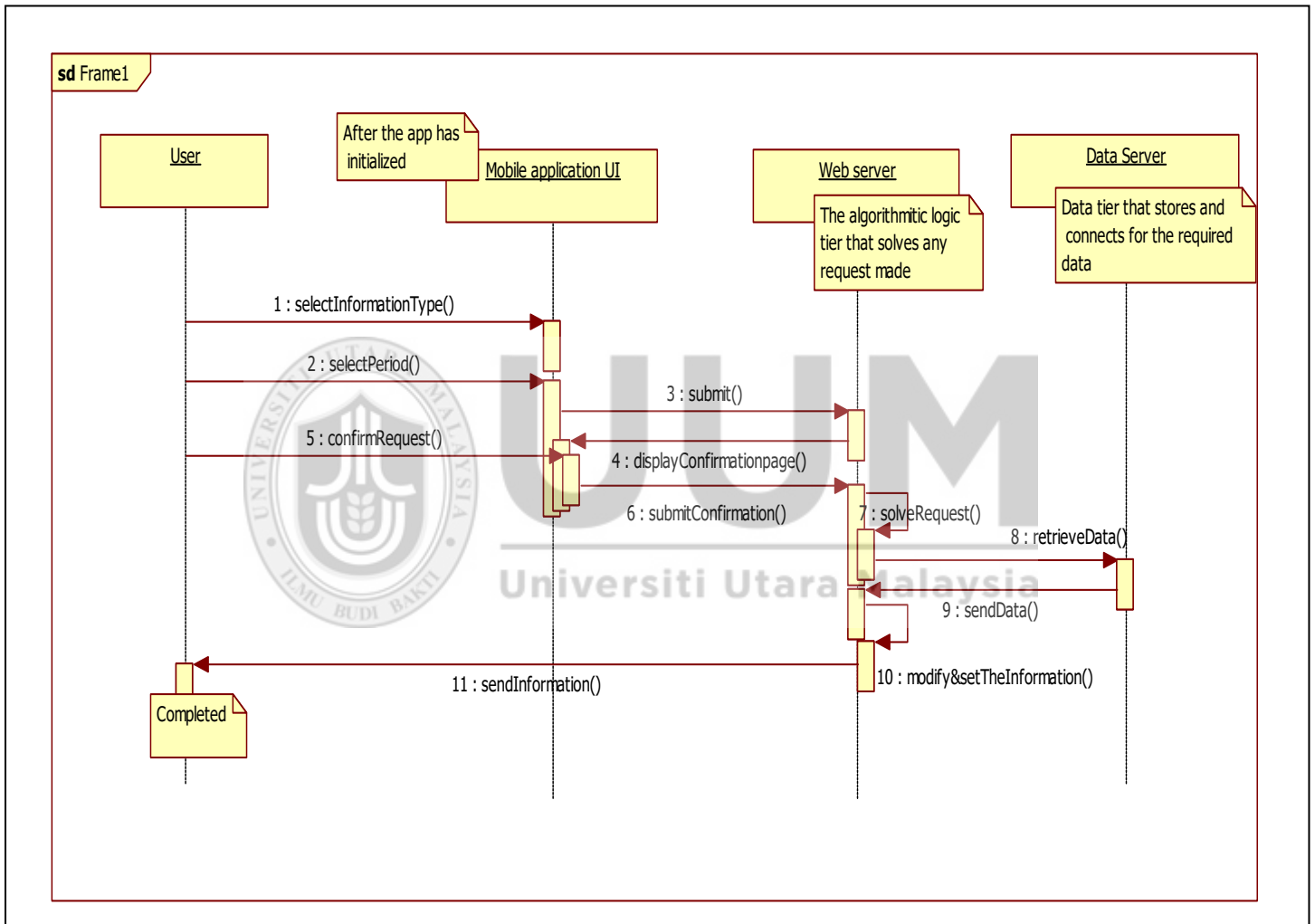


Figure 4.4: General Sequence Diagram

4.1.2.3 Activity Diagram

The activity diagram gives a well detailed description of the activities and processes involved as shown in figure 4.5 below.

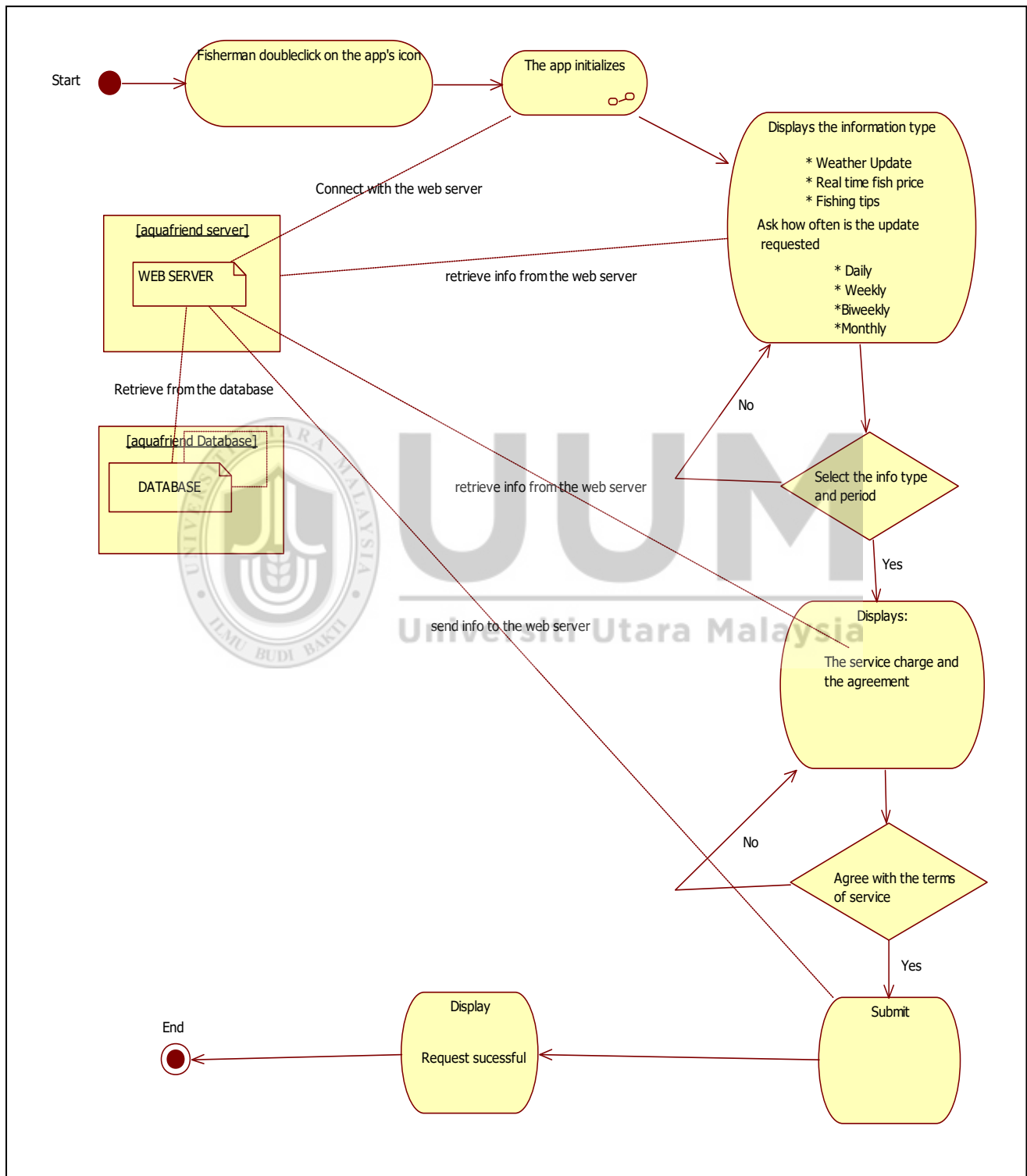


Figure 4.5: Activity Diagram

4.1.3 Implementation

The implementation stage is basically to effect what have been shown in the design phase with a show-cased result of the prototype that this research study intend to achieve, and subsequently use a visual simulation to show the flow of the application's functionalities to the prospective users in order to validate the designed functional requirements. This section entails the architectural framework of the client-server model, focuses on the client-side implementation design using Java 2 Micro Edition (J2ME), and shows the screen shots of the interfaces of the mobile application prototype.

4.1.3.1 Architectural Framework

In its overview, the architecture of this SMS service delivery is a typical three tier style that makes the system to be organised into three layers; namely: Interface layer, Application Logic layer and the Data Storage layer. The interface layer entails the objects that deal with the end users, application logic layer identifies the application business logic, and accurately address them, while the data storage layer realises the queries of the persistent objects that need to be stored, and retrieved. Figure 4.6 gives the illustration of the overview of the system architecture.

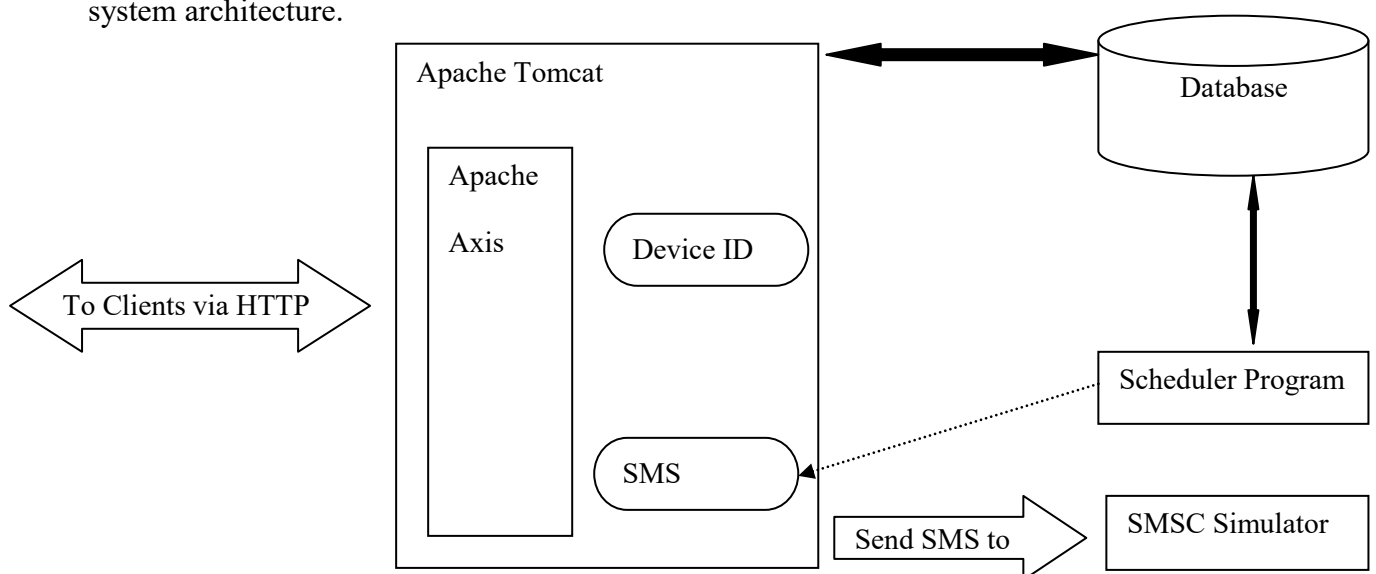


Figure 4.6: Overview of the System Architecture.

As shown above, the major deployed services are Device ID recognition service which is through the GSM subscriber identification module card (SIM card), and the SMS service, and also connected with this is a stand alone scheduler program which is to check the database and periodically feed the user through the SMS service as earlier requested by the user. For a simulated demonstration of the SMS function, Short Message Service Centre (SMSC) is required to be used for the process of sending SMS from the SMS service.

4.1.3.2 Client Implementation

In line with the scope of this study, only the client side will be practically implemented using Java as the implementation language on Netbeans Integrated Development Environment 7.2.1 version. The sequential flow of the user interface of the mobile application is given in figure 4.7 below with inscription in Bahasa Melayu.

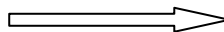




Figure 4.7. Sequential flow of the Mobile Interface

4.2 Functional Requirements Validation

This stage simultaneously served as the evaluation phase of the research methods, purposefully included to validate the enlisted functional requirements as incorporated in developing the mobile application prototype, and also evaluate the developed prototype.

4.2.1 Functional Requirements Validation Methods

This research employed user participatory design method; as posited by Elizabeth & Sanders, (2002) as a paradigm shift from user centred design, characterising users' involvement in the design process. To actualize this, a Qualitative approach method of data collection was

employed through semi-structured interview (Neuman, 2007) so as to exclusively ascertain the feelings of the respondents who are taken from the group of fishermen at Kuala Kedah in Malaysia.

A sample size of nine (9) was used for the validation process. This is done in consonance with the argument of Tullis & Albert (2008) that though larger sample size creates a high level of confidence when evaluating usability and usability-related issues, a sample size like eight (8) and nine (9) is appropriate. The questions posed to the respondents are tailored towards the following themes; namely: (a) Attitudes towards mobile technologies and applications, (b) Awareness about mobile technologies and applications, through the lens of the adapted model, and (3) Appropriateness of the enlisted functional requirements of the mobile application for fishermen. Appendix 2 shows a sample of the translated interview script.



4.2.2 Functional Requirements Validation Results

After due translation, thematization and transcription of the semi-structured interview, this study presents the results in a quantitative-informed manner by scheming and arranging the data in line with statistical arrangement like central tendencies, clusters, ranges and frequencies (Chenail, 1995). Figure 4.8 represents the results of the functional requirements validation stage.

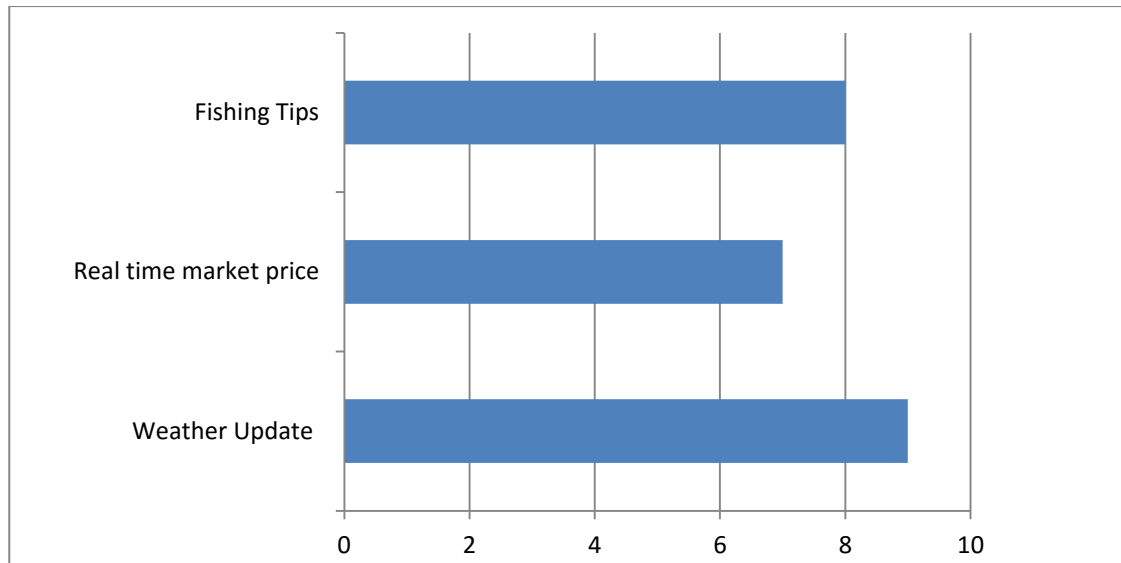


Figure 4.8: Results of the functional requirements validation

4.3 Summary of the chapter

This chapter brings to the fore the process taken to actualise the development of the mobile application prototype; the Rapid Application Development as precisely called, featuring its all inclusive stages: the requirement analysis done through the content analysis of past related works, the design stage showcasing the use case specification, activity diagram and the sequence diagram, then the implementation that utilized java as a programming language to develop the client side of the program. The functional processes involved are explained and diagrams precisely given, then the functional requirements as implemented in the developed prototype was validated and the result shown.

CHAPTER FIVE

DISCUSSION, LIMITATION AND CONCLUSION

5.0 Introduction

This chapter discusses the results and the observation made in the process of rapid application development, most especially the result of the semi-structured interview to validate the functional requirements of the developed mobile application prototype. The limitation of the study is highlighted, and an all encompassing conclusion of the research study's report.

5.1 Discussion

The findings of this research study supported claims (Inquirer.net, 2012; Mallalieu, 2012) that posited that people in rural areas are also gradually getting informed about the significance of employing information and communication technologies generally, and mobile technologies specifically in their daily pursuit, especially the indispensability of the enhancement aided by these technologies, thus shows that the rural dwellers are aware of the possibility of involving mobile application and technologies for the betterment of their livelihood. As evident from the research findings, this awareness is credited to government agencies on rural telecommunication projects, professional bodies of high-scaled fishermen and some Information technology awareness advocacy groups.

Accordingly, the findings shows that the subjective usage of any mobile technologies and application is determined by its ability to be easily learnable and operable; this as responded to after the visual display of the developed mobile application prototype shows that the prototype meant the criteria, and invariably bridge the limitation of a previous related project (Inquirer.net, 2012) of its application sophistication and platform compliance with Android operating system only, and relatively all the respondents still use mobile phones with buttons either java enabled, the Symbian operating system or the Windows phones.

The respondents validated the essentiality and appropriateness of the three functional requirements as designed in the prototype, with all the nine respondents interviewed validating weather updates, seven validated real time market price, and eight validated fishing tips. The use of the local language; bahasa melayu in the prototype development was highly applauded and opined that it will unfailingly meet the need of the fishermen since it is found useable and users-friendly.

In answering the research questions as posed by this research study, the result of the content analysis of past related projects revealed that functional requirements that could be involved in designing a mobile application having the fishermen as the centred users are: checking weather information which include water safety information and giving information about track of storms and intensity of rains, checking real time market price, getting fishing tips which include receiving information about locations of fishing areas, and advertisement of catch availability to wider public of fisher folk, indicating fish procurement need based on species and quantity, and facilitating contact information between interested parties for buying and selling.

However, the choosen three functional requirements used in the designing stage of the prototype in this study are requesting for weather update, requesting for real time market

price, and general fishing tips. Notably, all these three functional requirements are validated by the fishermen who are taken as the respondents and prospective users of the prototype.

5.2 Limitation

This study within its earlier stipulated scope meant the objectives and precisely answered the research questions as underscored by this study, however, the sample size is small and thus limit the level of confidence in the findings. Larger sample size is suggested for future research to increase the confidence level of the study (Tullis & Albert, 2008).

Also, time as a natural constraint could not allow the full implementation of the prototype development process; at both the client and server side as the design of the application function is expected to be, therefore, diminished the demonstration of the application functionalities to simulation using mobile emulator. Future researches are expected to concentrate on full implementation stage following the design as given by this study.

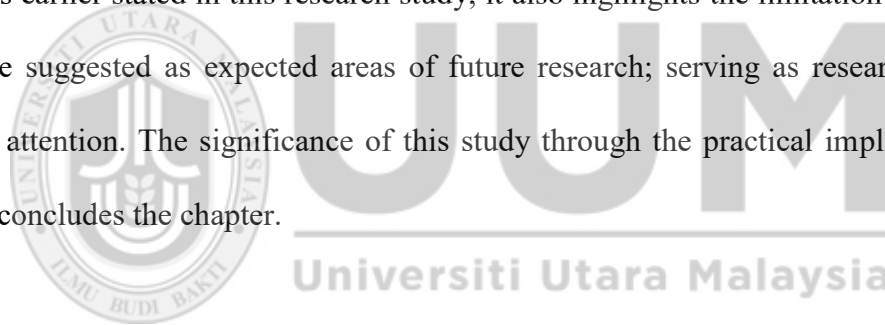
5.3 Conclusion

This study having taken the stages and phases as indicated in the research methods and precisely the prototype development process using Rapid Application Development (RAD) to answer the research questions, thus achieve the set research objectives concludes that a field study of users requirements as represented by this study is a key approach towards ensuring users acceptability of any information technology products, and also serve as an awareness stage for the prospective users.

Also, the paradigm shift in users' experience study by emphasizing users' participatory design method; designing with the users as succinctly put, over the user-centred design; designing for the users as shown in this study further adds to the glamour of the advocacy, having seen that designing with users has better opportunity of achieving a more users-friendly product.

5.4 Summary of the chapter

This chapter serves as the conclusive part of the research study, it discusses the results of the findings of this study as it answers the research questions and achieves the research objectives as earlier stated in this research study, it also highlights the limitation of this study and they are suggested as expected areas of future research; serving as research gaps that need future attention. The significance of this study through the practical implication of its deliverable concludes the chapter.



REFERENCES

- Babbie, E. (2010). *The Practice of Social Research*, 12th Edition. Wadsworth Cengage Learning, USA.
- CASEMaker (2000). What is Rapid Application Development? CASEMaker Incorporation.
Retrieved from: http://www.casemaker.com/download/products/totem/rad_wp.pdf
- Cha, S., Bernd, J. & Du, W. (2009). Towards a unified framework for mobile applications. Seventh Annual Networks and Services Research Conference. IEEE Computer Society, 978-0-7695-3649-1/09, pp. 209- 216.
- Chenail, R.J. (1995). Presenting Qualitative Data. *The Qualitative Report*, 2(3). Retrieved from <http://www.nova.edu/ssss/QR/QR2-3/presenting.html> on 13/12/2012.
- Creswell, J. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE Publication, USA.
- Davis, D. F.; Bagozzi, R.D. & Warshaw, P.R. (1989). User Acceptance of Computer Technology: A comparism of two theoretical models. *Management Science*, 35(8). Retrieved from: http://www.ii.metu.edu.tr/sites/default/files/DavisBagozziWarshaw_MS89_User_Acceptance_of_Computer_Technology.pdf
- Davis, F. D. (1986). A technology acceptance model for empirically testing new end-user information systems: Theory and results. (Doctoral dissertation, Sloan School of Management, Massachusetts Institute of Technology).
- Elizabeth, B. & Sanders, N. (2002). From User-centred to Participatory Design Approaches. In *Design and the Social Sciences*. J.Frascara (Ed.), Taylor & Francis Books Limited, 2002.

- Escalona, M. J., & Koch, N. (2004). Requirement Engineering for Web Applications – A Comparative Study. *Journal of Web Engineering*, 2 (3), 194-212. Retrieved from: <http://www.pst.informatik.uni-muenchen.de/~kochn/KochEscalonaJWE-rev.pdf>
- Finnegan, R. (1996). In *The Open University Collections of Data Collections and Analysis*. SAGE Publications, London.
- Firesmith, D. (2006). Requirement Engineering Tasks. *Journal of Object Technology*, 5(8), 21-29. Retrieved from: http://www.jot.fm/issues/issue_2006_11/column3.pdf
- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior : An introduction to theory and research*. Reading, Mass. ; Don Mills, Ontario: Addison-Wesley Pub & Co.
- Gebauer, J. (2008). *User Requirement of Mobile Technology: A Summary of Research Results*. A working paper of College of Business, University of Illinois, Urbana-Champaign. Retrieved from DOI: <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=?doi=10.1.1.132.8795> on 09/12/09.
- Ghauri, H. (2011). *Mobile Applications for Human Resources*. Workforce Solution Review, www.ihrim.org, pp. 14- 17.
- Hawley, M., Cunningham, S., Judge, S. Kolluru, B., Roberston, Z. (2008). Using qualitative research methods to inform user centred design of an innovative Assistive Technology device. A working paper of Dept. of Human Communication, University of Sheffield, UK. Retrieved from http://eprints.whiterose.ac.uk/10292/1/CWUAAT_paper_-_Judge_et_al.pdf , on 19/09/12
- Hellstrom, J. (2010). *The Innovative Use of Mobile Applications in East Africa*. Department for Human Development, Team for Knowledge, ICT and Education, SIDA. From:

<http://www.sida.se/publications;>

http://www.texttochange.org/sites/default/files/newsfiles/sr2010-12_sida_hellstrom.pdf

Hirschberg, M. (2007). Rapid Application Development (RAD): A Brief Overview. DoD Data & Analysis Centre for Software.

Ho, H. & Syu, L. (2010). Uses and Gratification of Mobile Application Users. International Conference on Electronics and Information Engineering (ICEIE, 2010), 1, 315-319.

Inquirer Technology (2012). IT expert creates mobile app to warn fisherman-father of bad weather. Posted on Oct, 18, 2012, retrieved from: <http://technology.inquirer.net/19060/it-expert-creates-mobile-app-to-warn-fisherman-father-of-bad-weather>

International Telecommunication Union (ITU-T). (2009). TechWatch Alert. Available at <http://www.itu.int/ITU-T/techwatch>

Kazmierczak, E. (2003). Requirement Engineering. The University of Melbourne Course work for Masters in Software Engineering. Retrieved from: <http://ww2.cs.mu.oz.au/~dmwilm/downloads/641.pdf>

Kourouthanasis, P. E., Giaglis, G. M. & Vrechopoulos, A.P. (2007). Enhancing user experience through pervasive information systems: The case of pervasive retailing. *International Journal of Information Management*, 27, 319-335

Kumar, R. (2011). Research Methodology, a step-by-step guide for beginners. SAGE Publication, Singapore. ISBN: 978-1-84920-300-5.

Malaysia Economic Planning Unit. Information available at the online website: <http://www.epu.gov.my>

Mallalieu, K. & Sankarsingh, C. V. (2012). Evaluation of the mFisheries Applications. Caribbean ICT Research Programme (TT), Retrieved from http://cirp.org.tt/mfisheries/pdf/Evaluation_of_mFisheries_Applications_Report.pdf on 25/11/2012.

Marcus, A. & Gould, E.W. (2000). Cultural dimensions and global user-interface: What? So what? Now what?, Proceedings of 6th Conference on Human Factors and the Web. Retrieved from: [http:// www.tri.c.com/hfweb/](http://www.tri.c.com/hfweb/).

Marshall, M.N. (1996). Sampling for qualitative research. Family Practice, Oxford University Press, 13 (6), 522-525

Mobile Marketing Association. (MMA). (2008). Mobile Applications, p. 1,

Myers, M. D. (1997). Qualitative Research in Information Systems. *MIS Quarterly* 21(2), 241-242. MISQ Discovery, Archival version.

Neuman, L.W. (2007). Basics of Social Research: Qualitative and Quantitative Approaches, 2nd Edition. Pearson International, USA.

Nuseibeh, B. & Easterbrook, S. (2000). Requirement Engineering: A Roadmap. A working paper of UK EPSRC projects MISE. Retrieved from: <http://mcs.open.ac.uk/ban25/papers/sotar.re.pdf>

Oracle Application Server Concepts. Part No. B13994-01. Retrieved from http://docs.oracle.com/cd/B15904_01/core.1012/b13994/wireless.htm on 02/12/12.

Qualcomm's Wireless Reach Initiative Report; QWRI. (2011). Available at <http://www.oecd.org/dac/aidfortrade/48367406.pdf>

Respect Consortium. (2008). Requirements for HER Systems providing Source for Clinical Research; a User Requirement Document. A project done under the aegis of HER/CR Working Group.

Retrieved from <http://www.eurorec.org/files/filesPublic/ehrworkshop/2008/EHR-CR%20User%20Requirements%20Document%20Release%201.pdf>, on 19/09/12.

S. Murugesan and B.A. Venkatakrishnan. (2005). Addressing the Challenges of Web Applications on Mobile Handheld Devices, *in the Proc. Int'l Conf. Mobile Business (ICMB 05)*, IEEE CS Press, pp. 199–205.

Shneiderman, B. & Plaisant, C. (2010). Designing the User Interface: Strategies for Effective Human-Computer Interaction, Fifth Edition. Pearson, USA.

Singh, S., Bartolo, K.S., Satchell, C. (2004). Grounded Theory and User Requirement: A Challenge for Qualitative Research. Proceedings of International Conference on Qualitative Research in IT & IT in Qualitative Research (QualIT2004). Retrieved from <http://mams.rmit.edu.au/mmm2vc1q1axj.pdf>, on 19/09/12.

Stokes, R. (2011). eMarketing: The essential guide to digital marketing. Fourth Edition. Quirk eMarketing (Pty) Ltd. ISBN: 978-0-620-52066-5

Tullis, T. & Albert, B. (2008). Measuring the User Experience: Collecting, Analyzing and Presenting Usability Metrics, Elsevier Inc, USA.

Unhelkar, B., & Murugesan, S. (2010). The Enterprise Mobile Applications Development Framework, IEEE Computer Society 1520-9202/10, pp. 33- 39

Vliet, H.V. (2007). Software Engineering: Principles and Practice. Wiley. Singapore

Williams, K. & Durrance, J. D. (2010). Community Informatics. *Encyclopaedia of Library and Information Science, Third Edition*. U.S.A. Retrieved from <http://people.lis.illinois.edu/~katewill/williams-durrance-encyclo-community-informatics.pdf>

- Wu, T. & Zheng, P. (2006). Developing a Web Service Based Application for Mobile Client. A Master Thesis; Stockholm, Sweden. ICT/ECS-2006-138
- Zave, P. (1997). Classification of Research Efforts in Requirements Engineering. *ACM Computing Surveys*, 29(4), 315-321.

