Designing AquaFriend: The Requirement and Process Models

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Abstract—This work is an extract of an on-going research work aimed at delivering a mobile application called AquaFriend. This mobile application is principally usable by fishermen in Malaysia, hence Bahasa Melayu is the language used for displaying its information. However, the requirement and process models presented in this paper are adaptable for usage in any geographical location. The requirement gathering phase of our study presents validated six functional requirements. From our findings, it is shown that some of the existing mobile applications are only compatible with android operating system, and fully internet-dependent. These features are not consistent with the socio-economic status and technology literacy level of many of these fishermen. This is because: they are mostly rural dwellers. Based on the results of the requirement gathering phase, this work presents a requirement model which shows the validated functional requirements of the mobile application, and also a novel process model of the mobile application. This process model highlights a semi-dependent internet-enabled client-server interaction. These two models are presented in Unified Modelling Language (UML) annotation, and users’ participatory design method was employed for the requirements validation process.

Keywords—mobile application, fishermen, requirements analysis, requirement model, process model.

I. INTRODUCTION

Usage of mobile devices has become inseparable from humans activities [16]. Users of mobile devices browse the internet for many purposes: communication, linking mobile software stores, accessing needed ones, downloading and so on. The use of mobile devices has also aided their interested computing activities without necessarily being on their desktop or their respective homes [32], [10]. The current statistics showed that: 60% of the world population uses mobile devices, with varieties of usage purposes via diverse applications [31].

[14] asserted that mobile phone is a tool that supports economic development as it encourages entrepreneurship and innovation. And, mobile applications as tools of alleviating poverty are becoming mainstreamed with observed usefulness of mobile applications in East Africa and Asia Pacific [12], [32].

In Malaysia, the rural telecommunication projects of United Nations-International Telecommunication Union (ITU) and the Malaysia Economic Planning are on rural dwellers’ empowerment through the provision of telecommunication infrastructure [35], [21]. Fishermen are one of the categories of the rural dwellers that said to be in need of mobile technology for the enhancement of their job performance and socio-economic status [17].

Though, few previous works have been done on mobile application for fishermen, conducting another study to deliver this novel mobile application is necessary because: (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 [12].

II. MOTIVATION AND PROBLEM STATEMENT

The requirement and process models of a mobile application for fishermen are the deliverables of our research. These were actualized after the requirement gathering phase. Notably, users’ requirements in HCI studies are emphasized for the actualization of user-centred products with usability compliance [28], [26]. Also, the challenges of mobile application developers are not only about the need to meet users’ requirements in terms of the designed content, but also about interoperability and compatibility of the mobile application with diverse mobile devices [5], [36].

This work: designing the requirement and process models of mobile application for fishermen is essentially motivated so as to achieve users-centered product. Also needed is a mobile application that will be interoperable and compatible with the Symbian operating system phones; being the mostly used mobile phones among the fishermen in Malaysia [1].

This is thus summed up to answer two research questions: (1) What are the validated functional requirements of the mobile application for fishermen, and (2) How can the validated functional requirements of the mobile application operate on a semi-dependent internet facility?
III. PAST RELATED WORKS

This section highlights the past works on mobile applications for fishermen. The limitations of these works that are within the scope of this study are explicitly stated, and the contributions of this study are duly stressed.

The development of mobile application for fishermen is a relative new trend in the field of software and application development. [37] reported a mobile application that was developed in Philippine to assist in managing flood. This mobile application also aids weather forecasting. The application was particularly to warn fishermen of any looming dangers in the weather, guide their fishing job, and minimize the risk involved in fishing during poor weather. These are expected to be done through message sending as warnings and alerts to the fishermen. This application is seen as a convenient source of information gathering for the fishermen. Evidently, it is 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 limited its operability and usage by the fishermen in Philippines. This is due to the fact that majority of these fishermen cannot operate complex applications. This limitation necessitates the need for a mobile application with simplified operation, and compatibility with non-android phones, mostly especially the Symbians.

On another hand, [22] in their study proposed a conglomerate of a set of mobile applications called mFisheries. This set of applications is designed for the fisher folks of Trinidad and Tobago with a specific one centered on enhancing fishing chances and associated issues called GFNF (Got Fish, Need Fish). These mobile applications are collectively expected to be used in advertising catch availability to wider public of fisher folk. It also indicates fish procurement’s need based on species and quantity. The mobile application facilitates contact information between the interested parties, and displays the real time market prices. Apart from the complexity of these applications because of being a conglomerate, it is wholly internet dependent. Impliedly, internet connection must be available at any point in time when the functions of the mobile application are to be operated, and the services to be accessed.

[25] reported a brew-based mobile application developed for the fishermen in Tamil Nadu and Puducherry villages in India in conjunction with Astute Technology, M.S Swaminathan Research Foundation and Tata teleservices. This mobile application is mainly to check weather information, water safety information, and real time market price. It also receives information about fishing locations.

The observed limitation of the mobile application as shown in the description of its functionality is its inability to be operated on numerous operating systems.

Also, [38] released a mobile application usable as fishing guide recently. In the design of the application, an interactive guide that can be employed to aid fish catch throughout the year is included. The application also gives weather updates on the active times of wildlife, and also tests the fishermen fishing knowledge. This mobile application works solely on android smart phones and tablets, it is even downloadable from the Google Play Store.

The contribution of this work as presented in this paper is to attend to the limitations highlighted from these past related works. Specifically, this work aimed to deliver a fishermen-centered mobile application that will be of simplified steps, thus easily operable by fishermen of relatively low technology literacy. This work also presents a process model that will not make information access through the application wholly dependent on internet.

IV. METHODOLOGY

To actualize the specific deliverables addressed in this paper: requirement and process models, we integrate users’ participatory design approach with Rapid Application Design Methodology. This is to achieve a user-centered mobile application that will undoubtedly address the issues highlighted earlier in this paper. The significant difference is that: designing for user underscores user centered design, while designing with users is the advocacy of the participatory design [39], [9], [30]. Users’ participatory method emphasizes gathering of users’ requirements through an iterative design lifecycle that directly involves the users. It is opined that its output is always better and more accurate in actualizing a user-friendly product [27], [29].

In view of designing these requirement and process models, the feedback from a previous requirement gathering study is used as a starting point. These requirements are abstracted to achieve the key ones that could be explored in view of achieving the tasks involved in all the gathered users’ requirements.

Following the Rational Unified Process (RUP), the abstracted requirements are modelled to use cases, sequence and activity diagrams using the Unified Modelling Language (UML) annotation. The activity diagram depicts a novel process of client-server communication. It illustrates how the client-server communication and its request-reply protocols can be solved without being absolutely internet-dependent.
The mobile application is subsequently developed, and a prototype delivered. The prototype is the final output of this study. Its workings are demonstrated to the fishermen, their responses were collected in view of validating the functional requirements of the application and evaluating the mobile application.

V. RESULT AND FINDINGS

A. Requirement Model

Table 1 shows the extracted seven (7) functional requirements of mobile application for fishermen

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Checking weather information which include water safety information</td>
</tr>
<tr>
<td>2.</td>
<td>Giving information about track of storms and intensity of rains.</td>
</tr>
<tr>
<td>3.</td>
<td>Checking real time market price</td>
</tr>
<tr>
<td>4.</td>
<td>Getting fishing tips about locations of fishing areas.</td>
</tr>
<tr>
<td>5.</td>
<td>Getting advertisement of catch availability to wider public of fisher folks</td>
</tr>
<tr>
<td>6.</td>
<td>Indicating fish procurement need based on species and quantity</td>
</tr>
</tbody>
</table>

Considering the issues of task complexity and requirements’ redundancy that are observed in the previous works, three core functional requirements are abstracted and modelled. These functional requirements are: (1) Requesting about weather update, (2) Requesting about real time market price, and (3) Requesting about general fishing tips.

These functional requirements are then modelled to use case diagrams using the UML annotation. The use case diagram representing the abstracted requirement model is presented appendix A.

B. Process Model

The process model signifies the chain of processes that the application user (fishermen) undergo in order to experience the functions of the mobile application. It also diagrammatically explains the communication between the tiers of the application components. The interaction between the tiers of the application components is given in figure 2 of appendix B. To understand the chain of the user-engaged activities in realizing the functions designed for the mobile application for fishermen, these are the description of the process flow:

i. The fishermen double click on the app’s icon on his mobile phone, (Preconditions: The Subscribers’ Identification Module (SIM) card number is registered for the service, and Internet connection is available).

ii. The mobile app initializes.

iii. The mobile app displays a page showing the information that will be checked according to the users’ need.

iv. The mobile app displays a service charge agreement that must be checked, and (Precondition: The information displayed at (iii) is checked and submitted by the user)

v. The mobile app displays ‘Request Successful’ (Precondition: The service charge agreement must be check i.e. agreed).

NOTE: The user is expected to log out of the internet connection immediately the ‘Request Successful’ message is displayed. The reply (information requested) is routed using the Short Message Service (SMS) Bearer called Push Proxy Gateway.

The Sequence and Activity diagrams representing the process model are presented respectively as figure 1 and 2 in appendix B.

C. Implementation

The implementation stage is basically to effect the operations and the requirements designed. A visual simulation will show the flow of the application’s functionalities of the client-server communication in real time. This paper only focuses on the client-side implementation design using Java 2 Micro Edition (J2ME).

In its overview, the architecture of this SMS service delivery is a typical three-tier style that makes the system to be organized into three layers: Interface layer, Application Logic layer and the Data Storage layer. The interface layer entails the objects that deal with the end users and the application logic layer identifies the application business logic, and accurately addresses them. The data storage layer realizes the queries of the persistent objects that need to be stored, and retrieved. The major deployed services are Device ID recognition service which is through the Global System for Mobile (GSM) subscriber identification module card (SIM card), and the SMS service. These are connected with a standalone scheduler program that checks the database and periodically feed the user through the SMS service as earlier requested by the user.
D. Prototyping

The screen shots of the interfaces of the mobile application are presented in appendix C, figure 1 to 4. *Bahasa Melayu* is used to present the information on the user interface. This is mainly to aid the users’ comprehension and enhance the users’ experience.

E. Users’ Experience Evaluation and Functional Requirements Validation

As earlier mentioned, users’ participatory design approach was used in this study. The design method emphasizes designing with users. In this vein, Qualitative approach method of inquiry was employed through a semi-structured interview [23]. This is to exclusively ascertain the respondents’ experience on the use of the mobile application.

A sample size of nine (9) was used for the user’s experience evaluation and requirements’ validation processes [33], [7], [3]. 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. All the nine (9) respondents validated requesting for weather update as a functional requirement. Seven (7) validated requesting for real time market price and eight (8) validated requesting for fishing tips.

The users’ experiences were positive: simplicity of tasks, users’ needs and comprehensive presentation of information were acknowledged by the respondents. The usage of *Bahasa Melayu* as the language in displaying the application’s information and directive is rated positively.

VI. FUTURE WORKS AND CONCLUSION

Our future works are:

i. Designing and testing the server-side real time data mining and analysis algorithm and, (b) client-server protocol. This algorithm will handle the mining and analysis of real time data. This will inform the content of the message to be delivered to the mobile application user. The client-server protocol will handle the resolution of the request call made by the client side application. This functionality is exercised in conjunction with the real time data mining and analysis algorithm. It will also present the result to the mail box of the SIM card.

ii. A simulated demonstration of the SMS functions with the Short Message Service Centre (SMSC) as a mechanism for the process of sending the SMS from the SMS service.

iii. Lastly is the final deployment phase of the mobile application, its laboratory testing and a heuristic evaluation.

In conclusion, this paper has presented another phase of our research work centered on delivering usable and user friendly mobile application for the fishermen. The requirement model validated requesting for fishing tips, real time market price and weather updates as the functional requirements of the mobile application. The users’ experience is also positively rated.

From the design of the process model, internet connection is only needed when the user is making the request. The response which is SMS delivery is not internet dependent. In this case, the financial obligation of internet connection is reduced and the chances of limited access to internet connection as experienced by rural dwellers are duly taken care of. The users’ participatory design methodology used has reinforced the users-centeredness of the mobile application. The final deployment and evaluation of the mobile application will duly meet the users’ requirements.

REFERENCES


Appendix A:

The Use Case Diagram

Figure 1: Use Case Diagram

Appendix B

Figure 1: Sequence Diagram
Start
Fisherman doubleclick on the app's icon
The app initializes
Displays the information type
* Weather Update
* Real time fish price
* Fishing tips
Ask how often is the update requested
* Daily
* Weekly
* Biweekly
* Monthly

Figures:

[Figure 2: Activity Diagram]

[Diagram shows a flowchart with steps including:
- Retrieve from the database
- Connect with the web server
- Select the info type and period
- Display the service charge and the agreement
- Agree with the terms of service
- Submit
- Request successful
]
Appendix C

Figure 1

Figure 2

What information update are you requiring?
Weather Update
Market Price
Fishing Tips
How often does u want the update?
Daily
Weekly
Biweekly
Monthly
Figure 3

Figure 4

This service attracts RM0.20 per SMS received.

I hereby agree with the conditions and terms of this service.

Request Successful