



# Public Market Price Monitoring Information System with SMS Notification: A Decision Support System

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## ABSTRACT

This study aimed at developing a decision-support system that will provide efficient and in real-time information that could be beneficial to both sellers and buyers of a community market at Estancia, Iloilo, Philippines to be known as Public Market Price Monitoring Information System with SMS Notification and subsequently evaluate its levels of usability and performance as well as determine difference in the perception of the respondents. This study employed developmental-descriptive research design. There were 72 respondents for buyers, 17 respondents for sellers and five (5) expert evaluators that participated in the study. The data were gathered through the use of a modified version of the PSSUQ instrument for the level of usability and a researcher-made survey questionnaire based from the ISO/EIC 9126 standards for the level of performance efficiency. Moreover, the Rapid Application Development was used in the development of the system prototype. The Mean and Mann-Whitney U tests were used to statistically compute the results. Results on the level of usability of the proposed system in terms of information quality and interface quality suggested that both buyers and sellers saw “Excellent” features and functions. They viewed the system prototype to have provided information in a simple and clear manner and at the same time easy to understand. Moreover, no significant differences were found in the perception on these features and functions by said respondents. Similarly, its level of performance in terms of time behavior and resource utilization has yielded as interpretation of “Excellent”. The expert evaluators noticed that since the system prototype is implemented in a web-based environment, the resources needed such as CPU utilization, memory requirements, disk space as well as the bandwidth needed are within the range of a typical desktop computer at the time this study was conducted.

**Key words:** local market price monitoring, decision-support system, SMS notification, web app development

## 1. INTRODUCTION

The central rule of a monitoring system is to allow users to capture data, process it and distribute information in a systematic and efficient manner. Monitoring systems can determine trends based on the data collected in the field. Monitoring of prices of products being sold in local public markets is an important economic activity to both sellers and buyers. Any changes in the prices of products would mean a potential increase in profit to the sellers while it would mean additional expenses to the buyers. A price monitoring tool can be helpful to the buyers because they would have updated information about the prevailing prices of the various products being sold at the market. They can track the prices regularly and at the same time budget their expenses efficiently. It can also be a way for the local government unit to properly manage the trade and commerce for the benefit of the local community.

On the other hand, the Municipality of Estancia is a 2nd class municipality in the province of Iloilo, Philippines. It is located in the northern part of the province, approximately 135 kilometers from the province’s capital. Estancia is known around the country as a center for commercial fishing, so much so that it carries the pseudonym “Little Alaska of the Philippines”[1]. The economic activities inside the Estancia Public Market, particularly of sea products, are ever dynamic. At present, some of the sellers tend to increase the price of the products they sell so to increase their profit. This is obviously disadvantageous to the buyers because they have to spend more money just to buy their needs.

The Philippines was once known as the “Texting Capital of the World” [2]. While social media has replaced the text messaging as the main communication tool, SMS-based messages are still a popular means of communication in the Philippines because it is much cheaper and accessible than Internet. And as a small sub-urban community, the people of Estancia, particularly the middle-aged and senior citizens, are still fond of using text messaging. Incidentally, these are the consumers of the products being sold in the community market.

In this context, this study is aimed at developing a decision-support system that will help the local government unit, sellers and most especially the buyers in the daily monitoring of prices of the commodities being sold in the community market; evaluate the level of usability of the proposed system in terms of information quality and interface quality as perceived by the buyers and sellers; determine the difference in the level of usability of the proposed system in terms of information quality and interface quality when respondents classified according to category and determine the level of performance of the proposed system in terms of time behavior and resource utilization as perceived by the expert evaluators.

## 2. RELATED WORKS

The use of information and communications technology in monitoring market price activities has been an interest to many researchers, mostly from developing countries. Its role on Supply-chain (SC) is important to a successful framework for the delivery of goods and services to customers and consumers [3].

In [4] for instance, they developed a web-based information system named KomoditiAceh and designed to be accessible for public who need agricultural commodity price information for people in Aceh region, in Indonesia. When testing their system product using System Usability Scale (SUS) method, they found out that the SUS score was 81 which meant that their system product was regarded to be excellent and acceptable to use.

Marketing information systems are a great tool for decision-makers. Ismael conducted an empirical study on the significance and importance of utilizing marketing information system on decision-making. It would show the roles of each part of his proposed system for developing marketing strategy, which present a real challenge to individuals and institutions. His findings confirmed that there are positive relationships between the level of utilizing and adopting “decision support system & marketing intelligence” and the success of an organizational decision making, and provided the organization with a competitive advantage to solve its problems [5].

Moreover, in [6], they presented an effective framework for market monitoring, supervision and price management in developing countries using information and communication technology (ICT). Their research also illustrated the possible ways to handle the price hike and also derives solutions to resist unethical and ill-motivated hoarding by integrating ICT. They further presented an overview on the application of ICT in disseminating market price information to the consumers and also existent mechanisms in adopting ICT as a

tool to stabilize the market price from the point of view of consumers' right. Illustrating ICT based promising and easiest framework of making the people aware of price of any product and thus maintaining a reasonable price for markets.

In fish farming, [7] conducted a study to mitigate issues during fish feeding time where he successfully developed the Enhanced Decision Support System for Automated Fish Feeder and Water Quality Detection with SMS Notification. The developed system has met the intended tasks such as feeding and water quality monitoring. The developed system automatically disposes of feeds based on the feeding hour in real time. The farmworker and managements then receive SMS notification that the fishes are fed in real time, frequency and the current feeds storage level of the feeder machine.

## 3. MATERIALS AND METHODS

### 3.1 System Development Life Cycle

In this paper, we used the Rapid Application Development (RAD) model as the software development life cycle as it provides RAD phases for business to become more agile, perform optimally and provide better customer engagement and outperform the competition [8]. The RAD describes a method of software development which heavily emphasizes rapid prototyping and iterative delivery. It focuses largely on planning and sequential design practices. The benefit of RAD is the ability to both easily and frequently receive feedback from users who are directly interfacing with the application during development and prototyping. As an alternative to heavy-handed design specification, the use of prototypes throughout the development cycle provides for a number of unique benefits [9]. Rapid Application Development generally follows a cyclical process that includes four basic steps namely Requirements Planning Phase, User Design Phase, Rapid Construction Phase and Cutover Phase [10]. At each phase, the researchers performed specific activities leading to the phase's deliverable which are presented to the user to further refine the final product. Figure 1 shows the RAD as the SDLC model in this study.

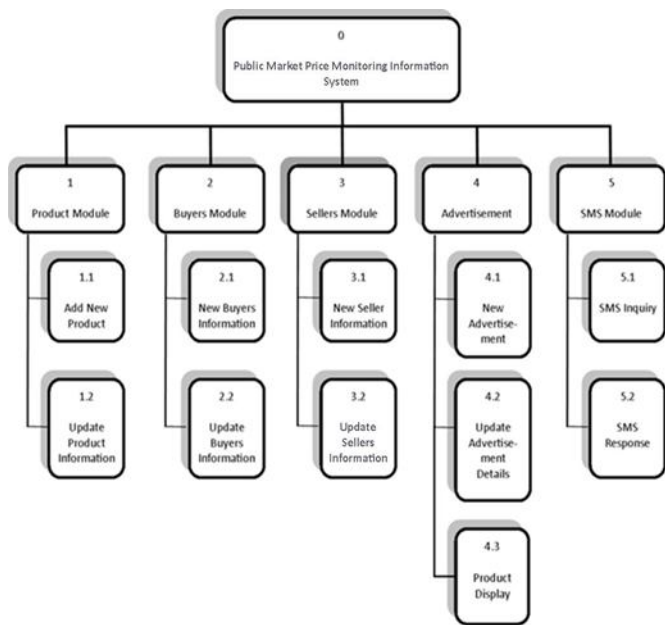


**Figure 1:** The Rapid Application Development Model (Image from [www.synopsys.com](http://www.synopsys.com)).

### 3.2 Process Model

Process modeling is a technique for organizing and documenting the structure and flow of the data through a

system’s processes and/or logic, policies, and procedures to be implemented by a system’s processes [11]. In the design of the proposed system, we used decomposition diagram. A decomposition diagram is a diagram that partitions the system into logical subsystems and/or functions [11]. This project is composed of five major modules namely Sellers module, Buyers module, Advertisement module, Product Module and the SMS module. The Sellers Information Module and Buyers Information module contained the basic information about the buyers and sellers. The Advertisement module is responsible for the price monitoring and the presentation of the products’ information. It could also added and updated sellers who want to advertise their products. The Products Module shall contain the important information of the products. New products would be added and would be updated the revision related to the products. The SMS module would handle the SMS-related activities such as notification and inquiry. Figure 2 shows the Decomposition Data Flow Diagram Depicting the Process Model of the Proposed System.



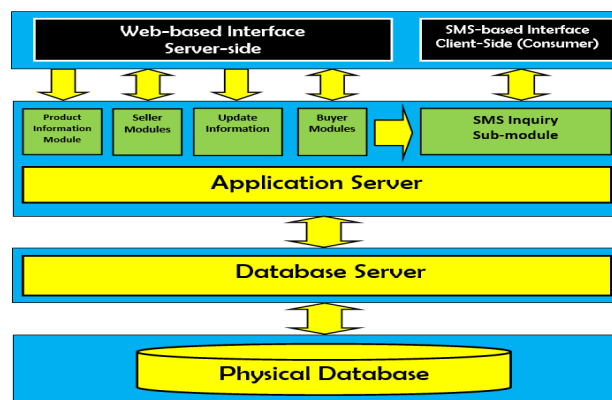
**Figure 2:** The Decomposition Data Flow Diagram Depicting the Process Model of the developed System.

### 3.3 Logical Architecture Design

Figure 3 shows the logical architecture design of the proposed system. We used the n-Tier architecture which is a type of a Client-Server architecture merged with the layered architecture. The design of the layout was composed of four layers. These are the presentation layer, the application and logic layers also known as the business layer, the data manipulation layer and the database layer.

The presentation layer component implemented the functionality necessary for the interaction between human or users and application. There are three user interfaces in the

system prototype. These are the web-based interface designed for the use of the system operator, while the television screen that serves as an e-board and the SMS-based interface which will provide real-time information to the buyers and sellers as clients of the system. The application and logic layers implement the main functionality of the system, and encapsulate the relevant business logic. The system function would execute by various modules and sub-modules are in these layers. The data manipulation layer would handle the processes in manipulating records contained of the developed system. It would give users access to data within the coverage of the system. This would be implemented using the Structured Query Language. The fourth layer was the database layer which is composed of the different relational databases and its corresponding tables, fields and attributes.



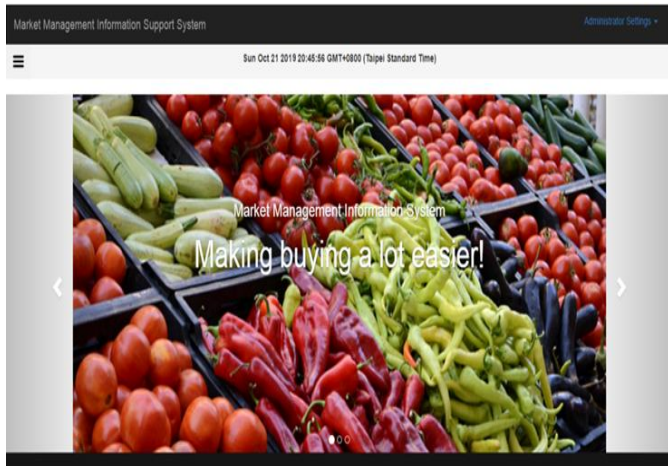
**Figure 3:** The Logical Architectural Design for the Developed System.

### 3.4 Construction of the System Prototype

In the construction of the system prototype, we used standard development tools. For the web-based components, we developed the system product using the HTML, CSS, Javascript and MySQL. Thus, to achieve this, we have also downloaded and installed XAMPP Version 3.2.2. For the SMS module, we use the Microsoft Visual Studio 2010. For efficient user interface design, we applied web-based techniques to design the graphical user interfaces of the system prototype with emphasis on the harmonization of fonts, color, sizes, styles as well as whitespaces.

#### 3.4.1. Main User Interface

The Main User Interface page is the initial display on the server side of the system prototype. From here, the system operator can log-in which would allow him to manage the various modules on the server side. The SysOp can add, update and delete records pertaining to products, buyers, sellers as well as advertisement. Figure 4 shows a screenshot of the Main User Interface page.



**Figure 4:** The Main User Interface Page of the Proposed System.

### 3.4.2. Widescreen Display Page

The Widescreen Display Page is where all the products information are displayed for the general public to see. For best possible readability, this page is displayed using a 55” television unit which is strategically located at the entrance of the Estancia Public Market. Information such as product code, description, selling price per unit and the current date are shown. An instruction on how to inquire through SMS is also appearing at the bottom of the screen. Sellers can also post advertisement for potential transactions. Figure 5 shows the screenshot of the Widescreen Display Page.



**Figure 5:** The Widescreen Display Page of the Proposed System.

### 3.5 Respondents of the Study

The respondents of the study were conveniently selected among the consumers of the Estancia Public Market. There were a total of 94 respondents of this study. They were categorized as sellers, with 17 respondents, and 72 respondents as buyers who evaluated the usability

characteristic of the system product. Five (5) respondents that were considered as expert evaluators evaluated the performance efficiency of the system product. They were considered experts because are practitioners in the field of software development.

### 3.6 Data Gathering Procedures

In the gathering of data, we first sought permission from the Local Government Unit (LGU) of the Municipality of Estancia to allow us to install a 55” LED television unit that would serve as the primary visual medium where various products being sold in the public market are displayed with their corresponding price of the day. The products were categorized as fresh fish, dried fish, condiments, fruits and meat products. With the system product up and running, we then requested consumers of the public market to spare some of their time to see the video on the screen. We also took time to discuss with them on how to request for prices using SMS messaging.

We requested the respondents to answer a simple survey instrument as to their perception of the usability of the system product. For the level of usability, we employed the Post-Study System Usability Questionnaire (PSSUQ) developed at the IBM Design Center in 1992 [12]. The PSSUQ is a 7-point Likert divided into three sub-characteristics namely system quality (items 1 to 6), information quality (items 7 to 12) and interface quality (items 13 to 16) where 1 is “strongly agree” and 7 is “strongly disagree”[13]. However, in the context of this study, we modified PSSUQ instrument by removing the items 1-6 and 8 since what we were looking after were the perceptions of the buyers and sellers as to the information quality and the interface quality of the developed system. More so, we changed the rating scale for consistency with the other survey instrument and as such 1 means “strongly disagree” while 5 means “strongly agree”.

On the other hand, we presented the system product to the expert evaluators and requested them to check it in terms of its performance. After which, we invited them to evaluate the system product of its performance efficiency. We adapted specific criteria lifted from the ISO 9126 standard [14] using a 5-point Likert Scale where 1 is “very poor” and 5 is “excellent”. The Mean and Mann-Whitney U tests were employed to determine whether the developed system passed the evaluation criteria. The results of the computation would then be interpreted as “excellent” (M=4.21-5.00), “above average” (M=3.41-4.20), “average” (M=2.61-3.40), “below average” M=2.61-3.40) and “extremely poor” (M=1.00-1.80) while inferential statistic was set at 0.05 level of acceptance.

**4. RESULTS AND DISCUSSION**

**4.1 Level of Usability of the Proposed System as Perceived by the Buyers and Sellers in terms of Information Quality and Interface Quality**

The proposed system was evaluated of its level of usability in terms of information quality and interface quality. The usability characteristic refers to the degree to which the system can be used specified users to achieve specified goals with effectiveness, efficiency and satisfaction in specified context of use.

Findings showed that the level of usability in terms of information quality, the buyers (M=4.33; SD=.74) and the sellers (M=1.38; SD=.71) described the system prototype as “Excellent”. They were in unison in their opinions that the system prototype provided information in a simple and clear manner and at the same time easy to understand.

In terms of interface quality, the buyers (M=4.32; SD=.68) and the sellers (M=4.41; SD=.65) perceived the proposed system as “Excellent”. They viewed the interface design of the system prototype to be pleasant while expecting the needed functions and capabilities being present. Table 1 showed the data.

**Table 1:** Level of Usability of the Proposed System as Perceived by the Buyers and Sellers in terms of Information Quality and Interface Quality

Sub-characteristics	Buyers			Sellers		
	Mean	SD	Interpretation	Mean	SD	Interpretation
Information Quality	4.33	.74	Excellent	4.38	.71	Excellent
Interface Quality	4.32	.68	Excellent	4.41	.65	Excellent

**4.2 Difference in the Level of Usability of the Proposed System in terms of Information Quality and Interface Quality when Classified According to Category**

We further examined whether there exist significant difference in the perception of the buyers and sellers of the system prototype in terms of the information quality and the interface quality. Using the Mann-Whitney U test set at .05 level of significance, both the buyers and the sellers have more or less the same perception for the information quality (u=572.500; p=.669) which is higher than the alpha level. Thus, their perception is not significant. More so, their perception in terms of interface quality (u=547.500; p=.482)

of the system prototype is also not significant. Table 2 shows the result.

**Table 2:** Difference in the Level of Usability of the Proposed System in terms of Information Quality and Interface Quality when Classified According to Category

Sub-characteristics	Category	N	Mean Ranks	U	Z	P	Interpretation
Information Quality	Buyers	72	45.55	572.50	-.427	.669	Not Significant
	Sellers	17	42.68				
Interface Quality	Buyers	72	45.90	547.50	-.703	.482	Not Significant
	Sellers	17	41.21				

P ≤.05 Significant at .05 alpha

**4.3 Level of Performance Efficiency of the Proposed System as Perceived by Expert Evaluators in terms of Time Behavior and Resource Utilization**

Table 3 shows the result of the expert evaluators’ feedbacks on the level of performance efficiency in terms of time behavior and resource utilization. The performance efficiency represents the performance relative to the amount of resources used under stated condition. The results showed that the proposed system, on its level of performance efficiency in terms of time behavior (M=4.80; SD=.44) while for resource utilization (M=4.77; SD=.45) are both perceived as “Excellent”. The respondents under this area of testing saw the system prototype to be very responsive and highly performing based on the functional requirements. On the other hand, since the system prototype is implemented in a web-based environment, the resources needed such as CPU utilization, memory requirements, disk space as well as the bandwidth needed are within the range of a typical desktop computer at the time this study was conducted.

**Table 3:** Level of Performance Efficiency of the Proposed System as Perceived by Expert Evaluators in terms of Time Behavior and Resource Utilization

Sub-characteristics	Mean	SD	Verbal Interpretation
Time Behavior	4.80	.44	Excellent
Resource Utilization	4.77	.45	Excellent

**5. CONCLUSION**

This study was able to successfully design and developed a decision–support system that provided efficient and real–time information that could be beneficial to both sellers and buyers

in the Estancia Public Market to be known as Public Market Price Monitoring Information Support System with SMS Notification.

The level of usability of the proposed system in terms of information quality and interface quality was viewed by the buyers and the sellers with as “Strongly Agree”. The sellers can easily present their offered products to the market by posting it and displayed in the television screen strategically mounted at the entrance of the public market. For the buyers, they can easily budget their money because they’re aware for the current prices of the products and they can find the sellers where they can buy the products they need. The respondents are also pleased with the interface design of the proposed system because they perceived it to be pleasant to their eyes. According to them the system interface was user friendly, the text are readable and at the same time the organization of the information as shown on the screen was clear. Moreover, there were no significant difference in their perception as to the quality of information and interface design of the system prototype.

The level of performance of the proposed system was also perceived by the evaluators as “Excellent”. These meant that the proposed system performs relatively well with the minimal amount of resources needed. It is very responsive and users are able to complete the task as expected. Furthermore, users did not experience any system lag during transactions.

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