Web-based Vaccination Mapping and Profiling with SMS Support: Its Usability to Health Workers in One City in the Philippines

[i]Rovilyn S. Osalla, [2]Dina L. Datolayta, [3]Kristine T. Soberano

[*1,2,3]*Northern Negros State College of Science and Technology, Old Sagay, Sagay City, Negros Occdiental, Philippines*

Abstract

Technology plays an important role, especially when COVID-19 wreaks havoc on the world. The world started to find a solution to end the devastating pandemic, and then they discovered vaccines. When the vaccination began across the country, it was hard to store residents' vaccine data in one city in the Philippines because of their manual system, which can easily lead to data loss. As a result, the researchers developed a Web-based Vaccination Mapping and Profiling with SMS Support to determine its usability for Health Workers and to improve the current manual way of storing data. With these, the researchers used a descriptive and developmental research design to develop a GIS map using the TomTom developer portal and Javascript programming language for easy locating and profiling vaccinated residents and to message them regarding the effects, what they shouldn't do after vaccination, and possibly scheduling their next vaccination. This study used the Rapid Application Development Model (RAD) approach in completing the project. The developed system was implied as being very good in functionality and usability duly assessed by IT experts using the criteria of Mc Call's Software Quality Model. The City Health Unit must update the system to optimize its potential and enhance its functions and usefulness.

***Keywords:** Mapping, Profiling, SMS Support, Vaccination, GIS*

I. INTRODUCTION

An effective rollout of vaccinations against COVID-19 offers the most promising prospect of bringing the pandemic to an end [1].As the global environment ages, the emerging trend for Information Technology has risen above the surface of development initiatives. As a process innovation, it lies at the center of streamlining processes both in the public and private sectors. It becomes less of a choice but more of a requirement for individuals, as computers play a crucial role in assisting people in organizing, storing and retrieving huge amount of information. It likewise serves as a tool which enables its users to do more tasks, hence making it a vital commodity especially in working environments [2]. However, some sectors still seem to be left behind in technology. Others may not fully understand the capabilities of computerized technology. Currently, the City Health Unit of Sagay City in the Philippines keeps their vaccination records on record file and manually stores them in any physical storage. It is a very formal way of storing data and records; however, the disadvantage of storing data in this manner is that it is prone to human error, such as mistakes in writing accurate details and poor handling of the paper logbook, which may result in data loss [3].

The Web-based Vaccination and Profiling with SMS Support will be helpful for the city health staff since it will make it simple for them to encode, store, and manage vaccination records. Additionally, it will keep tabs on their vaccination schedule and identify residents who haven't received their shots for more straightforward access.

The system's use can enhance records keeping and data management aspects of the city health unit's operations, including the related services provided and the workflow. It also lessens the daily workload typically provided for the employees and makes managing the health unit more manageable and straightforward. The City Health Unit will be able to monitor and guarantee the transparency and correctness of the vaccination records, even save the data for extended periods, and greatly simplify and ease access by putting this system into place.

Additionally, the WVPS is a reliable and efficient tool for managing vaccination records and identifying city areas with vaccinated residents through GIS. With this, it is easy to locate how many residents

have been vaccinated in a specific area within the city. Geographic Information System (GIS) is a computer-based tool that analyzes, stores, manipulates and visualizes geographic information, usually on a map [4]. The system also has SMS support to remind residents of the possible schedule of their next vaccination date and what they shouldn't do just after vaccination.

The researchers developed the Web-based Vaccination Mapping and Profiling with SMS Support to easily locate and monitor vaccinated residents of the city as shown in Figure 1.
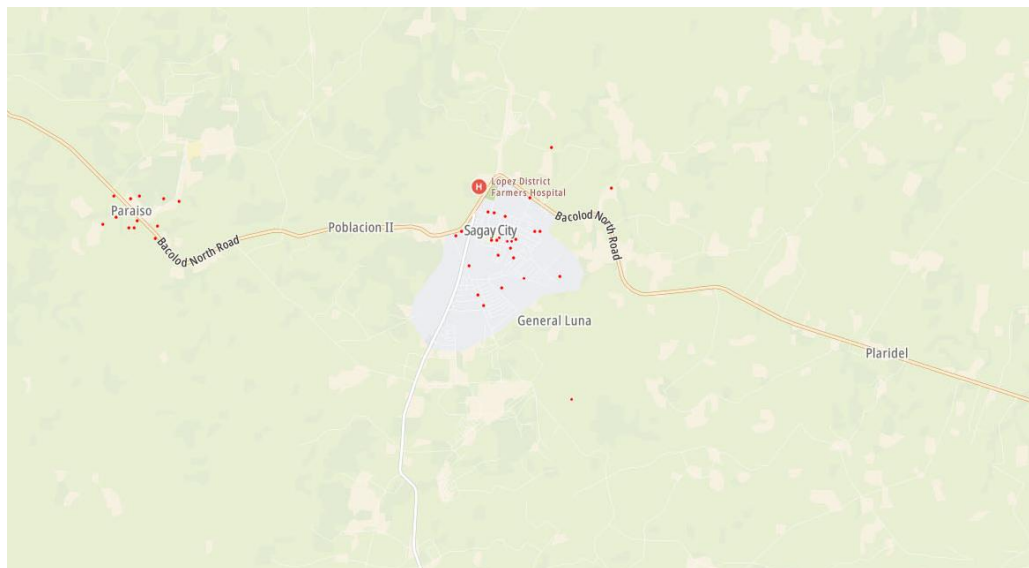

Figure 1 Vaccinated Residents Mapping and Profiling

Conceptual Framework

The researchers conceptualized a Web-based Vaccination Mapping and Profiling with SMS Support: Its Usability approach to Health Workers in Sagay City.

The input–process–output (IPO) model is a widely used approach in systems analysis and software engineering for describing the structure of an information processing program or another process [5].The Input phase refers to the Residents' Profile Information. The Process phase includes Web-based Vaccination Mapping, Profiling with SMS Support: Its Usability to Health Workers in Sagay City. The Output process is the system's usability.
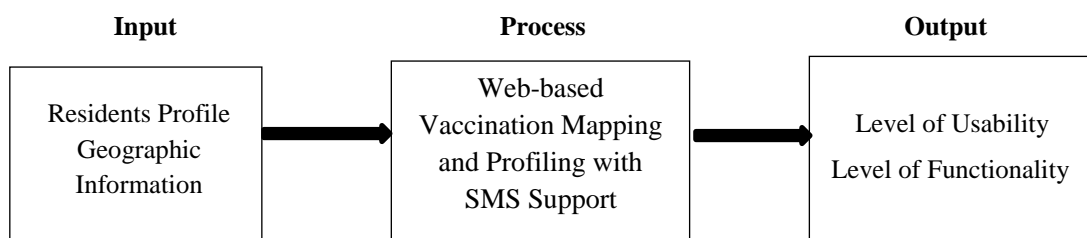
Input	Process	Output
Residents Profile Geographic Information	Web-based Vaccination Mapping and Profiling with SMS Support	Level of Usability Level of Functionality

Figure 2 The Conceptual Framework of the Study

II. Methodology

2.1Research Design

The research design refers to the overall strategy and analytical approach that you have chosen in order to integrate, in a coherent and logical way, the different components of the study, thus ensuring that the research problem will be thoroughly investigated. It constitutes the blueprint for the collection, measurement, and interpretation of information and data. [6].

In this study, developmental and descriptive research designs were employed.Developmental research as the systematic study of designing, developing, and evaluating instructional programs, process, and products that must meet the criteria of internal consistency and effectiveness[7].

Descriptive research design uses a range of both qualitative research and quantitative data (although quantitative research is the primary research method) to gather information to make accurate

predictions about a particular problem or hypothesis.As a survey method, descriptive research designs will help researchers identify characteristics in their target market or particular population.These characteristics in the population sample can be identified, observed and measured to guide decisions [8].

2.2 Software Development Life Cycle

Software development life cycle (SDLC) is a method by which the software can be developed in a systematic manner and which will increase the probability of completing the software project within the time deadline and maintaining the quality of the software product as per the standard. The System Development Life Cycle framework provides a sequence of activities for system designers and developers to follow for developing software [10]. In short, The methodology used in this design is the RAD method which consists of identifying the objectives and information requirements, designing the system, building the system, and introducing the new system [11].   Specifically, this study used the Rapid Application Development Model or RAD.
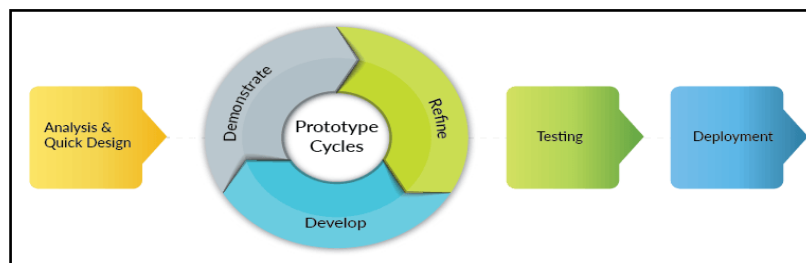

Figure 3 Rapid Application Development Model

Figure 2.0 shows the Prototype Model that was used by the researchers for the development of the system. It shows the different processes that the researchers need to follow to have a better outcome for developing the systems.

Analysis and Quick Design

During Analysis and Quick Design phase, the researchers interviewed the respondents and the chosen company where the study was conducted. The respondents were given the privilege to suggest and request on how the system will be designed and developed. After conducting the data gathering, the researchers made an initial design for the proposed system.

Data Analysis

The researchers analyzed all data, information, and user requirements. This phase also helps the researchers to have an idea on how to build and create the system and help conceptualize on how the proposed system would be beneficial and if it is the solution to the needs of the respondents.

System Design

The researchers start to develop the proposed system. It includes the design or layout of how the system would look like based on the user requirements, and researchers/programmers also add personal designs to make the system more interactive.

Prototype Cycle

This stage includes building, demonstration, and refinement from the information that were gathered and analyzed. The researchers first build the prototype of the system that was demonstrated to the client. In building stage, the researchers collect together all the data that was gathered to build the prototype. After building the prototype, it demonstrates to the client; the researchers show the function of the system, the flow on how it works, and the functions of the features included in the system. The last stage is the refinement. In this stage, the researchers refined the system by client's additional needs. It includes changes in features, flow, and functions that based on the requirements added from the clients.

Testing

This is the feed backing process of the proposed system after it was implemented and undergo testing to the Three (3) Experts and its intended users. It informs the developer if there are any suggestion and flaws, and if the system's functionality work well.

Implementation

This phase discusses the implementation of the proposed system wherein the Three (3) Experts evaluates the proposed system. This phase also discussed if the recommended functions and suggestions of the respondents and users was met.

2.3 Process Model

Process modelling involves graphically representing the processes, or actions, that capture, manipulate, store, and distribute data between a system and its environment and among components within a system [9]. The researcher used the DFD to depict its logical design in this paper. The DFD (Date Flow Diagram)is a graphic that illustrates the movement of data between external entities and the processes and data stores within a system [9]. Figure 4 shows the relationship between the system and other external entities of the data flow diagram.
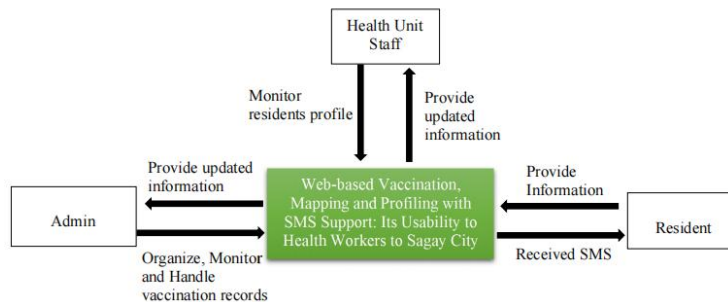

Figure 4 The Context Data Flow Diagram of the Developed System

2.4 Testing and Evaluation

To gather data the researchers used a researchers-made questionnaire validated by experts using the Good and Skates validation tool. The questionnaire was distributed to fifty-five (55) respondents, including the administrator, health unit staff, and residents within Sagay City only. Due to the completion of the developed system, the researchers asked three (3) IT Experts to determine the whole quality of the system. Questionnaires were given to IT Experts based on the criteria of McCall's Software Model. Furthermore, the data collected from the surveys were tallied, evaluated and interpreted.

III. PRESENTATION OF DATA AND INTERPRATATION OF RESULTS

This chapter presents the generated data and provides the data analysis and interpretation of results.

3.1 Level of usability of the Web-based Vaccination Mapping and Profiling with SMS Support in terms of learnability and operability

Table 1 shows the mean and interpretation results from the respondents' feedback on the developed system's usability in terms of learnability and operability. In terms of Learnability (M=4.69) interpreted as "Very good" which means the users of the system can quickly and effectively become proficient. In terms of Operability (M=4.80) interpreted as "Very good" because the system has the ability to function as intended and meet the needs of its users in the context of its operating environment. The usability of the developed system with an overall mean of 4.75 was interpreted as "Very good".The respondents rated the usability of the Web-based Vaccination and Profiling with SMS Support: Its Usability to Health Workers in Sagay City.This means that the developed system had a high level of usability, with users finding the system's functions user-friendly and the information displayed on the system generic enough for easy comprehension. It was simple for first-time users to navigate the system since it was intended to be user-friendly.

Table 1: The Level of Usability of the developed system in terms of Operability and Learnability

Implementation Indicators	Mean	Verbal Interpretation
Learnability	4.69	Very good
Operability	4.80	Very good
Level of Usability	4.75	Very good

Legend: 1.00 -1.80 (Poor); 1.81 –2.60 (Fair); 2.61 –3.40 (Average); 3.41 –4.20 (Good); 4.21 –5.00 (Very Good)

3.2 Level of functionality of the developed system in termsof its security, accurateness and suitability

Table 2 shows the mean and interpretation results from the respondents' feedback on the functionality of the developed system in terms of security, accurateness and suitability composed with the following mean: In Security (M=4.56) interpreted as "Very good", accurateness (M=4.67) interpreted as "Very good", and it's suitability (M=4.89) interpreted as "Very good). The overall mean of the functionality of Web-based Vaccination Mapping and Profiling with SMS Support is 4.71 verbally interpreted as "Very good" because the system has a wide range of features, such as data processing, communication, user interface design, error handling, security, and performance. Therefore, it was very functional regarding security, accuracy, and suitability. With these, the system is accessed by authorized users and maintains precise information management records.

Table 2: The Level of Functionality of the developed system in terms of Security, Accurateness, and Suitability

Implementation Indicators	Mean	Verbal Interpretation
Security	4.56	Very good
Accurateness	4.67	Very good
Suitability	4.89	Very good
Level of Functionality	4.71	Very good

Legend: 1.00 -1.80 (Poor); 1.81 –2.60 (Fair); 2.61 –3.40 (Average); 3.41 –4.20 (Good); 4.21 –5.00 (Very Good)

IV. CONCLUSION

The main problem with the manual system was that the City Health Unit data management was prone to human error, mistakes in writing accurate details, and poor handling of the paper logbook, which led to data loss. The study revealed that the city health workers highly recommend the developed system. The Web-based Vaccination Mapping and Profiling with SMS Support: Its Usability to Health Workers in Sagay City met the needs of respondents and intended users. They saw the system as having the potential to assist the city health unit in managing vaccination records. Implementing the developed system will improve the efficacy and efficiency of managing vaccination records and likewise, save time in locating and monitoring vaccinated residents.

Therefore, based on the information gathered, the researchers concluded that the developed system is usable and fully functional. The developed system's advantage will assist the city health unit to improve vaccination record-keeping, easily monitor vaccinated areas, and update residents' possible vaccination schedules and other vaccine-related matters. The system's implementation will reduce the data management problems, difficulties in record keeping, and workload encountered in the manual process. The developed system is only accessed by authorized users and maintains precise information management. It will make maintaining the vaccination record convenient for the user.

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