

Web-based SERVQUAL Customer Satisfaction Survey System for Data-Driven Decision Making in the Philippine Department of Health

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Abstract—The Department of Health has sought to enhance the collection and analysis of customer satisfaction data within public health service provision, as evidenced by the issuance of Department Memorandum No. 2021-0100 also known as the Updated Customer Satisfaction Survey Form. Despite these efforts, implementing digitalization to streamline this process has yet to be fulfilled due to resource limitations. This study addresses this gap by developing a web-based application that is tailored according to the minimum requirements of this issuance and industry standards. Employing a Waterfall methodology, the development process leveraged website technologies and embedded analytics for the front end while utilizing MySQL via PhpMyAdmin for the backend infrastructure. Through systematic prototyping, implementation, and testing, the study demonstrates the efficacy of the developed system in achieving a robust web platform, thereby presenting an improved CSS process. The results underscore the transformative potential of technological innovation in modernizing public health service delivery, facilitating evidence-based decision-making, and ultimately enhancing the quality of healthcare provision for all stakeholders involved.

Keywords—Web Application, SERVQUAL, DOH, Customer Satisfaction Survey, Evidence-based Decision Making

I. INTRODUCTION

Ensuring access to quality healthcare services is a vital component of nation-building. By maintaining positive physical and mental well-being, individuals can strive towards their goals and contribute to society. The Department of Health (DOH) is a key government agency in the Philippines, dedicated to providing healthcare services to all Filipinos, regardless of their background. The DOH was established as the Board of Health in the New Republic, following a Presidential Proclamation on June 23, 1898, under the leadership of then-President Emilio Aguinaldo. Over the years, the Board evolved into the Department of Health, which is now governed by Executive Order No. 102 and the Administrative Code of 1987 [1]. Overall, the DOH plays a crucial role in promoting and nurturing the health of the Filipino people.

In line with its role in providing quality healthcare services, the DOH established a system that can enable it to capture customer satisfaction across various public health service delivery providers. In 2021, the DOH issued

Department Memorandum (DM) No. 2021-0100, otherwise known as the Updated Customer Satisfaction Survey (CSS) Form [2] that will be utilized to assess the quality of its services better and in return, can be able to provide accurate insights for continuous improvement of its processes and services provided to the public. Regardless of the intention to improve services, the need for improvement was still observed and evident in the memorandum. For instance, it was inferred in Section "III. Implementation of the Tool" of the issuance that the survey will be paper-based and require manual processing. According to [3], relying solely on paper-based surveys and manual processes can slow down workflows, introduce errors, and hinder an organization's ability to compete in today's fast-paced, data-driven environment.

The DM No. 2021-0100's issuing office has already explored ways to enhance the current process, specifically by transitioning to digital means. However, this initiative has not yet come into effect due to de-prioritization and lack of resources within the department. Automating or digitizing the system would address the challenges associated with its usage and administration. As cited in [4], the implementation of an automated system in public services yields several benefits, including improved accessibility, a swift response rate, a hassle-free process, and the assurance of user privacy and safety. It can be expected that automation will optimize government services, making them more accessible and up-to-date with evolving times and public demand. Thus, this study aims to automate the data entry process, storage, management, and analysis of customer satisfaction survey in the Philippine Department of Health. Specifically, the study aims to:

1. Gather the system requirements for a web-based survey application;
2. Design and develop a minimum viable product for production-level use; And,
3. Evaluate the developed system via black box testing, stakeholder feedback, and existing survey process comparisons.

This proposed solution could have a significant positive impact on the DOH by streamlining its operations, improving efficiency, and minimizing errors. By adopting a digital solution, the department can optimize its operations, maintain agility, and remain accountable to its stakeholders. Ultimately,

this will enhance the public's trust and satisfaction with the department's services.

II. RELATED WORKS

A. Customer Satisfaction Survey

Government agencies, like other corporations and organizations in the private sector, must also obtain feedback regarding the public's view and reception of the services provided. One way of obtaining such information is through customer satisfaction surveys, which, according to the study conducted by [5], can help determine the satisfaction rate of the public towards government initiatives provided for them. The quality public is an essential part of government agencies, and the feedback of its users can play a pivotal role in enhancing such services and ensuring the achievement of quality. As such, it was also indicated in the same study that the information or responses that will be gathered from administered customer satisfaction surveys can offer the government valuable insight and feedback, particularly on issues or concerns that need immediate addressing, and also help the government enhance its public service provider image and reputation. Customer satisfaction surveys can also help foster and establish transparency in providing government services for the public.

Customer satisfaction is crucial for maintaining service quality across industries, with satisfaction surveys providing insights into user needs and preferences [6]. In local government, customer satisfaction correlates with improved access to public services [7]. Factors like anti-public bias and personal experiences influence public perceptions of government services [7]. Regular assessment of government services is necessary for efficiency and improvement, with technology integration enhancing service delivery [8]. Online surveys also offer advantages such as increased response rates and cost-effectiveness across sectors [4, 9, 10]. Automation of surveys improves efficiency and accuracy, as seen in web-based performance appraisal systems and automatic survey completion tools [11, 12]. Web-based administration systems aid in data collection and decision-making in various fields [13, 14].

B. E-Government

[15] introduces e-government, emphasizing its role in improving efficiency, streamlining processes, and reducing errors in government services. Digitalization allows for quick access, reuse, and sharing of electronic data, addressing administrative burdens and reducing costs while ensuring quality service. Client satisfaction increases with automation, fostering trust and enhancing the government-public relationship.

In Gambia, [16] highlights how electronic communication improves government-public relations. E-governance facilitates communication between government branches and enhances service delivery. Studies underscore the importance of e-governance in delivering fast, cost-effective, and efficient public services. Technology integration in government operations is now standard practice, enhancing decision-making, managerial efficiency, and overall productivity.

C. Automation and Digitization in Government

[17] discusses the challenges of integrating automation in government processes, highlighting its potential to streamline operations and maintain service quality amidst serving a large citizen base. Automation is crucial for government agencies

to meet efficiency and convenience expectations, necessitating a shift away from manual processes. Equipping government agencies with appropriate tools and software, such as embedded analytics, enhances data retrieval and decision-making processes [18]. Embedded analytics also improves user experience, increases revenue streams, and boosts client satisfaction [18].

Ensuring the quality of automated government services is paramount, with a focus on client perspectives and trust levels [19]. The success of e-government services hinges on continuous quality improvement and fostering citizen trust. E-government services offer accessibility, feedback mechanisms for service enhancement, cost-effectiveness, and bolstered trust in government. Therefore, the government sector must thoroughly study and implement technological integration.

III. METHODOLOGY

In this study, the Waterfall methodology was the guiding framework for project management and development. The Waterfall model was chosen due to its sequential approach, which aligns well with the structured nature of the project and development process. This methodology comprises distinct phases: requirements analysis, design, implementation, testing, and maintenance [20]. Each phase is executed linearly, with progress flowing downwards, akin to a waterfall, ensuring clear delineation between stages and focusing on completing one phase before moving on to the next. However, it should be noted that maintenance phase was excluded in this study due to the project's timeline limitation.

Additionally, within the Waterfall framework, the integration of a Prototyping approach and weekly stand-up meetings serve as crucial checkpoints within this combined framework. This injects agility into the process, ensures alignment with project objectives, and facilitates effective communication among the development team and stakeholders.

A. Requirements Analysis

The requirement analysis phase of this study involves a multifaceted approach integrating formal literature and policy reviews with a review of previous studies and informal communication with the Performance Monitoring and Strategy Management Division (PMSMD) (formerly Office of Strategy Management), the implementing office of the customer satisfaction survey within the department. The research identifies current trends, best practices, and regulatory frameworks relevant to healthcare quality improvement and patient satisfaction measurement by examining academic literature and policy documents. Simultaneously, previous studies' insights inform the survey instrument's design and implementation. At the same time, informal communication with stakeholders provides practical insights into contextual nuances and specific requirements for successful implementation.

B. Design

The design phase encompassed the UI/UX and data model design, each crucial for developing a user-centric and efficient web application.

The UI/UX design phase commenced with an in-depth analysis of user requirements, informed by literature, policy, and stakeholder engagement. Using Figma, wireframes and mockups were developed and refined through internal testing

to ensure intuitive navigation and functionality. Prioritizing simplicity and responsiveness, the design aimed to cater to diverse user preferences, with meticulous attention to critical features such as survey administration, data visualization, and reporting.

In parallel, the data model design laid out the backend structure for efficient data management and processing within the web application, utilizing an Entity-Relationship (ER) diagram to depict the relationship between entities. This involved defining the database scheme's structure, relationships, and constraints to support the application's functionalities. Similar to the UI/UX design, this is informed by existing literature, DOH policies, and feedback from stakeholder engagement.

The culmination of both UI/UX and Data Model design efforts resulted in a comprehensive design specification document, providing guidelines and blueprints for the development team. The document will serve as a roadmap for implementing the envisioned features and functionalities, ensuring alignment with user needs, technical requirements, and project objectives.

C. Implementation

In the transition from design to implementation, a crucial intermediary step was the development of a prototype for the web-based application. This study leveraged high-fidelity prototypes with advanced functionality to refine the envisioned user experience before transitioning to full-scale development. The prototype served as a proof of concept, allowing for validating design assumptions and user workflows in a controlled environment. Internal testing and feedback during weekly stand-ups were conducted to fine-tune the UI and UX, ensuring seamless navigation, accessibility, and alignment with stakeholder expectations.

Following the prototype development, the implementation phase commenced with translating the revised design specifications into fully functional web-based applications using web forms, website technologies, and embedded analytics. Employing industry-standard tools and frameworks such as HTML, CSS, JavaScript, PHP, SQL, and Microsoft Power BI, the study embarked on the development process. During implementation, scalability and performance were prioritized to create a minimum viable product with robust functionality and user experience. Integration with backend databases using MySQL via PhpMyAdmin facilitated seamless data storage and management, enabling the application to access and process information securely and in real-time. Seamless integration was also done from the backend to Power BI to deliver analytics services and dashboards for the web application. This additional feature enhances the application's capabilities for data-driven decision-making and performance monitoring.

After the website was developed, it was configured and hosted online through hostinger.com with the appropriate domain name for the project.

D. System Testing

The testing phase employed a black-box testing approach, focusing primarily on functional testing to ensure the robustness and reliability of the developed web-based application. The project team conducted this testing internally, which served as an evaluation of the system's functionality across the high-level functions. Functional testing aimed to

validate the application's adherence to specified requirements and ability to perform expected tasks accurately.

Additionally, informal functional testing was conducted by stakeholders, with a focus on soliciting user feedback and assessing usability within their business context. This informal testing process provided insights into user interactions, preferences, and pain points, helping to refine the application's UI and address any usability issues identified.

Furthermore, the developed system was subject to a comparative analysis against the current manual system regarding process flow and efficiency in administering a customer satisfaction survey. This assessment aimed to identify areas of improvement and demonstrate tangible benefits of adopting the new system. By analyzing factors such as process complexity and the number of steps required to complete tasks, it highlights the advantages of the proposed system in streamlining workflows and enhancing overall efficiency.

IV. RESULTS

A. System Requirements

The findings of the System Requirements analysis revealed significant limitations within the current DOH-CSS process, necessitating a transition towards a more streamlined and dependable system. The manual handling of surveys poses inherent risks to data accuracy and analysis due to potential errors, consequently impacting the reliability of collected. Moreover, the manual process imposes a substantial workload on employees and clients, decreasing performance and productivity.

In response to these identified challenges, a proposed solution introduced an automated system for survey response gathering and data analytics to enhance the efficiency of the existing process. A crucial aspect of the solution is the depiction of the survey administration process through a well-defined process flow diagram, as shown in Figure 1. Additionally, insights into the data interaction between clients/patients, stakeholders, and web applications through a data flow diagram provide a comprehensive visual representation in Figure 2, elucidating the intricate dynamics of information exchange within the proposed system. These illustrations enhance our understanding of how the proposed system operates.

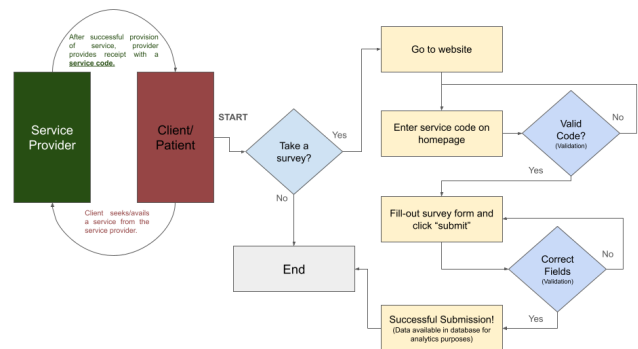


Fig. 1. Process flow diagram of the web-form.

Subsequently, the system's primary functions are delineated through a user story approach, meticulously detailed in Table 1. These elucidations significantly augment

our comprehension of the operational intricacies of the proposed system.

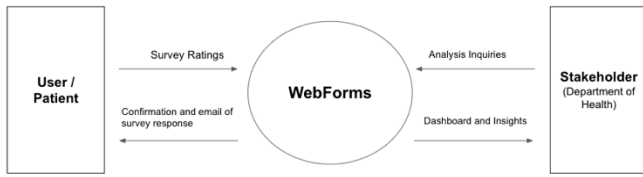


Fig. 2. Solution Level 0 Data Flow web application.

TABLE I. USER STORIES

No.	User Story (Client/Patient)
1	A client/ patient accesses the survey form on an official agency website.
2	The client/ patient enters a valid transaction-specific service code on the website.
3	The client/patient is redirected to a WebForm with field validation rules.
4	The client/patient submits a complete self-administered web survey.
5	The client/patient receives a confirmation that the survey was completed.
No.	User Story (Stakeholder (DOH))
1	The stakeholders can review and filter the survey satisfaction forms by Team and Bureau/Office.
2	The stakeholders can navigate through a dashboard with all the KPIs in the analysis plan of DM No. 2021-0100.
3	The stakeholders can acquire insights on the results of the survey questionnaire in both the quantitative (rating) and qualitative data (comments).

More importantly, requirements on the technical specifications of the solution were also defined to show the system's control flow, primary modules, user interface, and system scope (see Table 2).

TABLE II. TECHNICAL SPECIFICATION

No.	Technical Area	Requirements
1	Data	Service Code, Survey client/patient demographics, Survey client/patient ratings and comments, and Stakeholder inquiries or business questions that can be addressed by the data Client/Patient Scenario
2	Control Flow	<ul style="list-style-type: none"> The client/patient accesses the website via URL in a web browser. The client/patient enters a unique transaction-specific service code on the website. The client/patient is redirected to a WebForm with field validation rules. The client/patient submits a complete self-administered web survey. The system captures and stores the completed questionnaire as a transaction (unique row) in the database. The client/patient receives a confirmation that the survey was completed.

No.	Technical Area	Requirements
		<ul style="list-style-type: none"> The client/patient should be unique and controlled for each survey question answered. Stakeholder Scenario <ul style="list-style-type: none"> The stakeholder accesses the website either via general QR or URL in a web browser. The client is provided a comprehensive dashboard and UI to ask questions about both quantitative and qualitative data.
3	Main Modules	(1)The Data Entry Web Form with validation rules and (2)Stakeholder Dashboard App
4	Interface	A web-based interface for both client/patients and stakeholders that is intuitive for data entry, storage, and analytics of customer satisfaction results.
5	Scope	<p>While there are three survey forms in DM No. 2021-0100, only Survey Form 1 or the Routine Services form is explored since it is the most frequently used form in the agency and common across sub-agencies.</p> <p>It is also assumed that there is an existing mechanism in place for the service code generation which is issued after a successful delivery of a service/s.</p>

B. Software Design

a) *UI/UX Design*: The design process yielded a user-friendly interface that seamlessly integrates the webforms and analytics functionalities (See Figure 3).

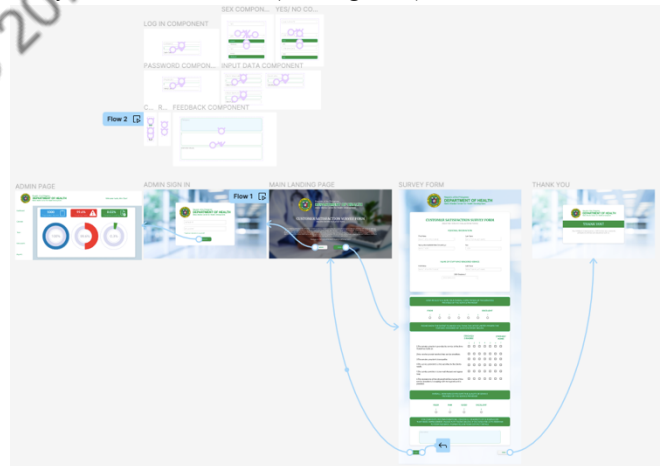


Fig. 3. Prototype web application mock-up via Figma.

The homepage is the central hub providing access to client-facing web forms and an Admin page. The web form interface presents all questions of the survey form in a single, intuitive viewport, streamlining the data entry process for clients. Upon successful submission, clients are redirected to an acknowledgment page confirming the completion of their transaction.

In contrast, an Admin page redirects qualified DOH users to a login portal, granting access to comprehensive analytics, reports, and dashboards for survey data analysis. This intuitive design approach enhances user experience and facilitates efficient navigation for clients and administrators, ensuring seamless interaction with the survey system.

a) *Data Design*: On the data side, an ER model was created with four primary entities to show a structured approach for capturing and analyzing the survey data. This model is illustrated in Figure 4.



Fig. 4. Entity relationship diagram of the web-form.

The four primary entities in the ER model are defined as:

1. **Client**: This entity represents individual clients/patients who have availed themselves health or health related administrative services from a provider.
2. **Provider**: This entity represents the service providers within the system. It is identified by a unique Provider ID (primary key) and includes attributes such as the specific offices and teams.
3. **Service List**: This entity maintains a comprehensive list of services offered by the providers. Each service is uniquely identified by a Service ID (primary key), with additional attributes, for example the service name.
4. **Form 1 Survey**: This central entity is the repository for all client survey data.

The data elements that will be collected, stored, and processed in this data model are defined in the data dictionary in Table 3.

TABLE III. DATA DICTIONARY

Data Element	Description	Data Type	Remarks
Service Code	Unique identifier associated with a specific service transaction	Alphanumeric	The code will be used to link survey responses to the corresponding service received by the client/patient.
Service Info	Inclusive of Service Availed, Name of	Text	Service availed and Name of Office are a

Data Element	Description	Data Type	Remarks
	Provider, and Name of Office		predefined list, while the name is a user input field.
Client/ Patient Demographics	Inclusive of Full name, email address, gender, birthdate, DOH Employee (Y/N)	Text and Date	This corresponds to basic client/patient information required by DM No. 2021-0100.
Survey Rating	Response provided by the client/patient to each survey question	Numeric	This is a likert scale based on the current DOH CSS forms where SERVQUAL questions are measured on a scale of 7.
Comments	Optional open-ended text response provided by the client/patient	Text	This allows for capturing qualitative feedback beyond the ratings.
Admin Profile and Credentials	Inclusive of first name, last name, email, and password	Text	This is used to allow users login to the Admin/ Analytics page of the website
Keyword/ Criteria	Specific terms or filters used by stakeholders to search and analyze survey data	Text	This enables stakeholders to focus on specific aspects of the report.

C. Prototyping and Implementation

Given the user requirements laid out in the first phases of the development cycle, a CSS web application prototype was developed to refine user experience and validate design assumptions before transitioning to full-scale development. The prototype only includes the front-end of the application following the mock-up designs in Figure 3. This prototype is currently live on: www.kenvdiaz725.pythonanywhere.com/.

The results of this prototype demonstrated several key findings that contributed to the design and features of the production level application.

Firstly, the prototype validated design assumptions and refined user workflows by simulating the intended user experience and gather feedback from internal testing and weekly stand-up sessions. For example, instead of having the whole survey form in one view port, a better design is to divide the form into manageable sections with guided visual cues and auto generation and validation of service and service provider details. Since in the prototype, all information is currently encoded by the Client/Patient.

Secondly, the prototype also uncover potential design issues and challenges early on such as: most users would be accessing the web application on a hand held device (including tablets) rather than a desktop or laptop, while the dashboard and reports are best presented on a full desktop screen as this is used by administrative staff on site. It was also observed that despite having only one platform for both the webforms and analytics services on the Admin page, these two

modules should be independent in both design and technical specification but complementary of each other. Hence, the homepage was redesigned to focus primarily on survey administration that would immediately redirects the user to the survey forms after entering a unique and valid service code, while the Login and Register feature of the Admin page was placed conspicuously in a navigation menu on the homepage and other pages of the website.

Lastly, the prototype served as a proof of concept which demonstrates the feasibility of the proposed solution and alignment with stakeholder expectations. More so, it also provided an avenue to add more sections in the website which includes the “About us” and “Contact us” sections to inform website goers, patients/clients, and stakeholders details about the platform and contact should there be any issues or concerns raised about the web application system.

Following the prototyping phase, the implementation stage of the web-based application marked a critical progression towards realizing the envisioned website. Informed by insights gleaned during prototyping, the implementation processes focused on translating design concepts into a fully functional website while maintaining a commitment to deliver a seamless user experience. Leveraging on industry-standard tools and frameworks, a robust website with integrated analytics capabilities was developed as shown in Figure 5. This approach ensured that the website not only meets functional requirements but also facilitated data-driven decision-making and performance monitoring for users. Currently, the implemented website is hosted on www.arisedb.com website.

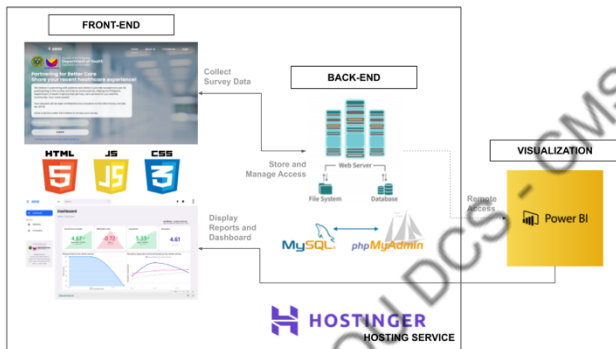


Fig. 5. Implementation architecture of the Web Application system.

D. Block-box Testing and Stakeholder Feedback

In conjunction with the implementation phase, the testing phase employed a black-box testing approach, focusing primarily on functional testing to ensure the robustness and reliability of the developed web-application.

Conducted internally by the project team, this comprehensive evaluation aimed to validate the application's adherence to specified requirements and its ability to perform expected task accurately. The functional testing process systematically examined the high-level functions of the website grouped according to the two main module of the system: Data Entry Web Form (Survey) and Stakeholder Dashboard App (Admin Page).

TABLE IV. HIGH-LEVEL FUNCTIONS (BY MODULE)

Data Entry Web Form (Survey) Module	
Req. ID	Description
WSREQ1	Functional Web Application site interface
WSREQ2	Can validate unique transaction-specific service code to ensure client/patient is unique and controlled for each survey question answered.
WSREQ3	Web survey form with field validation rules.
WSREQ4	Client/Patient can submit a valid self-administered web survey form.
WSREQ5	The web application system can capture, and store completed web survey forms as a transaction (unique row) in the database.
WSREQ6	Client/Patient receives confirmation upon survey completion.
Stakeholder Dashboard App (Admin Page) Module	
Req. ID	Description
WDREQ1	Functional Web Application dashboard accessible to stakeholders via admin user credentials.
WDREQ2	Comprehensive dashboard and UI for quantitative and qualitative data.

For each of these high-level functions in Table 4, test scenarios on the expected behavior of the website were developed and executed. A total of four test scenarios with at least three test cases each were laid out for both the Web Form and Admin page modules. Details and results of these tests scenarios are outlined in Tables 5 – 8.

TABLE V. TEST SUMMARY RESULT FOR TEST SCENARIO #1

Test Scenario #1:	Enter a valid service code in the Web	
Objectives:	1. Verify the accessibility of the web application when accessed online. 2. Verify if the web application can validate a valid and unique service code.	
Requirements:	WSREQ1, WSREQ2	
Pre-conditions	Need to use Chrome on a desktop and a valid service code.	
Test Case	Expected Output	Result
Access the Web Application	The homepage of the website will load on the browser	Pass
Enter a valid service code	It should load the web application page 1 of the Survey Form	Pass
Enter an invalid service code	It should prompt the notification “The code is invalid”	Pass

TABLE VI. TEST SUMMARY RESULT FOR TEST SCENARIO #2

Test Scenario #2:	Answer and submit the survey form in the Web Application	
Objectives:	1. Verify the accessibility of the web application survey form when accessed via the Chrome browser. 2. Verify if the web application can validate the survey form against the validation rules: a) Required field marked with an asterisk, and b) valid email.	
Requirements:	WSREQ3, WSREQ4	
Pre-conditions	Need to use Chrome on desktop and valid answers on the survey form.	
Test Case	Expected Output	Result
Access the web application survey form.	The 3-page web application survey form should load on the browser.	Pass
Submit an invalid survey form. - Empty required fields - Email format	It should prompt the error notifications.	Pass

Submit a complete and valid survey form.	It should proceed to the next page	Pass
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TABLE VII. TEST SUMMARY RESULT FOR TEST SCENARIO #3

Test Scenario #3:	Access and interact with the Dashboard Application	
Objectives:	1. Verify the accessibility of the Dashboard web application when accessed via the Chrome browser. 2. Verify if PowerBI was successfully integrated. 3. Verify if survey form data are stored and reflected on the Dashboard Application.	
Requirements:	WSREQ5, WSREQ6, WDREQ1, WDREQ2	
Pre-conditions	Need to use Chrome on desktop and have a valid admin account (username/password). PowerBI for the dashboard features.	
Test Case	Expected Output	Result
Admin sign-in with invalid credentials	Error notification to ask for valid login credentials.	Pass
Admin sign-in with valid credentials	Successful sign-in/login to the Dashboard Application.	Pass
The survey form submitted was stored in the database and a unique code was recorded.	In SERVQUAL page 2 under Survey Transaction should reflect the previously submitted survey form answers including the Unique Row for the service code.	Pass
Data visualization	The Dashboard Application should render a comprehensive dashboard powered by PowerBI with its intricate data visualization options and features such as filters and focus mode.	Pass

TABLE VIII. TEST SUMMARY RESULT FOR TEST SCENARIO #4

Test Scenario #4:	Additional features.	
Objectives:	Verify additional features included in the Web Form Application	
Requirements:	N/A	
Pre-conditions	N/A	
Test Case	Expected Output	Result
SERVQUAL Reporting	It should show a SERVQUAL report that captures consumer expectations and perceptions of a service. It also should have a filter feature (by date, provider, and DOH Employee).	Pass
Survey Transaction	It should show all captured Survey Transactions data (Date, Code, Office, Team, DOH, Service, Age, Gender, Questions, and Response) which can be sorted. It should also have a filter feature (by date, code, provider, DOH Employee, service, and gender).	Pass
Comments analysis feature	It should show a Sentiment analysis from the comments and display a section for "Key Phrases". It should also have a filter feature (by date, provider, DOH Employee, and service).	Pass
Functional "About us" page	It should render an "About us" page that reflects the project description and the team members.	Pass
Functional "Contact us" page	It should render a "Contact us" page with the following fields:	Pass

	Name, Email address, and Message. As well as a submit button.	
Sign-up/Register	It should show a sign-up page with the required fields, remember me option, and terms & conditions. Function to allow the user to create an account. Login using the registered account.	Pass

The system testing results for the Web-based application showcase its successful validation across various test scenarios. From confirming the accessibility and accurate validation of unique service codes to ensuring seamless functionality of the survey form and dashboard application, the system testing process affirms the robustness, reliability, and adherence to requirements of the developed platform.

Additionally, the implementation of additional features, such as SERVQUAL reporting and Comments Analyses, further enhances the application's capabilities, providing intuitive dashboards, accurate data reflection and insightful analysis. Auxiliary pages like "About Us" and "Contact Us" demonstrate seamless navigation and interaction within the application. Overall, the comprehensive system testing validates the web application's readiness for deployment and use, ensuring its effectiveness in meeting the needs of stakeholders and end-users alike.

Furthermore, on stakeholder testing, feedback was received from one of the current leads in the PMSMD through an informal channel and extended her appreciation and commendation to the proposed system. More so, a significant feature that she highlighted, especially on the reporting side is the ability of the system to performer high and low level disaggregation's of the report for both the SERVQUAL and Comments Analyses sections. She further added that future improvements may also include a standard analysis feature that would explicitly indicate and measure "Good" and "Bad" performance of a certain office or team within the department. As well as the fixing of minor issues in the survey buttons and compatibility of the Webforms in most mobile UI. All of which can be extended through further iterations and addition of a maintenance phase in the development framework. The full text of this feedback is shown in Figure 6.

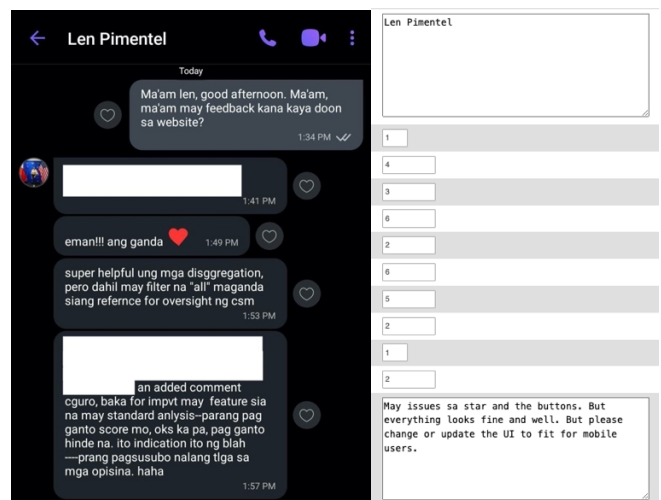


Fig. 6. Screenshot of Stakeholder feedback on Viber (left) and in the WebForm (right).

E. System Comparative Assessment

The comparison between the manual and proposed automated system as shown in Figure 6 unveils significant disparities in terms of efficiency, resource utilization, and overall complexity. In the manual survey administration process, the sequential steps involved in data collection, entry, storage, and not even including analysis necessitate considerable time and labor investments. Initially, providers must physically distribute survey forms to clients/patients, a task that often requires coordination across multiple stakeholders and locations. Subsequently, clients/patients manually fill-out the paper-based forms, which are then collected, transported, and manually entered into an Excel workbook by administrative staff. This iterative process not only consumes valuable time and at least two human resource but also introduces opportunities for errors, inconsistencies, and data loss, particularly during transcription and data entry stages.

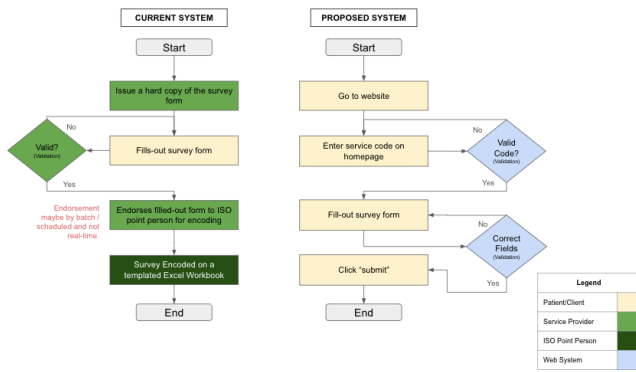


Fig. 7. Simplified survey administration and encoding process comparison: Current VS Proposed web-based System.

Conversely, the proposed automated system streamlines the entire survey administration process, significantly reducing the time and effort required for data collection and analysis. Through web-based forms, clients/patients can conveniently access and complete survey forms online, eliminating the need for physical distribution and manual data entry. Moreover, the integration of data automated validation rules ensures data accuracy and completeness in real-time, minimizing errors and discrepancy. Administrative personnel are freed from manual data entry tasks, allowing them to focus on more value-added activities i.e., data analysis, interpretation, and decision-making. This reduction in manual labor not only enhances operational efficiency but also mitigates the risk of human error, ultimately leading to more reliable and actionable insights for stakeholders.

V. CONCLUSION

The development of a web-based application with embedded interactive analytics for Customer Satisfaction Survey in the DOH represents a pivotal advancements in the realm of public health service provision in the Philippines. The transition from manual survey processes to automated systems not only addresses the inherent limitations and challenges associated with the traditional methods but also heralds a new era of efficiency, accuracy, and transparency in data collection and analyses. Through system testing, the robustness and reliability of the developed web-based application have been affirmed, validating its readiness for deployment and utilization by stakeholders and end-users. The successful validation of high-level functions across various

test scenarios underscores the effectiveness of the implemented solution in streamlining data entry, storage, management, and analysis processes, thereby enhancing the overall quality of public health service delivery.

Moreover, the comparison between the automated system and the current manual intervention highlights the transformative impact of technological innovation on service delivery outcomes. The shift towards digital surveys not only enhances convenience, accessibility, and privacy for survey respondents but also significantly improves data accuracy, reliability, and timeliness. Stakeholder feedback further underscores the positive reception and acceptance of the proposed system, affirming its alignment with user needs and expectations. This paradigm shift towards modernization in public health service provision underscores the pivotal role of technology in facilitating evidence-based decision-making, resource allocation, and performance monitoring, ultimately advancing the overarching goal of delivering high-quality healthcare services to all Filipinos.

In conclusion, the adoption of web-based application for survey administration and data analytics represents a significant step forward in the pursuit of improved public health service delivery in the Philippines. By leveraging technology to automate and streamline critical processes, the developed system not only enhances operational efficiency and data reliability but also foster greater transparency, accountability, and stakeholder engagement. Moving forward, continued investment in technological innovation and capacity-building initiatives will be essential to sustain and expand the benefits of digital transformation in the public health sector, ultimately contributing to better health outcomes and improved quality of life for all.

ACKNOWLEDGMENT

The authors would like to express sincere gratitude to all those who have provided support and encouragement throughout the completion of this project.

REFERENCES

- [1] Department of Health, "Department of Health," 2008. [Online]. Available: https://www.dbm.gov.ph/wpcontent/uploads/OPCCB/opif_2008/OPI_F/doh-FINAL.pdf
- [2] Department of Health, "Updated Customer Satisfaction Survey (CSS) Form," 2021.
- [3] B. Klievink, N. Bharosa, and Y. H. Tan, "The collaborative realization of public values and business goals: governance and infrastructure of public-private information platforms," *Government Information Quarterly*, vol. 33, no. 1, pp. 67-79, 2016. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S0740624X15300241>
- [4] H. Salvatori, "Advantage and disadvantages of online surveys," *Cvent*, 2023. [Online]. Available: <https://www.cvent.com/en/blog/events/advantages-disadvantages-online-surveys>
- [5] M. S. Mahmud, M. A. M. Tahir, N. H. M. Foziah, and P. L. Ghazali, "Customer satisfaction and corporate image in government initiative influencing customers loyalty in Terengganu, Malaysia," *Advances in Social Science, Education and Humanities Research*, vol. 292, 2018. [Online]. Available: <https://www.atlantispress.com/article/55911058.pdf>
- [6] P. Cleave, "Customer satisfaction surveys – why they are important?" *Smart Survey*, 2017. [Online]. Available: <https://www.smartsurvey.co.uk/blog/why-are-customer-satisfaction-surveys-so-important>

- [7] R. Boyle, "Measuring customer satisfaction in local government," IPA - Institute of Public Administration, 2020. [Online]. Available: https://www.ipa.ie/_fileUpload/Documents/measuring.pdf
- [8] C. Lardizabal, J. Mapa, G. Taguinod, F. Vigonte, and M. V. Abante, "Analyzing client satisfaction with government office services: a study of demographic data and empirical findings – IMRAD," World Citi Colleges, 2023. [Online]. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4616372
- [9] E. Scornavacca, J. L. Becker, and S. J. Barnes, "Developing automated e-survey and control tools: an application in industrial management," *Industrial Management & Data Systems*, vol. 104, no. 3, pp. 189-200, 2004. [Online]. Available: <https://doi.org/10.1108/02635570410525744>
- [10] S. Watt, C. Simpson, and V. Nunn, "Electronic course surveys: does automating feedback and reporting give better results?" *Assessment & Evaluation in Higher Education*, vol. 27, no. 4, pp. 325-337, 2002. [Online]. Available: <https://doi.org/10.1080/0260293022000001346>
- [11] P. Borse, A. Chinchpure, R. S. Deepak, and S. Shinde, "Comprehensive faculty appraisal and development system using data analytics and data visualization," in 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBE), Pune, India, 2018, pp. 1-6. [Online]. Available: <https://doi.org/10.1109/ICCUBE.2018.8697379>
- [12] Z. Davis, C. Brill, H. Siddiqui, and A. Olmsted, "Automating e-surveys," in 2016 International Conference on Information Society (i-Society), Dublin, Ireland, 2016, pp. 103-104. [Online]. Available: <https://doi.org/10.1109/i-Society.2016.7854187>
- [13] A. Sarhan, O. Addam, J. Rokne, and R. Alhajj, "Utilizing digitized surveys for data collection: the case of developing countries," in *Proceedings of the Future Technologies Conference (FTC) 2020*, Volume 3, 2021, pp. 1-6. [Online]. Available: https://doi.org/10.1007/978-3-030-63092-8_11
- [14] I. P. Sari, M. S. Roikhan Maulana, E. Septiandini, and A. R. Rusmantoro, "Web-based educational administration system for student affairs: an initial step to develop data-driven decision making," in 2020 International Conference on Informatics, Multimedia, Cyber and Information System (ICIMCIS), Jakarta, Indonesia, 2020, pp. 142-146. [Online]. Available: <https://doi.org/10.1109/ICIMCIS51567.2020.9354322>
- [15] J. T. Bajar, "E-government in the Philippines: an assessment," *Ciencia: Humanities, Education, Arts, Languages and Social Sciences (HEALS)*, vol. 1, no. 1, pp. 26-50, 2021. [Online]. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3762071
- [16] C. Dawda, "Exploring the efficacy of e-government models through information systems management – case of The Gambia," *Arden University – Munich Personal RePEc Archive*, 2022. [Online]. Available: https://mpra.ub.uni-muenchen.de/113400/9/MPRA_paper_113400.pdf
- [17] E. Estevez, T. Janowski, and B. Roseth, "When does automation in government thrive or flounder?" *Inter-American Development Bank Felipe Herrera Library*, 2024. [Online]. Available: <https://publications.iadb.org/en/when-does-automation-government-thrive-or-flounder>
- [18] J. Kowieski, "Embedded analytics: a step-by-step guide to unlocking your data's potential," *Thought Spot*, 2023. [Online]. Available: <https://www.thoughtspot.com/data-trends/embedded-analytics>
- [19] W. Dodeen, "Exploring the quality of e-government service from citizens' perspectives," *RMIT University*, 2019. [Online]. Available: <https://core.ac.uk/download/pdf/224795752.pdf>
- [20] U. S. Senarath, "Waterfall Methodology, Prototyping, and Agile Development," *ResearchGate*, 2021. [Online]. Available: https://www.researchgate.net/profile/Udesh-S-Senarath/publication/353324450_Waterfall_Methodology_Prototyping_and_Agile_Development/links/60f41f71fb568a7098b9d035/Waterfall-Methodology-Prototyping-and-Agile-Development.pdf