

# Public Feedback on the Programs and Services of Municipal Health Office of Padada through Sentiment Analysis using Convolutional Neural Network

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## ABSTRACT

This project goal is to assist the Municipal Health Office of Padada in its daily operation in terms of collecting and facilitating data through its client satisfactory survey forms. There are two systems deployed which is the Web portal and Mobile application. Web portal is the medium to assist municipal health office administrators in reviewing the submitted data and its results coming from the clients who are using the mobile application, modification of the existing details of the programs and services and posting important announcements. The mobile application is utilized by the clients, in medium of submission, the clients can receive announcements posted by the administrators for information dissemination, review the programs and services that is being offered in the health office and the easy access on giving its satisfactory rating and comments. The app was created with through Java (React Native Framework) and JavaScript(ReactS, NodeJS) and with Firebase product and its tools. To obtain final feedback and validate whether or not the desired output was successfully materialized, various testing methods were used. Test cases and results were made and disseminated. The findings indicate that the system passed the testing phase and met the users requirements. Moreover, using the Web portal and Mobile Application, these applications provide user with a quick, easy-to-use and efficiently facilitating results from the collected data coming from different users and automated sending of satisfactory rating and comments.

**Keywords:** Automated, electronic, Web portal, Mobile Application, CNN, Comments

## 1. INTRODUCTION

Government agencies play an essential role in the growth of a society, providing relations between individuals and governments. Fix the issues and concerns of its society, enact policies, and hold power over its populations. Due to the pandemic (covid-19), the front-line service is the essential service that must take place across the globe and

in every corner of the government. Government health offices should have the tremendous responsibility to provide their individuals with the various medical services they need. The organizations recognize that this distribution of this particular medical attention to their individuals is not only a by-product of the delivery of services but rather drives the office and maybe the critical factor in deciding the service to its citizens' success or failure. To use this knowledge, the office must understand the medical delivery, distribution, personnel, climate, and facility organizations. The proficiency of positioning services to its people must not be taken for granted.

The Municipality of Padada Health Office provides its residents with various medical services. At various ages, these Padadadeños composers vary, even for various medical attention. Health office activities include periodic Padada reviews for the elderly and services such as free vitamins. Pregnant women, their status needs to be tested and tracked as well. Other services include tooth extraction, circumcision, blood- letting, free-check, etc. According to the health officer/ nurse Ms. Nurse, the average number of clients daily needing extra medical attention is 60-70. It is also easy to keep track of the participants and their client's satisfactory survey for doing this activity years before provided that the only way to keep this information is to store it in a small box, which will be opened after a month and checked manually. This client satisfaction survey is very vital because the health office has this annual request for renewal for accreditation and local score card, also known as the local health system. Currently, the Municipality of Padada Health Office still delivers this service. However, from the perspective of keeping this post-evaluation client satisfactory survey, a growing population and making output is another story. They manually pick up the client's satisfactory forms in the box and have to read what are the comments and suggestions written in the form and also identify whether the rating is good or not In this way, the office creates a decision. In this instance, how the client's satisfactory rating survey form was handled raises the significant risk in making decisions, forming a better understanding, hearing the right attitudes from the clients,

and identifying the correct rating. On the enumerated scenarios above, the identified problems such as the handling of the client satisfactory survey form, generating reports such as the number of the individuals and its ratings in each indicators and the its comments since it is manually generated and the identification of the assumed attitude of the clients based from its feedback desires the researcher to build cross-platform system to understand the clients better is for its cause.

## 1.2 Purpose and Description

As mentioned above, the average client per day that needs medical attention at the municipal health office of Padada is around 60–70 individuals, ranging from different ages, sex, body type, culture, norms, and principles. The municipal health office also encountered some instances where the individual needing medical attention was not from Padada but had to accommodate them According to the Nurse, that statistic has increased from years ago, which makes the demand for medical attention increase because of the increasing population of at least 29,878 in 2020, an increase of 17,731 people over 60 years. The latest census figures in 2020 denote a positive growth rate of 2.49%, or an increase of 3,291 people, from the previous population of 26,587 in 2015.[10]. This increased population also means the number of clients might require medical attention. Suppose this is a figure for the client satisfaction survey. In that case, it will be heavy because the report to be made from the office is monthly, so they have to open the container containing the forms and manually read and interpret the records. The system will significantly help the beneficiary, especially the nurse head and the attendees. They only need to monitor the data thru the web portal from the data gathered from the users. This also portrays the graph from the automated result from the sentiment analysis through the work of CNN that classifies whether the comment is positive, neutral, or negative. The users will only have to use the mobile client satisfactory app on their mobile phone, and they can leave comments and ratings there.

The researcher proposes cross-platform applications: Web and mobile applications. The head nurse can view the comments, read the words, and interpret the graph from the data gathered from user ratings and comments. It implies that the web can generate relevant and accurate results because the form can now be automated, and the amount of data will be counted precisely and securely. The data rating score and the comments will be placed accurately in the database. With this web capability, the municipal health office will be productive in processing results from the analysis and their derivatives and documentation. In the mobile application, the user can quickly leave their ratings and comments. Those ratings and comments are significant because they will be part of the official documentation. This capability is convenient because it will be just one click away, sent automatically, and viewed on the web. Establishing a system of this kind

is necessary, especially in these trying times like the pandemic, where we must move from the traditional written to the automated one. This implies that the mobile feature is necessary for automation and technological upgrades both from the office and the individual.

## 1.3 Objectives of the Study

The main objective of this study is to help the municipal health office receive clients' suitable survey forms electronically, post and receive announcements, and monitor the client's sentiments and ratings. Specifically, this study intends to perform the following.

1. To develop a cross-platform system for mobile and web applications using Java (React Native Framework) and JavaScript(ReactJS, NodeJS).
2. Develop a module on online client satisfaction surveys wherein leaving comments and ratings may be made possible out of the office through a mobile application.
3. To develop a feature that will provide the data collected using quantitative tools such as mean, median, and mode.
4. To develop a feature that will classify comments, whether it is positive, neutral, or negative, using a Convolutional Neural Network.

## 1.4 Scope and Limitation

This proposal's research scope and limitations are subjected to the Municipality of Padada, which is the beneficiary of this research and the most likely to use the system. The proposed method utilizes mobile and web development, and it is inevitable that it will mostly work when the device is connected to the Internet. The user can fill up the necessary information on their smartphone and send it through a one-click process. It will also provide extra details, like announcements and updates on the municipality's activities. On the other hand, the administrator will use the website to post updates, including downloading the results in PDF format. The admin can only exercise this feature. In the area of the language, Bisaya, Basic English and Tagalog was used in this research for the model for its learning mechanism but because of the wide array of languages used by each individual, the model foreign words will be taken as unidentified language.

## 2. REVIEW OF RELATED LITERATURES AND SYSTEMS

A description of some related studies and applications is given in this chapter, which highlights the functions performed by some researchers and programmers to help develop the concept of the application.

## 2.1 Related Literatures

An emotion is a perspective or attitude toward a circumstance or occurrence. It frequently involves a variety of self-indulgent emotions, including delight, tenderness, sadness, and nostalgia. One can define sentiment labels in terms of polarity or valence (e.g., positive, neutral, and negative) or several emotional states (e.g., angry, happy, sad, proud). Although machine learning approaches have been widely employed and have demonstrated relatively good performance, they heavily rely on manually-defined features, the definition of which requires considerable effort from domain experts. In recent years, deep learning approaches have gained popularity because they may reduce the work required to define features and achieve relatively high performance (e.g., accuracy). It has been demonstrated that a single convolutional layer, a mixture of convolutional filters, can achieve comparable performance without the need for hyperparameter tweaking. Additionally, CNN does not require specialized knowledge of the linguistic structure of a target language. Due to these benefits, CNN has been effectively applied to different text analyses, including semantic parsing, query-based search, and sentence modeling. CNN, which has been extensively used to image datasets, extracts the image's key features as the "convolutional" filter (i.e., kernel) traverses the image. The same CNN function might be applied to the text if the input data are presented as a single dimension. As the filter is moved across the text area, local text information is recorded, and key features are extracted. Therefore, CNN is effective for text classification[8]. There have also been studies defining hand-crafted characteristics for sentiment classification. Using emotive lexicon, misspelling, and emoticons as features, Yassine and Hajj[11]attained 87 percent accuracy for ternary classification using the SVM. Other ways classify emotions on two scales: the valence of the emotion, which indicates whether the sensation is pleasant or negative, and the arousal level, which indicates the intensity of the emotion. [12]. employed unigram features for sentiment binary classification and achieved 79 percent utilizing the NB for the data consisting of translated Urdu tweets. All of these experiments using n-gram features generally produced accuracies ranging from 70–90 percent, and the SVM was the model that proved to be the most successful [13]. It was suggested to use the CNN model, which consisted of three convolution/pooling layer pairs. The performance of this model was superior to that of other earlier models, such as the Matrix-Vector Recursive Neural Network (MV-RNN)[14]. Using a deep convolutional neural network, they analyze Twitter sentiment. The network is trained using big text corpora's unsupervised word embeddings. We add two fully connected layers with dropout and a softmax layer to CNN with multiple filters and window widths. According to our research, using pre- trained word vectors and Twitter corpora for unsupervised learning is beneficial.

The experiment uses benchmark datasets from SemEval 2015's Twitter sentiment analysis job. We obtain comparable performance to state-of-the-art approaches on the Twitter2015 set without hand-crafted features, with an F1 score of 64.85%. [15]. Current methods that use artificial neural networks (ANNs) have demonstrated encouraging results for classifying short texts. However, many short texts occur in sequences (for example, sentences in a document or utterances in a dialog), and the majority of the currently available ANN-based systems do not utilize the short texts that came before to classify the short text that comes after it. In this study, it was provide a model that includes the brief sentences that came before it This model is based on recurrent neural networks and convolutional neural networks. . The model can obtain state-of-the-art results for the prediction of dialog acts on three independent datasets.[16]. Many NLP tasks require sentiment analysis of a text. As social media develops, sentiment analysis is needed to extract useful information from Internet's vast data. We're interested in employing deep learning models for sentiment analysis. In this research, we propose Word2vec + CNN and test it on a corpus of movie review excerpts labeled negative, slightly negative, neural, somewhat positive, and positive. Our network achieves 45.4% test accuracy in this dataset, which is better than RNN and MVRN (MV-RNN)[17].

## 2.2 Related Systems

A deep learning system for sentiment analysis and emotion recognition in Twitter tweets is demonstrated in the work of [18]. The system comprises of a classifier for which they tested a variety of different classifying methods and a convolutional neural network utilized for extracting characteristics from textual data. Using pre-defined word embeddings discovered through unsupervised learning on sizable text corpora, we trained the network and compared the performance of various word vectors for the task. used datasets from the Sentiment analysis in Twitter task from the SemEval competition to evaluate the system on 3-class sentiment analysis. Using an automatically annotated dataset with 7 distinct emotions, they also investigated the method's efficacy for emotion recognition. The architecture enhances outcomes in the area of emotion detection on the test we use in our evaluation and achieves comparable performances to state-of-the-art methods in sentiment analysis. [19] implements a Convolutional Neural Network model that can recommend airline tickets using BERT to classify internet reviews' sentiment. Using reviews from six social networks, different sentiment categorization methods are compared. The new approach classifies airline tickets as affordable choice or not based on customer happiness, destination, hotel information, eateries, and tourism attractions. First, it explores the importance of choosing a transfer learning model for sentiment categorization of online social platforms in recommender system prediction accuracy. Second, the



from the users is being stored, accessed, and managed from the database. The database contains all the data and functions so that they can modify them, added, updated, and deleted (if the logic permits).

The convolutional neural network (CNN) is a neural network with one or more convolutional layers that is used mostly for image processing, classification, segmentation, and other auto-correlated data processing; this research focuses on the classification of the comment, whether the statement is positive, neutral or negative. After the CNN classification, the words will be categorized accordingly, whether positive, neutral, or negative with this, the graph will be used to illustrate the results better and can easily be readable by the human eyes.

### 3.3 Technicality of the Project

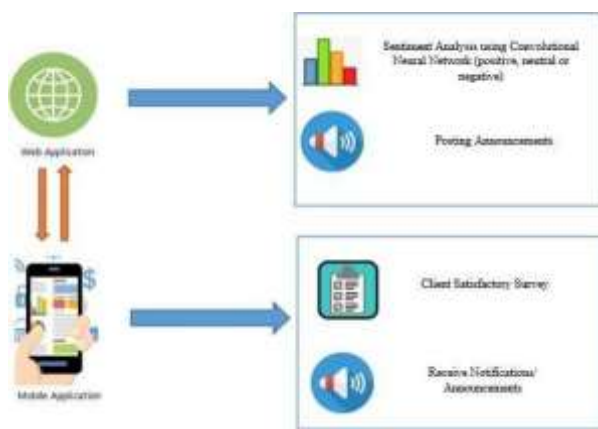


Figure 3: Technicality of the Project

#### 3.3.1 Website

In figure 3: The website is where all the necessary processes are made, and the administrator will only operate it. It consists of features like posting relevant announcements related to the municipal health office development, updates, and a calendar of activities. On this side also resides the application of the CNN, which will generate the results from the text classification and be presented through a graph. The posting graph consists of positive, neutral, or adverse comments. The results from the statistical tool will also be applied here, shown in a separate graph.

#### 3.3.2 Mobile Application

General mobile users use the application and answer the survey questionnaire. They can leave their respective ratings and comments. The user clicks the submit button, and it automatically sends and saves. The accumulated data will be utilized by the web and for data analysis. The mobile user will also get notifications whenever the administrator posts important announcements regarding municipal instructions, development, health issues, etc.

### 3.4 Sentiment Analysis

Sentiment analysis of text content is essential for many natural language processing tasks. Sentiment analysis is a market analysis that includes using text analysis, biometrics, natural language processing, and computational linguistics to recognize the state of the said information. In simple terms, it is the process of determining whether a piece of content, like in this instance, the comments from the client of the municipal health office of Padada, is negative, positive, or neutral. Sentiment analysis enables you to ascertain public opinion and understand consumer experiences. This research uses fine-grained sentiment analysis because the model derives polarity precision. It conducts a sentiment analysis across polarity categories: positive, neutral, or negative. [9] Thus, as the amount of textual data is exponentially increasing, it becomes more important to use a tool to analyze and classify text data automatically. The text may contain various labels, such as gender, age, country, sentiment, etc. Using such labels may benefit some industry fields, like the health office of Padada. Many studies of text classification have appeared, and recently, CNN has been adopted for sentiment classification.

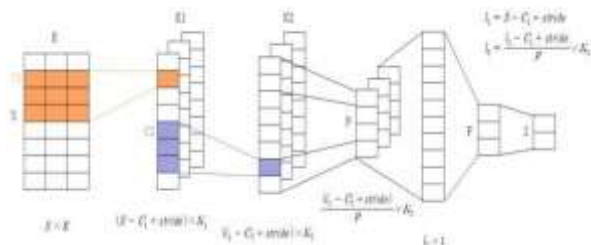
### 3.5 Convolutional Neural Network

The Convolutional Neural Network, one of the known research employing deep learning to categorize text, makes use of so-called convolutional filters, which automatically learn to be appropriate for the given task. As demonstrated in the paper [1], convolutional filters may capture fundamental syntactic and semantic aspects of emotive expression if we utilize CNN for sentiment categorization. CNN also doesn't demand in-depth familiarity with a target language's linguistic structure [2]. Others may counter that CNN is not superior to other analysis tools for maintaining word order, but CNN not only has that ability but also has the ability to capture sequential patterns as they relate to local patterns by the convolutional filters; for example, the filters along with the attention technique have been successfully applied to machine translation[3]. In addition, compared to the other tools, CNN typically has a smaller number of features[4].

One of the three subtasks in sentiment analysis noted by [5] is to determine the polarity or orientation of a text. Subsequently, the goal to predict the class of the comment/sentence via the sentiment analysis using CNN primarily needs the corpora that serve as the basis for polarity detection application. This corpus plays a vital role in all information retrieval systems needed to drive the model classifier to obtain helpful information resources. The corpora that have plenty of words and sentences [6][7] will be used for training the classifier and predicting the class/polarity for the sentiment analysis.

The "convolutional" filter (also known as the kernel) of CNN, which has been widely employed on image

datasets, extracts the important features of the image as it passes through it. The exact CNN function might be utilized in the text as well if the input data are provided as one-dimensional. While the filter is moving across the text area, local text information is saved there and key components are extracted. Consequently, it is efficient to use CNN for text classification[8].



**Figure 4:** The graphical representation of the network (Kim & Jeong, 2019)

In figure 4. They explained that the model has An  $S \times E$  matrix is produced by an embedding layer that maps each word of a sentence to an  $E$ -dimensional feature vector, where  $E$  represents the embedding size. It is a layer that digitizes the topic by arranging words received as input into a semantically well-designed area where words with similar meanings are close together and words with opposite meanings are far away. The embedding layer is the process of transforming a two-dimensional matrix into a low-dimensional vector space in order to produce a word vector.

This also explained that in the output of the embedding layer, the  $S \times E$  matrix, is then laid down as the first convolutional layer. The  $C1 \times E$  matrix is the first convolutional layer, and it stores the local information required to identify the sentiment in a  $S \times E$  matrix and communicate it to the next convolutional layer. The  $C1 \times E$  matrix slides (i.e., convolves) all of the  $S \times E$  matrix values with an arbitrary stride, compute the dot product and transfers the dot product result to the next layer. The second convolutional layer uses the  $C2 \times K1$  matrix to extract features from the contextual information of the main word based on the local information stored in the first convolutional layer. The filter sizes of each convolutional layer are denoted by  $C1$  and  $C2$ , and the two convolutional layers have  $K1$  and  $K2$  different filters, respectively, to capture unique contextual information. In other words, the first convolutional layer examines simple contextual information while scanning the  $S \times E$  matrix, and the second convolutional layer examines key features and extracts them (e.g., worst, great) that contain sentiment influencing categorization.

The matrix that passed through the subsequent convolutional layer is used as the input to the pooling layer. While average-pooling and L2-norm pooling were used as pooling layer positions, the proponent employed max-pooling, a technique for picking the greatest value as a representation of the periphery

values. The proponent used the max-pooling technique because the sentiment is often defined by a combination of multiple words rather than conveying the sentiment in every word in the sentence.

The pooling layer slides all of the matrix values from the second convolutional layer with an arbitrary stride, resulting in output vectors. Because max-pooling is the layer that sends the largest value among numerous values to the next layer, the output vectors are substantially smaller. In other words, the convolutional layer examines the context and extracts the primary characteristics, while the pooling layer selects the most prominent features. After passing through the pooling layer, the two-dimensional feature map from the output is flattened to a one-dimensional format and delivered to an  $F$ -dimensional Fully-Connected (FC) layer. Because the FC layer only accepts one-dimensional vectors as input, the two-dimensional vector delivered by the pooling layer must be flattened. All input and output neurons are linked by the FC layer. A vector that goes through the FC layer produces a positive or negative output. In the FC layer, the activation function softmax is used to classify several classes. The softmax function generates a value, which is the probability value, for each class. Most people believe that having several convolutional layer stacks is better for storing local information and extracting contextual information; nevertheless, deep networks do not always outperform shallow networks. Because the variation of a network (e.g., deep or shallow) may depend on the length of the data and the number of data and features, this study found that data passing through two consecutive convolutional layers and then the pooling layer is effective at storing context information and extracting prominent features features[8].

### 3.5.1 Data Cleaning

In order to properly identify the appropriate sentiment of the comment, a comment must be clean before going to the model. There are employed steps in this area. Firstly, the model prepare a readable text making sure that everything must be in lowercase/ converted to lower cases. A "Ballpen" is not equal to "ballpen". Remove all the unwanted characters like punctuation, question marks, asterisk, since this is not necessary. After those processes, tokenization takes place. It is used to break the sentence into words. The model has stop words, SW are necessary to remove unwanted words/remove words that do not add meaning to the NLP. Result can be identified by how many times that word/s appear(positive, neutral or negative).

### 3.6 Project Tools

**3.6.1 Convolutional Neural Network - CNN** is the main technology used by the proponent to classify comments (Convolutional Neural Network). This is used to retrieve comments from a database, and each

one is handled as a moving, one- dimensional object. The most popular application for this kind of deep learning, which can be used on any platform, is the classification of images.

**3.6.2 Firebase** - The Google platform for creating powerful internet and mobile applications. Because Google fully controls and runs the backend elements of Firebase products and technologies, this platform was chosen. The Firebase client SDKs interface directly with these backend services, benefiting the proponent by eliminating the need for any middleware between the app and the service.

**3.6.3 Cloud function for Firebase** - A platform called Firebase enables app developers to store and deliver user-generated content including images, videos, and text passages. The data is saved in the cloud storage when a user registers for a mobile app, when a site administrator updates infographics or announcements, and when the program receives and saves user input.

**3.6.4 Functions in Firebase** - a serverless framework that enables the automatic execution of backend code in response to events brought on by Firebase features and HTTPS requests. When an event occurs, the cloud function is engaged and puts its purpose into action. The app's event kinds turn on five separate features.

- a) Mobile app user registration,
- b) Notification for announcements,
- c) User Log-in for both mobile and web users,
- d) Clients' survey data generated from the survey from,
- e.) Sentiment classification on the comments received from the users. Whether the text is positive, neutral, or negative

**3.6.5 Firebase Authentication** - It offers ready-to-use UI frameworks, simple SDKs, and backend services for user authentication. Having access to the user's Google account enables the app to manage it, store user data securely in the cloud, and provide a unified, individualized experience across all of the user's devices.

## 4. METHODOLOGY

This chapter discusses how the data is acquired and processed into information. This would be the proponent's strategy for developing the system, which would include public research, interviews, and other research methodologies, as well as current and historical information on the project. This would be the proponents' process of developing the system, including collecting data from the said office or recipient.

### 4.1 Development Approach

The researcher used Extreme Programming (XP), an agile project management approach, to develop the

system. This approach is because the proponent is looking for a process where the requirements cannot be fully predicted from the beginning but will constantly change as projects move on. Hence, proponents need a methodology capable of adapting to changing requirements during the project.

The main concern of the XP methodology is the ability to embrace changes that are likely to happen in projects. And that is what the proponent is looking for that fits the study. It begins at the planning stage and ends at the final output, where the system is fully functional. Following the XP methodology's dimensions correctly improved the system's development. Below are the processes that proponents start to undergo.

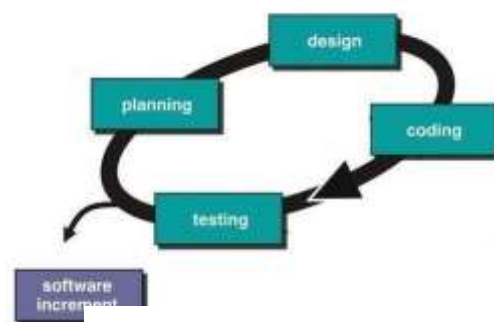


Figure 5: XP Agile Methodology

#### 4.1.1 Planning

In Figure 5. The municipal health office provided the data. Unfortunately, the only data provided was only the acceptable rating form, which in this form used to be an avenue to gather the sentiments and comments of the clients. As for the data from the previous years, it was kept by the Head Nurse or any on-duty attendant of the health office as it is part of the data privacy, and the HN only gives figures on the approximation of the clients per day (60-70 individuals). The said municipality is politically subdivided into 17 barangays, 3 of which comprise the "Poblacion," or urban center. The clients come from different barangays, but the office will also cater to some individuals in emergencies or urgent cases outside the municipality.

#### 4.1.2 Context Flow Diagram

The researcher presents a context flow diagram of the system to dig progressively more profound into how data is handled. This may include the current system and proposed system.

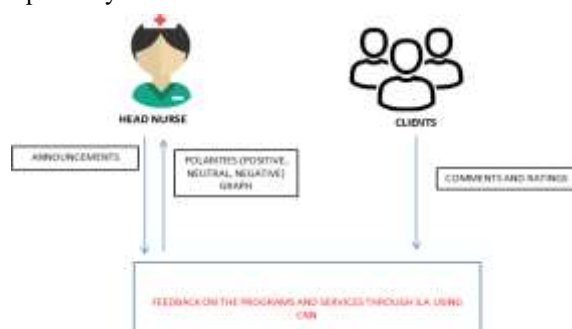


Figure 6: Context Flow Diagram





The municipal health office of Padada refers to this form. The client will only choose YES or NO whether he/she is satisfied or not in response to each question. After the client finally makes out this form and hits the save button, it will save it to the database in which all the data is stored and later on be used for the graphical representation of the results. The Convolutional Neural Network, or CNN, will work as the primary tool or algorithm to perform and generate polarities. These polarities are positive, neutral, or negative. CNN will call all the generated comments and classify whether the particular comment belongs to a particular polarity. Aside from the CNN, a simple statistical formula will assess the data gathered to illustrate the statistics in the graph better. The mean, median, and mode. The results can show the mean and median of all the yes-or-no data from the staff and facility ratings. These results can be viewed in each section after opening the facility's and staff's dashboards, respectively. In the presentation, polarities can be displayed using bar graphs, and in statistical results, they are posted on the dashboard automatically.

Ms. Nurse will be the administrator of the website, in which she can automatically generate the results and print the results in PNG, SVG, and CSV formats when necessary for future reference. The administrator can also post some important announcements that are relevant to the operations and the clients. This might include health issues, in which COVID is the main topic so far; rescheduling of activities; new services offered; emergencies; and even important matters such as (if needed) the schedule of activities so that the client will be informed and be part of the activities.

#### 4.1.5 System Requirements Specification

In this stage, the researchers show how the user can interact with the system and vice versa. This may include the Functional Requirements and Non-functional Requirements.

##### 4.1.5.1 Functional Requirements

The functional requirements refer to the operations and activities that a system must be able to perform. The municipal health office's Padada system has interfaces with admin user/s. These are the following things that users can do:

##### Website

**A. Login module** - This module allows the authorized user to enter the portal. Verify the user's credentials for security. Unauthorized users may have to ask permission directly from the administrator personally for accounts if necessary for valid reasons.

**B. Dashboard module** - allows the authorized user to add, edit, review, and delete existing records such as announcements, records, and results.

**C. Report Module** - This module allows the authorized user to review and print the results from CNN and statistical formulas. These results can be visually viewed through the pie and line graphs, respectively.

**D. Survey Module** - This module allows the user to review the results from the accumulated ratings and comments.

**E. Announcements Module** - This module allows users to send important and relevant announcements concerning health and other connected matters.

##### Mobile Application

**A. Login Module** - allows the authorized user to enter the mobile application. Verify the user's credentials for security. An unauthorized user may have to send an email notifying the administrator for clarification of the current account.

**B. Dashboard Module** - This module allows the user to view and receive notifications from the administrator, such as important announcements and other matters.

**C. Survey Module** - This module allows user to leave their respective ratings and comments.

##### 4.1.5.2 Non-Functional Requirements

**A. Security** - The municipal health office of the Padada system is secured through the username and password mechanism, which means only authorized users can access the website. The authorized user can only see data such as comments and ratings. This also applies to mobile application users that are secured through a username and password.

**B. Usability and Compatibility** - The municipal health office of padada system can be accessed through a desktop computer as long as it has an internet connection. The system itself is very understandable for user convenience. The mobile application requires an Android platform and iOS to run the system.

**C. Availability** - This system availability means that both the website and the mobile application require an internet connection to access the system thoroughly.

##### 4.1.6 Designing

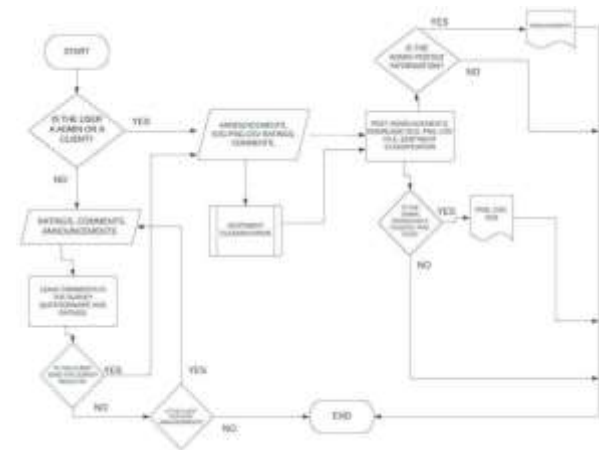
After planning, the researcher define the features of the system. By combining the idea and suggestions of the municipal health office officer, the researcher created two leading portals: a website and a mobile application. The website will serve as the main board for the administrator and mobile application for the clients. The Head Nurse Officer provided the sample survey form for guidance. Through the survey form, the client can leave their comments and ratings. Also, the website shows the plotted data from the results using CNN and statistical formulas. This result is in document format so that the admin can print it out for future reference. The website also shows the posted announcements that mobile application users receive. The researchers also

develop mobile applications for clients. The mobile application was handy for the client, in which they could leave their comments and rate conveniently. Mobile application users can register, receive notifications for announcements and leave their comments and ratings.

**4.1.7 System Design**

At this stage, the researchers present their system design, including the architectures, modules, and interfaces where the process is defined. Also, the researchers present their system flowchart, use case diagram, and infrastructure. Below are the processes where researchers define the development of the system.

**a. System Flowchart**



**Figure 10.** System Flowchart

Figure 10. shows the researcher system flow chart for the website and mobile application. The system will show the login form for the mobile application, asking its users for their usernames and password. After submission, the system will navigate that particular user to its specific dashboard on the mobile application or website. If the credentials are for the administrator, it can post announcements and save particular files from the dashboard containing the details for the staff satisfaction rating and facility satisfaction rating in SVG, CSV, or PNG. It can also review the received comments and ratings from the clients' users. Comments are the important data that the convolutional neural network needs to perform sentiment analysis to view the positive, neutral or negative trends in the comments. On the mobile application dashboard, they can leave their ratings and comments accordingly. They can receive announcements posted by the administrator.

**4.1.8 Use Case Diagram**

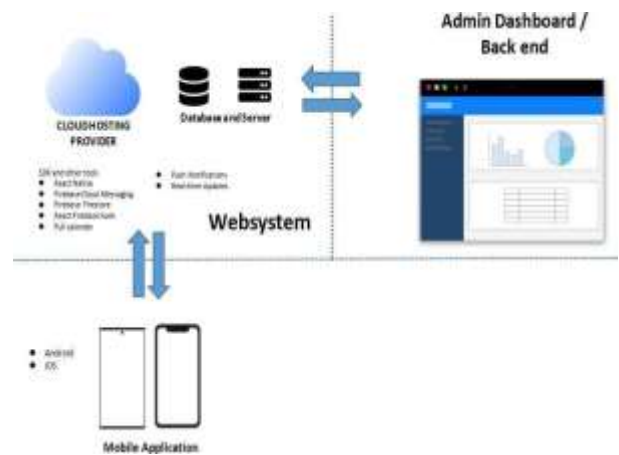


**Figure 11:** Use Case

The researcher uses a use-case diagram to illustrate and summarize the details of the system's different users and their interactions. The system is for the municipal health office, which means no other departments are allowed to access the system unless authorized by the office administrator with appropriate documentation. Below is the diagram for the use case.

In figure 11, Both the administrator and the clients must log in to access the system. For the administrator, the admin can add important announcements, edit, delete, or update the posted reports, and print the graphs that include the line graph for ratings and pie graph for comments, respectively. For mobile users, the client can receive notifications of important announcements from the administrator. Notably, after the undertaken service or program, the client can leave their comments and ratings.

**4.1.9 Infrastructure**



**Figure 12.** System Flowchart

The system infrastructure has two main parts: the web system and the mobile application side. The web system has server-side programming languages such as Java(React Native Framework), JavaScript(ReactJS, NodeJS), and Firebase tools and products. The web system manages and stores information for Cloud Firebase. The system uses Firebase for storing and retrieving data. It has business logic that defines the constraints of how the municipal health office operates regarding how the client satisfaction survey is gathered. The tools, such as Firebase cloud messaging, for receiving and sending notifications(announcements) for mobile users(clients) from the administrator. Firebase Firestore to store and view the received notices (reports). The Firebase hook is used to send queries of data. Full Calendar to note essential matters from the administrator with the corresponding information.

The second one is the admin dashboard. It is the main dashboard for the administrator, in which the administrator can perform functions such as setting calendar dates for essential matters, sending announcements for the clients in the mobile

applications, and downloading the results from the CNN and statistical formulas. Modify existing data, such as the posted announcements, review the comments gathered from the clients, and add edits or delete the services or programs if needed.

It is recommended to have an internet connection since the mobile application will run over the Internet. The application can run on different platforms, either Android or iOS. The app will ask for credentials from the user, and they must provide information to access the application. It can receive important announcements and leave comments and ratings. The Cloud Firestore, a versatile, scalable database from Firebase and Google Cloud for mobile, web, and server development, is where all the data in the app is saved and retrieved from. It uses data synchronization to update data on any connected device.

It offers offline capability, which caches data that is currently being used by the program. As a result, even when the device is not connected to the Internet, the app can write, read, listen to, and query data. Users were authenticated using Firebase Authentication, which offers backend services, an easy SDK, and ready-made UI libraries. For app developers that need to store and serve user-generated content like photographs and videos, Cloud Storage for Firebase was created. User ratings and comments are sent through the app and saved in the cloud.

A serverless framework called Cloud Functions for Firebase enables the automatic execution of backend code in response to an event brought on by Firebase functionality and HTTPS requests. The cloud function is engaged and starts working when an event happens. The onWrite and onCreate event types invoke and control certain functions in the application. The ML kit for Firebase also includes a component for reading data (comments) produced by mobile client applications. The website is where sentiment analysis takes place; a network connection is not necessary. In this case, machine learning allows CNN to automatically recognize this data. This machine learning toolkit is in charge of categorizing sentiment.

#### 4.1.10 Coding

The development of this system uses Java(React Native Framework), JavaScript(ReactJS, NodeJS), and Firebase tools and products. The first one is a framework for writing real, natively rendered mobile applications for iOS and Android; with this, either the client has an iPhone or an Android, and the application can be installed. Together with the tool React JavaScript for developing websites for the administrator and mobile applications for clients. This tool designs a simple view for the website and will update and render just the suitable component whenever data changes. It is also used to build user interfaces specifically for single-

page apps and to handle the view layer for web and mobile applications. The researcher also uses the Node JS tool to develop the system in real-time. It allows for managing input-output operations, which makes it much easier for Node.js to achieve the level of performance for the clients and administrators of modern and real-time applications.

#### 4.1.11 Testing

In this approach, development and testing are carried out simultaneously. In this phase, a user acceptance test was performed, both Alpha and Beta testing. The alpha tests were done by the developer and the adviser guided by the test cases; this is the last test done before beta testing. Right after alpha testing is beta testing, this testing is done with the actual users or clients of the application, and the main goal is to evaluate customer satisfaction.

##### a. User Acceptance Testing

In this test, the sheet states the functions on the client side, both with the administrators and ordinary users. This identifies the website and the mobile application, respectively. The proponent visited the municipal health office to conduct such beta testing with the municipal health nurse, and the municipal doctor served as the primary user to test the system.

Below are some of the snapshots of the testing criteria. The website is tested in 3 kinds of web browsers namely: Mozilla Firefox, Microsoft Edge and Google Chrome. Test case scenarios are arrived from the International Software Testing Qualification Board. Different functions in website are tested accordingly with the different browsers.

The 3 browsers(Microsoft Edge, Google Chrome and Mozilla Firefox) got into the dashboard that means the administrator successfully logged in. In the area of downloading the CSV, PNG and SVG file from the staff satisfactory rating, the Microsoft Edge, Google Chrome and Mozilla Firefox successfully downloaded the data. In the area of downloading the CSV, PNG and SVG file from the facility satisfactory rating, Microsoft Edge, Google Chrome and Mozilla Firefox successfully downloaded the data from the dashboard. In the in the area of downloading sentiment analysis results from the main dashboard, Microsoft Edge, Google Chrome and Mozilla Firefox successfully downloaded the data from the dashboard of sentiment analysis. Changing or modifying existing questions from the facility is successfully done in Microsoft Edge, Google Chrome and Mozilla Firefox. Adding new question/s from the facility dashboard is successfully done in Microsoft Edge, Google Chrome and Mozilla Firefox. Changing or modifying existing questions from the programs is successfully done in Microsoft Edge, Google Chrome and Mozilla Firefox. Adding new question/s from the

programs dashboard is successfully done in Microsoft Edge, Google Chrome and Mozilla Firefox. Changing or modifying existing descriptions from the services is successfully done in Microsoft Edge, Google Chrome and Mozilla Firefox. Adding new question/s from the services dashboard is successfully done in Microsoft Edge, Google Chrome and Mozilla Firefox. Changing or modifying existing descriptions from the staff dashboard is successfully done in Microsoft Edge, Google Chrome and Mozilla Firefox and Adding new question/s from the services dashboard is successfully done in Microsoft Edge, Google Chrome and Mozilla Firefox.



Figure 13.1: Microsoft Edge

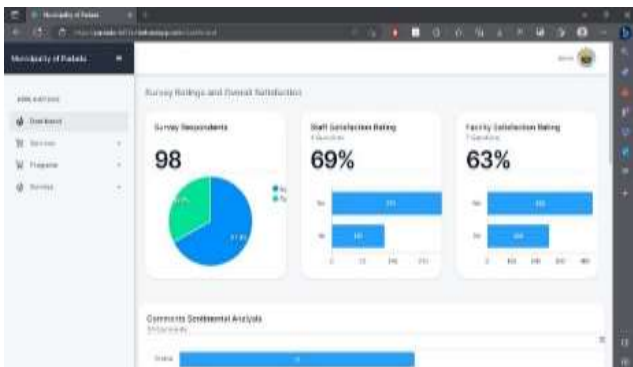


Figure 13.2: Google Chrome



Figure 13.3: Mozilla Firefox

TC002	Add new service	The administrator can add new services	Navigate to the services	New service	Administrator / added new service	Successfully added new service	Pass		
TC003	Ability existing staff survey question	The administrator can modify existing staff survey	Navigate survey questions	Modify question	Administrator	Successfully modify existing staff survey questions	Pass		
TC004	Add new staff survey questions	The administrator can add new survey staff questions	Navigate to the survey task	Add new survey questions	Administrator / can add new staff survey questions	Successfully added new staff survey questions	Pass		

Reviewed and Evaluated by: *[Signature]* 8/19/2023 2:16 PM

Figure 13: Website testing Criteria

In the testing of mobile application. The exe. File is installed in android device to illustrate the demonstration purposes. In the mobile device, different functions are tested during the demonstration. The first test case is to verify credentials of the registered user. The app will send OTP(One Time Password) for the user to be able to log in after hitting the log in button. After the user successfully logged in, it now navigates to the main dashboard which in this case, it successfully done the following criteria. If there are new mobile user, the user is required to submit initial description or data to be able to utilized the system. After feeding necessary data, the mobile app successfully registered the new user. In the area of receiving announcements from the administrator, the mobile application successfully reviewed the posted announcement. Sending ratings and comments from this mobile application was also successfully performed during testing.

TC005	Send ratings and comments through mobile application	The user must send ratings and comments	Navigate to the survey task	Rating and comment	The user must send the ratings and comments	Successfully send the ratings and comments	Pass		
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Figure 14. Mobile testing Criteria

#### 4.1.12 Implementation

The proponent requires implementing their system as soon as the procedure is done. To make this possible, the recipient must have a computer unit to access the administration side or the website itself. Install the necessary prerequisites and requirements for the team, such as the browser to access the system and the internet connection. This desktop computer to be used can be placed in corner of the office so long it is conspicuous and clean. On the client side, it is required for them to have mobile data or at least be connected to wifi with internet access to access the mobile application. All the testing has been done to ensure that the system is fully accessible and functional.

#### **4.1.13 Ethical Considerations**

##### **A. Inclusion Criteria**

The researcher includes in Health office of Padada's municipal doctor and the nurse where they are the primary spoke person on the office. Also individuals who are experienced to have any transactions on the office since they also part to test the system prototype.

##### **B. Exclusion Criteria**

The researcher excludes the personnel who are not part of the municipal health office of Padada and individuals don't have any record of transaction for the purpose of this study.

##### **C. Withdrawal Criteria**

The researcher informed the municipal doctor, municipal nurse and few individuals who tested the system model that they can withdraw in the system testing.

##### **D. Voluntary Participation**

The recipient of this project was to inform the office and the head of the office itself. The researcher discusses the purpose of the study, making sure that the office headed by the head nurse understands the purpose. After discussion, the researcher secured the approval of the head nurse.

##### **E. Privacy and Confidentiality**

The head nurse read the ICF in which he agreed on the confidentiality of the data and the researcher's intention of gathering the necessary information/data(if available). The data that are gathered are used carefully used only in this research project.

##### **F. Informed Consent Process**

As the researcher has the opportunity to discuss the nature of this project, The researcher is also open to the inquiries or questions of the recipient. This includes the discussion of the purpose of the study, procedures, etc. Respect the principle of the office and its operations. The researcher elaborates and clarifies that this project and the data that it needs are part of this project's making.

##### **G. Plagiarism**

The researcher has stated the necessary references in the statements on the pages. Any figures or illustrations are carefully labeled with the proper information needed. Clearly cited illustrations that is being labeled to the authors, included appropriate quotations to any statements coming from the appropriate references and uses Grammarly tool for better grammar correction.

##### **H. Permission from the Organization / Location**

The researcher actively expressed and securely got written permission from the recipient's office. The researcher securely has a document signed by the other party.

##### **I. Benefits**

The primary purpose of this capstone project is to give the health office an idea of the importance of digitalizing the client satisfaction survey. This includes the gathering, transformation, automation, and security of it. The researcher also highlighted that these projects would pave the way for the betterment of its client-side and municipal health office operations. The health office mostly benefit this technological development for its operations and to mobile users that uses in submitting ratings and comments.

##### **J. Recruitment**

The researcher appropriately informed the nature and the purpose of this study to the participants specially in the system testing. This includes the nurse/s, municipal health doctor. This identified parties are important since they are the one be beneficial in this project development.

##### **K. Risk**

The researcher informed the risk of this project in the purpose of participation in this study to the system participants and to the municipal doctor and nurse. This includes not to share the credentials in log in the website to anyone unless provided with appropriate office policy if any and to the mobile user not to share the OTP to anyone.

##### **L. Falsification**

The researcher does not falsify any information or statements in the study. Related literatures, related systems that are done and published and serve as basis for development of this study has been carefully labeled in the references.

##### **M. Fabrication**

The study was proposed relevant and existing problem in municipal health office of Padada. In which the researcher proposed and secured a signed Informed Consent Form to the appropriate party to develop such website and mobile app to address the present condition.

##### **N. Technological Issues**

The materials used in this capstone project such as Firebase and its resources, Language Java(React Native Framework) and JavaScript(ReactJS,NodeJS) are in full stack development. Participant / Users can navigate the user interfaces on such applications only not to those codes. After the client send their respective comments

and ratings using the mobile app, it will be received automatically by the administrator / nurse attendant. All the information gathered is securely stored to the database.

**O. Authorship**

The researcher asked for the guidance with the adviser for the purpose of this study. Creation of the design of the prototype and its tools used are collaboratively discussed with the researcher adviser.

**P. Conflict of Interest**

This capstone project is a technological developed to address the current problem in the municipal health office of Padada that is identified. The researcher does not engage in any personal interest in return of this project development.

**Q. Deceit**

The researcher project development followed appropriate processes such as securing ICF form from the other party informing the purpose of this project and the development tools being used by the researcher to materials the website and the mobile applications.

**R. Observation**

The researcher observed how and where might be specifically implement the system prototype in the municipal health office. As soon as the client had an installed mobile application, he / she can send the ratings and comments after taken the health service. Sending of such can be done inside the health office or outside. As to the website, when the computer is connected the internet, the system can be accessed by the administrator / nurse attended inside the office.

**5. RESULTS AND DISCUSSIONS**

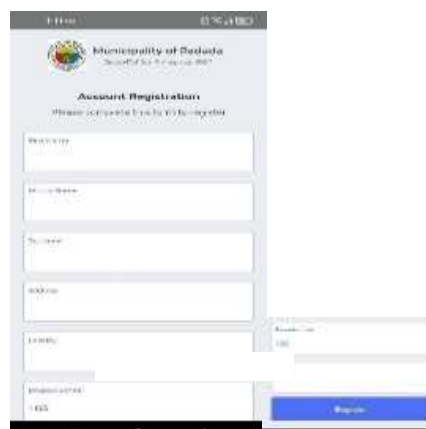
This chapter provides the results of the study. The following is the discussion of how the investigation progressed (1). The creation of cross-platform web and mobile applications is utilized by the municipal health office administrator and client users. (2) The creation of the module that will let the mobile users log in to the mobile app or register in the app if necessary, leave their comments and ratings, and review the posted announcements. (2.1) for the administrator to post announcements, review the posted comments, and download the results from the bar graph in CSV, PNG, or SVG file for references to which comment data is used for the facility and staff rating dashboard. The utilization of a convolutional neural network for comment classification and review of the services and program items and these results can also be downloaded.

**Mobile Application**



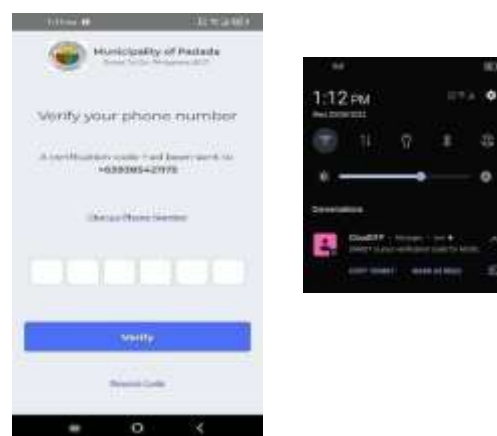
Log in to the dashboard of the mobile application

**Figure 15:** Log in through mobile app



This mobile window will let the new users register their accounts.

**Figure 16:** Registration



The mobile application will send an OTP number to be used for logging in in the mobile application

**Figure 17:** Verification



This is the home page of the mobile application. This shows the Vision, Mission, and Performance Pledge of the Municipality

**Figure 18: Home Page**



This Tab shows the Programs that are available in the office as well as the Services

**Figure 19: Services/Program List**



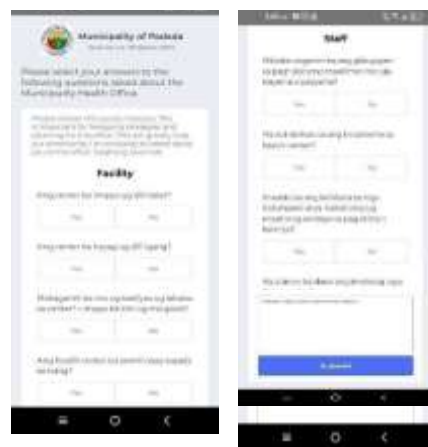
This is the Tab in which the user can view the posted announcements from the health office

**Figure 20: Announcements**



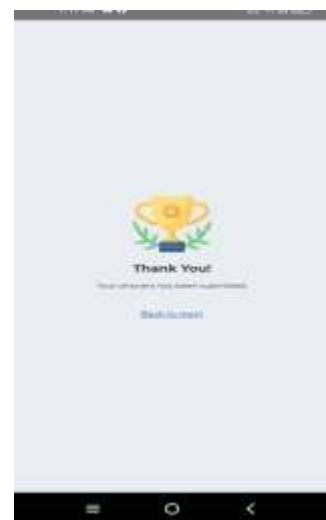
The user must fill in the required data needed by the mobile application. The name is optional for a sense of confidentiality

**Figure 21: Survey Form tab1**



This is now the surveytab where the user will leave their respective rating and comments

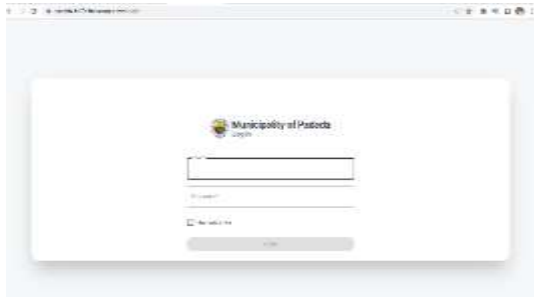
**Figure 22: Survey Form tab2**



After submission, this is the message saying "Thank you," signifying that the user successfully submitted the data

**Figure 23: Messaging**

**Website**



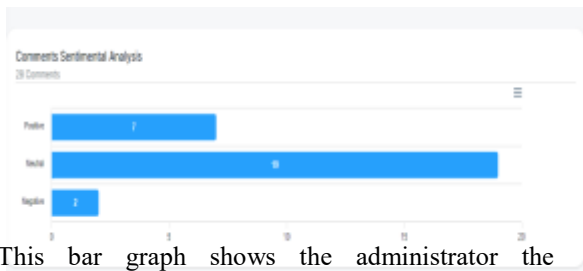
The administrator should provide the necessary data to access the main page of the website

**Figure 24:** Log in Dashboard



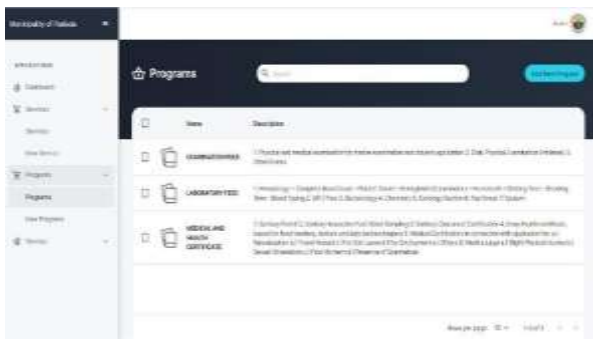
This is the main dashboard of the website. It shows the survey ratings and overall satisfaction data

**Figure 25:** Main Dashboard



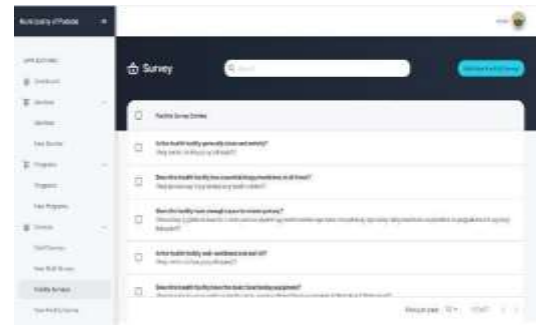
This bar graph shows the administrator the classification of the comments through sentiment analysis using CNN

**Figure 26:** Sentiment Analysis Dashboard



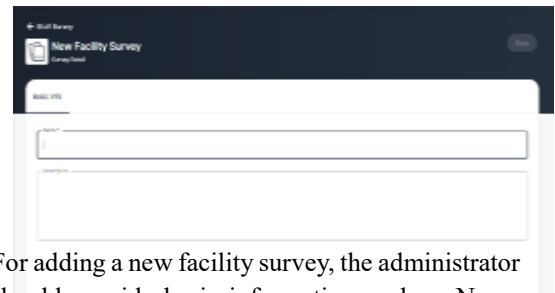
This will show whenever the administrator clicks the dashboard of the facility's satisfaction rating. Showing the trends of the data per question as well as the mean, median, and mode and the option to download the data to whatever format, such as PNG, CSV, and SVG

**Figure 27:** Facility Survey Dashboard



The administrator wants to add a new facility entry or review the entries

**Figure 28:** Facility Survey Questions Dashboard



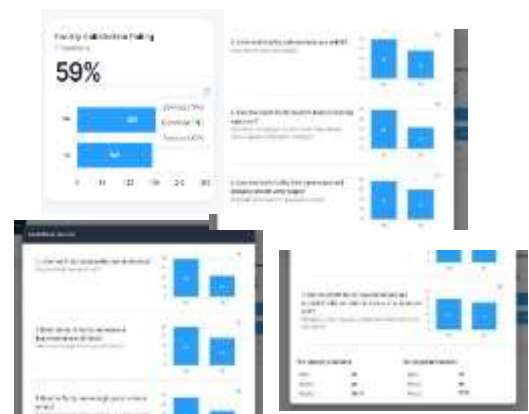
For adding a new facility survey, the administrator should provide basic information such as Name and description

**Figure 29:** Facility Survey Questions Dashboard- Adding



When the administrator wanted to add a new program or review the entries

**Figure 30:** Programs Dashboard



For adding a new program survey, the administrator should provide basic information such as the Name and its description

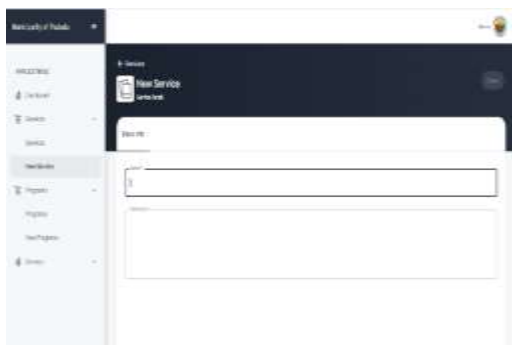
**Figure 31:** Programs Dashboard





The dashboard for Services

**Figure 32:** Services Dashboard



The administrator wanted to add new services or review the current services

**Figure 33:** Service Dashboard- Adding



When the administrator clicks the dashboard on the staff rating, it will show the following data

**Figure 34:** Staff Survey Questions Dashboard



The administrator can download the following data SVG, PNG, and CSV

**Figure 35:** Download Staff Satisfaction Dashboard



The administrator can review the staff survey questions and add the necessary information.

**Figure 36:** Survey Staff Entries Dashboard



The administrator can review the staff survey questions and add the necessary information. They should provide the basic information such as the name and description

**Figure 37:** Survey Staff Entries Dashboard- Adding

## 6.CONCLUSIONS AND RECOMMENDATION

### Conclusions

The app was totally functional and had well-designed functionalities, the conclusion showed. It also proved that both installing a website for the administrator to use and a smartphone for mobile applications are practical for both customers and office staff. In addition, because the app will use smartphones to transmit users' ratings and comments, it might be implemented at a lesser cost than if it used printed paper for customer satisfaction survey forms. As for the administrator, they won't need to count every paper from the survey forms because it will be tracked on the website. The mobile app and website help the municipal health office's current processes be improved. Right out of the box, it makes it easier to keep, manage, and track customer survey forms. This app's improvement of this method benefits both the administrators and the clients. The app's data is stored in the cloud, making it accessible at all times for viewing, receiving updates, and sending reviews and comments. The rollout did encounter a few minor issues, though. The app's performance was slowed down by the internet connectivity, which is what led to these problems. It is transferring to a provider of a speedier internet network. It did, however, stop the seatback.

### Recommendations

This study illustrates the numerous advantages of using this system (website and mobile application), however owing to limitations in network and technology, it has not yet reached its full potential. Mobile devices are a crucial component of this study, thus it is expected that

as new models with high specifications and features—higher memory, processor, and camera—become available, they will grow more powerful. The advancements in mobile technology include quicker mobile networks, better operating systems, and hardware components. Additionally, web browsers are used to visit the website, and it is advised to keep track of the website's version in case there are any compatibility problems. Better integrates the polarity-related parameters in the implementation of a different comment categorization method. By including this as a consequence, a factor implementation that affects these comments will enhance office administration.

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