Intelligent Customer Relationship Management System Using Facial Emotion Recognition

By

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Statement of originality of submitted work

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Here by confirm that the work presented here in this report, and in all other associated material, is wholly my own work, and I agree to assessment for plagiarism

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Acknowledgement

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Abstract

A traceability system can be defined as a system capable of tracing the feeling of the customer regarding the purchased product. Face traceability indicates the ability to recognize the customer's thoughts about his or her purchased products and help shop owner to get a better idea about the demand for consumer products. As consumer surveillance and manufacturer's internal quality requirements increase, new demands are placed on face traceability using Artificial Intelligence. Existing centralized solutions to get an idea of customer regarding their purchased products suffer from the lack of isolated data storage and accurate when multiple parties are involved, and they are less advance to provide best result to the shop owner than to profit. A face detecting approach seeks to overcome these shortcomings by creating a more efficient and accurate feature which can understand the feelings of customers regarding their purchase goods, that supports to shop owners by indicate the quality and some important factors of consumer' goods automatically.

According to the proposed component it allows customers to buy any type of goods from supermarket himself and when he arrives to cashier for pay the bill, the camera which is spotted in cashier identify the mobile application registered customers. After that process recognize the emotions of customer regarding his purchased products by tracing his facial expressions using Artificial Intelligence. Finally, the feedback is taken from the customers emotions. This saves customer and cashier time and is convenient for both parties. The camera which is spotted in cashier acts as a middle party of proposed component and consumer and shop owners are other main parties of app.

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Chapter 1: Introduction

When customers come to buying a product, frequently they will concentrate about the quality of the product. Customers increasingly concerned about the quality of their products since the past decades. Consumers prefer to consume products that meet certain environmental and ethical standards. Also, the manager of the supermarket must have a basic understanding of how customers feel about the products they buy. how much they are satisfied with the products.

Customers are the assets and helpful to survival of the business. without customers cannot survive any business. So, keeping their interesting is most important. Therefore, customer feedbacks are integrating with growth of the business.

This allows them to quickly and conveniently resolve any defects in the product and achieve customer satisfaction. With the advancement of the technology, everything is become computerized and Here I introduce a technology, that is much more advanced way rather than that current providers use to get customer feedbacks and also customers can able to see offers in specific days. In here I proposed system as, facial recognition algorithm using machine learning and identify customer facial emotion reactions that they expressed and get automatically feedbacks by the customer. I target through the system carries great value to the society

1.1 Problem statement

There are few facts we should discuss, the reason for go for this kind of system introducing to the market. After researching the problems and accuracy of customer feedback I gave a thought this kind of AI will help both the customer and seller (organization or supermarket) also the accuracy and reliability of these kind of feedbacks are on a higher level. Below mentioned about condition of the study and where and when does the problem arise.

Consumer goods should always be of high quality and it is the primary responsibility of the seller to provide such quality goods to their customers. Consumers also pay special attention to the quality of the product when they buy it and they are satisfied by meeting their expectations form the products. But some occasions may not like this. Customer satisfaction is the profit of the seller. Usually, most consumers come to supermarkets to purchase their required goods because it is easy to take lot of products in one place. Because supermarkets available many products and

No need to go place to place to find essentials. There are many factors that determine the quality of a consumer product. such as the appearance of the product, the design or design quality of the product, the fit from the customer's point of view, and the degree to which the product conforms to the specifications. No matter what factors determine the quality of a product, the final decision on whether to purchase the product is made by the consumer. Therefore, it imperative to consider compatibility from a customer point of view.

Usually, most goods sellers' willingness to know how much customers were pleased with their service. And what are the facts they have to improve for provide good service to customers. On the other hand, customers can be able to express their ideas or react about their expectations will meet or not through their shop by service provided.

They follow the methods of giving customer feedback forms to asking feedbacks and maintain a customer feedback box (complaint box). Most of the time customers do not urge to fill it because it is extremely time consuming, inefficient and inability to wait. And also some customers do not like to it because visible to everyone. So they receive low amount of feedbacks from customers. Therefore, the process of checking these feedbacks become slow because they wait to receive many feedbacks until feedback box reached too full. Customers cannot get immediate result under the existing system. Aforementioned circumstances may cause to decrease their customers due to their dissatisfaction. This situation is not good to their organizational image. In business world competitiveness is most important. The future of a business that is determined by managers depends directly on the selections of managers. So their decision are important to the business.

Moreover, with the relevance of the study there can be find data lose. Sometimes it will occur when employees check those feedback forms which are written on papers, those papers can be missing. So valuable responses or feedbacks of consumers become lost. Most of the time, only required customers will express their feedbacks others not willingness to it. Supermarkets cannot aware customers ideas on every sale. As I mentioned before, consequences of the current system have to face both organization and customers. Above problems and difficulties would be identify through this explore. I will use survey to analyze these problems and take required solution to achieving the situation and overcome aforementioned factors.

1.2 Literature Review

Anatomy based facial graph for recognize facial expressions

This research was done by authors Sina Mohseni, Niloofar Zarei and Saba Ramazani. According to the research they have introduced a new definition of reliable face recognition. The framework was based on a person's facial expressions and looks, and it works well for expressions. The facial model with the clear or standard text used in this study has 53 conclusions. The moving verticals allow it to match the facial features of the image. Tests were performed on three different classifiers to demonstrate the effectiveness of the proposed method. The best performance obtained from the MMI database via Adaboost. It should be noted that the results are not directly comparable due to different information and test parameters. The main conclusions of this study are the analysis of facial features by removing geometric features from important facial features. The graph used the boundary scale instead of the reduction point, which creates various errors due to the position of the head. In the future, they aimed to use the specific facial model with the Active Appearance Model (AAM), which was also a powerful eye catcher with a variety of body shapes and functional designs. (Mohensi, et al., 2014)

Figure 1.1 sample images from MMI

Facial Expression Recognition from Different Angles

This research was done by Md Inzamam, UI Haque and Damain Valles. They have studied about the facial expression recognition from different angels of children to identify their emotions. Further research has been done in this paper to teach children with ASD to acknowledge human facial expressions in an exceedingly friendly and active environment. With ASD children get pleasure from playing on mobile devices reminiscent of smartphones and tablets, therefore the goal of the study is to teach them to use the device's camera to monitor facial expressions.

First, we created an Android or iOS application that can work on compatible platforms and devices. The algorithm used by this application is a pre-trained model from the Deep Coevolutionary Neural Network (DCNN) for face recognition. When a child with ASD points the camera at a person, the app will automatically recognize the face and distinguish the person's face. The status of the face is displayed as an icon on the gadget screen. The aim of this study is to use these facial slogans as icons to show how children with autism point to the camera and express emotional aspects. To make this model more dynamic in all environments and perspectives, it is trained not only on the facing faces, but also on the face images from different perspectives such as side and top and bottom views. The model ought to even be able to predict the form of the face in numerous lighting environments in different dark or bright distinction areas. (Haque, 2019)

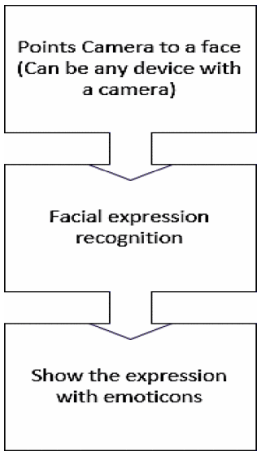


Figure 1.2 Path to facial recognition

Automatic 3D facial expression recognition

According to the research study of Amal Azazi and Syaheerah Lebai Lutfi (Azazi, et al., 2014), they have proposed a completely independent and autonomous facial recognition system that uses standard geometric features and variations. The proposed program began with the creation of 3D facial images on a 2D plane using a map simulation process to reduce the size. Using face-to-face maps with 2D maps, they have extracted a few facial expressions that were almost scattered on the face.

In addition, they introduced a new way of determining facial expressions based on increasing the accuracy of discrimination and reducing the exaggeration of indications. Sample identification algorithm between reference points sent to form a large set of indicators. To select the best indices, they injected SURF, DE and RBF-SVM techniques into the optimization process. All system parameters do the same thing. Using the Phosphorus database, they have trained and evaluated our specific program, and gained similar recognition for courses in this field.

Automatic Analysis of Facial Affect

The research study done by Evangelos Sariyanidi and Hatice Gunes have analyzed the processes that affect face recognition in the key elements of face registration, imaging, resizing, and recognition. To analyze facial expressions in detail, they have discussed the strengths and weaknesses of the faces, the types of information used, the ability to detect hidden expressions, the size and complexity of the computer. Also, they have described new classroom fires and mathematical models affecting related forces, explaining differences in mood and facial expressions, the mathematical dependence of different facial movements, and the effects of personal gestures on facial expressions. Examine the evaluation procedures and measures and analyze the results of the recently scheduled automated competitions that affect perceptions.

(Sariyanidi, et al., 2014)

Human face expression recognition

This research was done by the authors of Michael Revina and W.R Sam Emmanuel. This is a survey that describes face expression recognition technologies that convey non- verbal communication that expressed through facial expression. This research obtained different expressions with specific face features of each expression. FER (face expression recognition) has significant stage in feature extraction and classification.

Feature extraction included two types of geometric based and appearance based. Local curvelet transform (LCT) is a feature descriptor of extracting the features based on patch-based methods. Texture feature is more helpful method of face extraction. SVM classification technique is also involved. Conclusion of this study is gaining the enhancement using FER. View facial poses through real-time applications. Discover the utilizing developers to develop algorithms based accuracy and provide highest recognize accuracy 99% by SVM and detect several expressions.

Facial Emotion Recognition with shape models

Another facial emotion recognition application developed by Gil-Jin Jang, Jeong-Sik Park, Ahra Jo and Ji-Hwan Kim. using shape models and statical pattern recognizers. They suggested an effective way to visualize facial recognition based on the user's facial image, compare different mathematical pattern identifiers, and determine the optimal combination of export and pattern recognition functions. A 5-step review was performed to ensure the reliability of the proposed method in a small database. Divide the entire database into 5 sections, deploy 4 training subsets, and check the rest. Five combinations can be used. According to the test results, the SVM (Support Vector Machine) is accurate with a sensitivity range of 3 to 6 compared to the MLP (Multi-Layer Perceptron) classification. (Jang, et al., 2014)

Emotion recognition through facial expression by SVM

This research was done by Moulay smail, Nourddine Enneya and Abdelailam sadiq. They suggested another effective way with the support of Emotion identification through facial expression. According to this research they try to achieve and introduced a new definition regarding to the face recognition. Their contribution is goes on to find automatic facial expression analysis system that can predict behavior of customer. Their propose framework consist three layers which including data collection, data processing and emotion detection. And classify the detected emotions in three ways of convey from emotions.

Classify an overall result as expressing positive, negative or neutral. They produced FACS (facial action coding system). Within the data collection layer use key frame extraction techniques. Data processing stage is divided into sub stages like face detection and emotion detection. Using POEM (patterns of oriented edge magnitudes) algorithm to analysis. Create database contain 213 images of facial expressions posed by 10 japaneese female models. The main conclusion and perspectives of this study in analyze emotions through classification algorithm of POEM. And tested the performance by creating model. As a result, this work provide the measure emotions of predict behaviour.

Adaboost based system facial recognition

According to the research study of Ebenezer owusu, Yongzhao and Qi rang. Through this study improves recognition accuracy of facial expression recognition system. Which is the purpose of the research. Under any circumstances automatically recognize facial expression recognition via system with the help of technology of artificial intelligence. Feature selection is done by using adaboost algorithms which enables to increase the process of classification. Also they have created mathematical functions and identify how formulated them according to the research requirements. Obtaining the results through databases of the areas which having best performance and weakest.

Utilizing 3D facial feature for expression recognition

In year of 2008 this research was carried out two authors of Hamit soyel and Hasan demiral. The purpose of the research conducted recognize gestures and facial expressions under the 3D facial feature. And classify those expression they taken. Their they used to consider techniques under the 3D space. Utilizing 84 facial points of categorized their expressions seven ways. To take the expected results of the system use LDA classifier. However, overall system capability of expression recognition goes up to 83.5 of percentage.

This research was done by Amit pandey, Aman gupta and radhey shyam with the contribute of these three authors. And it was carried out department of computer science in Lucknow, India. In here used computer algorithms to identify human face expressions. People usually expressing emotions by their faces. It can be mentioned non verbal communication method between human being. The perspective of this research is to study and recognize about accurate face emotion and detection through the deep learning and machine learning algorithm. They used technical strategies to realize the study. Their research was based on the approach called CNN which useful to identify face features. Used essential geometric parts of human face (eyebrows and eyes) to emotion recognition process. When consider about result of the research, they used 412 poses and maximumly accuracy of their research finally reached to 55%. Emphasized about future will improved feedback interrelated as well as interfaces human-robot.

1.3 Research objective

- To proposed effective and reliable AI Based customer face detection and face emotion feedback system.
- Protect Customer's privacy of expressing opinions.
- Getting accurate feedback on the products they buy through their facial expressions.
- Save customer time on filling out feedback forms manually or online. Time is more important with the busy lifestyles of customer.
- Increasing the security of the system.
- Thereby giving a direct idea of the customer for the goods they are selling

According to the research my objective is to implement customer face emotion detection system based on AI technology. Through this system I hope to detect most accurate feedback of the customer who comes to the supermarket. Also, it will be facilitating to track or find positivity of products that customer purchased. Through this system supermarkets able to make the adjustments according to the feedbacks about their premises. There is most important each and every customer feedback. through this system supermarket owners able to decision making. Furthermore, helps to build a close relationship with customer. By providing user friendly system like this it will be a reason to increasing their client base. Also, customers gain good shopping experience with no time consuming and safe their privacy of feedback.

1.4 Relevant Research Question

This research was mainly conducted to find proper solution to the research question. The question that I based is arise when we went into the supermarkets. We can see almost each and every town or the areas located supermarkets. Nowadays their branches spread into many areas and every branches facilitates opportunity to get feedbacks of customers. Normally, as a customer myself also faced that problem. So I taken as my research question "Why most customers are not expressing their feedbacks" . So, I decide to start investigate through this question.

Here I gathered information by an interviewing with customers who arrive at the supermarket.

1. Are you a frequently buying goods from the supermarket?
2. Are you a satisfied about their service and quality of products?
3. Are you happy with their system here to provide customer feedbacks?
4. Have you posted any feedbacks using their current system? Is it good
5. What is your opinion instead of a technical system to express customer feedbacks?

Those are the questions that I asked from customers. Most of the customers expressed ideas are not positive with the current status the way currently followed to receiving customer feedbacks. it carries draw backs. Majority will not urge to do it. Therefore, I think to proposed a system which is rapid and easy to both customers and supermarkets, expressing opinions and receiving customer feedback

1.6 Project Scope

This research is to ensure efficient and convenient application that will aid the collect customer feedbacks and avoid drawbacks of currently following method because it was time-consuming and tedious. And gain features which are convenience to manage both organization and customers. Under this system consider functionalities register, view details and check offers. Also utilize technology how customers feel about their buying products, finding their emotionally answer and easy to make future decisions to organization about their providing service to the customers on a reliable platform with secure environment.

1.7 Significant of the study

This research is based on the customer's shopping feedback system to allows finding customer satisfaction from their emotions regarding to the buying products and service they provided. By using AI based intelligent customer relationship management system through a mobile application. By recognizing its entities and the nature of their relationships. Study the flow of information among the components that make up this environment. This system is helpful and provide better solution to avoid existing issues of presently identified and easy to receiving feedbacks. And benefited to both supermarkets and their customers. This document mentioned all the information The suggested system would improve efficiency of customer relationships management process.

1.7 Limitations of the study

Limitation of the time period

With the short time period given to create a complete functional application, it gives a tight pressure situation. Time is important component, which is one of the main limitations of this project. Because this is the first time of using AI based systems need to be trained several times to obtain the best set before deploy it to production.

Lack of having experience

This propose system must be meet industrial standards. So, this is the first time I develop such a project. And also, I don't' have much experience in Artificial intelligence too. Lack of experience will cause to slow the process of implement.

Lack of strong network connection

Strong network connection is needed to function this application without any interruption.

Hardware Issues

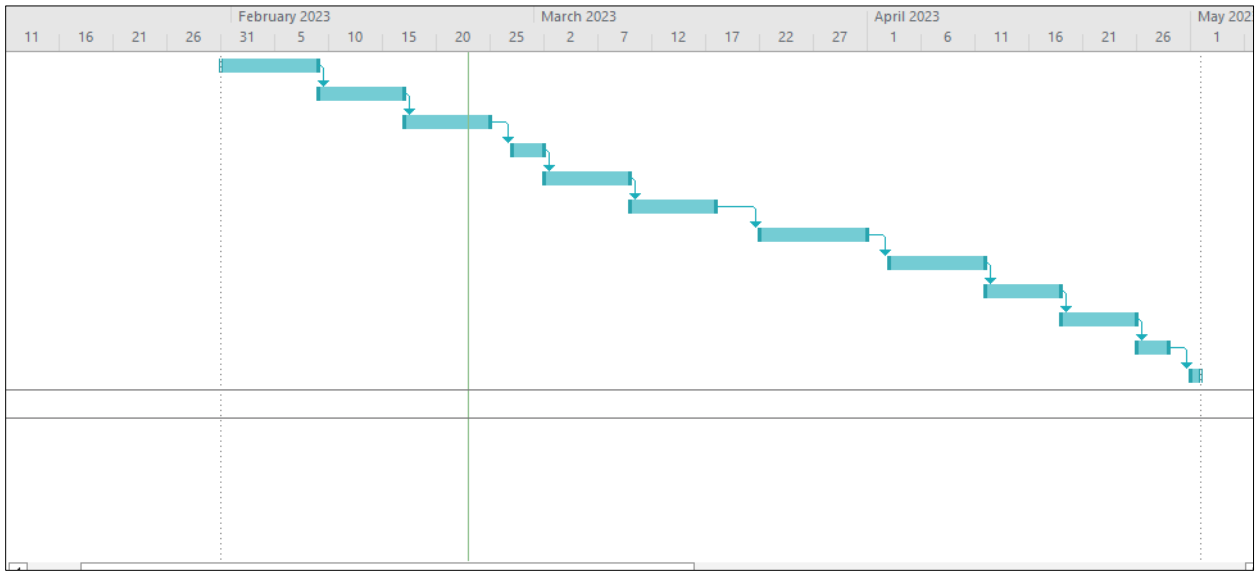
Hardware is essential component. AI technology-based systems are usually processor heavy algorithms. There should be a set of hardware components with better performance to develop the system.

1.9 Gantt chart and working plan

GANTT CHART

	Task Mode	Task Name	Duration	Start	Finish	Predecesso
1		Identify the project topic	7 days	Tue 1/31/23	Wed 2/8/23	
2		Collecting the data	6 days	Thu 2/9/23	Thu 2/16/23	1
3		Background study	6 days	Fri 2/17/23	Fri 2/24/23	2
4		Identify issues and variables	3 days	Mon 2/27/23	Wed 3/1/23	3
5		Proposal writing	6 days	Thu 3/2/23	Thu 3/9/23	4
6		Proposal submission	6 days	Fri 3/10/23	Fri 3/17/23	5
7		Proposal presentation	8 days	Wed 3/22/23	Fri 3/31/23	6
8		Prepare requirement gathering	7 days	Mon 4/3/23	Tue 4/11/23	7
9		proposal presentation 1	5 days	Wed 4/12/23	Tue 4/18/23	8
10		Proposal presentation 2	5 days	Wed 4/19/23	Tue 4/25/23	9
11		Final presentation ans VIVA	3 days	Wed 4/26/23	Fri 4/28/23	10
12		Final document submission	1 day	Mon 5/1/23	Mon 5/1/23	11

Figure 1.3 working plan and time schedule



Chapter2: Literature review

This chapter further try to imply about literature reviews with regarding to the research topic. As a result of this literature reviews expect to reach their findings according to their perspectives.

In year 2019 research, it was carried DETI university of Averio. This research was conducted two authors Daniel canedo and Antonia neves. (canedo & Neves, 2019) Process of emotion recognition emphasize on different fields. One of the fields is marketing. Which is relevant to this research area also because marketing is essential component in business. In this research, they used different methods to recognize emotions. There are review about same topic that done previous years regarding in under various publishers. Among them most ones used algorithms. And identified it difficulty of recognize the accuracy of face features. According to the research conclusion is about FER is still gradually developing method. However, their having progress it was a challenge to identify exact poses of faces. They got 83.07% rate of accuracy through their research. After using CNN approach to do the findings and solving problems, it caused to get better results of FER system rather than before.

This chapter indicates how Literature review relative on the topic how detect customer satisfaction using their emotion with the help of early researches that done in early years.

2.1 Dependent Variable

In my research, I have taken customer face emotion recognition as a dependent variable. Because it depends on the other variables. Recognize customer emotion and get it as a feedback is a final outcome of the system. But prior to that we need to do some processes. Therefore, this variable have to depend other variables to get the result. Basically In here I got the AI based part to generate relationship between dependent and indepenent. this section provides how customer satisfaction occur helping with other independent variables.

2.2 Independent Variables

Here, I have taken four variables to denote this. Customer NIC Number, face angles, face features and face expressions. I used NIC number to uniquely identify each customers who registered in this system. Which is important key to identify each customer separately. And get different face angles of the customer of the application when upload a photo. Detect face muscles movements and understand the emotions under the categories. Through this process organization able to get the clear idea about positivity and negativity. Relationship between these variables

visually present by using structure or model called conceptual framework. This mentioned in upcoming chapter with relevant hypothesis.

2.3 Gaps in Literature review

As I before mentioned literature survey that earlier conducted provide better evidence to needed of the automatic face emotion recognition system. The facial recognition is the most important phase in my research. Parts of video-based algorithms use approaches from the basis of immovable technicians. I try to introduce a quick and efficient face recognition system that recognizes faces in crowded backgrounds very quickly**.** According to my knowledge there was not any kind of facial emotion recognition system in supermarkets.

In 2018 research project, studied about the facial expression recognition from different angels of children to identify their emotions. In here children with ASD (Autism spectrum disorder) to recognize human facial expressions in a friendly and active environment. Most children with ASD enjoy playing on mobile devices such as tablets and smartphones, so the goal of the study is to teach them to use the device's camera to monitor facial expressions. They used the DCNN algorithm for face recognition. The goal of this study is to use these facial to show how children with autism point to the camera and express emotional aspects.

According to the previous studies and existing systems, there are lot of face detection system such as school attendance system, work attendance system etc. But there is not any proper emotion detection system which support to analyze the customer feedback of purchased products with face detection feature.

Once the face detection part is done, we get customers face emotion feedback from camera near the cashier. Previously this process was done by filling in the documents or by speaking with customer satisfactions. It is too hard and waste high time and tedious because customers are reluctant to come back. According to the literature survey above conducted it is evident to this research implementation since only few researches have has been done targeting that. From this proposed system avoided these things and give opportunity to customers to get very convenient service.

	Save time	Customer satisfaction	Easy to handle for the cashier	Offers	Identify the customer. With face	AI based customer feedback system
Coupon				✓		
Loyalty card		✓		✓		
Talk with cashier				✓		
Proposed system (Improved User authentication)	✓	✓	✓	✓	✓	✓

Table 1 Research gap

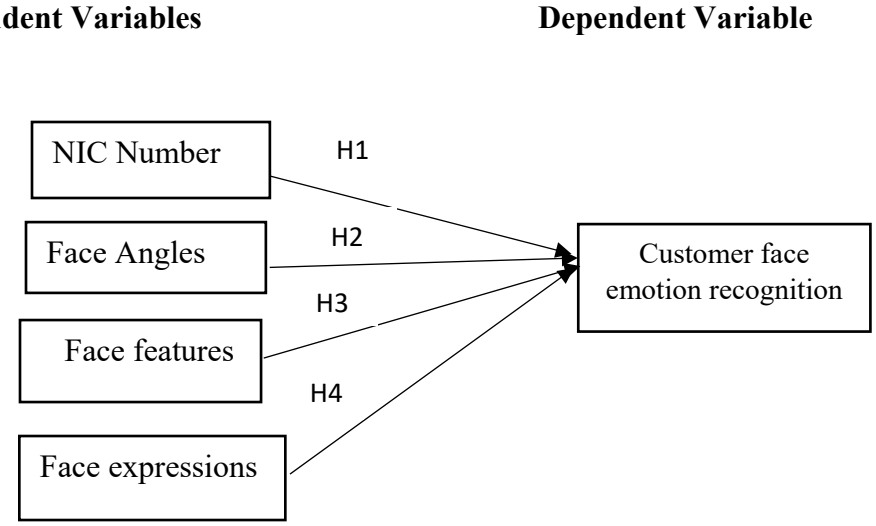
Chapter 3: Research Methodology

This chapter will indicate about the methodology used in this research and it is an approach. Moreover, methodology describes the way of doing a research. It defines relevant techniques and different procedures regarding to the research topic. and gaining idea about how researcher collect required data, data analysis , different methods of requirement gathering and validity of this research. and also cover the accomplish of research objectives.

3.1 Conceptual Framework

Conceptual framework is a perception of the person who done the research. This framework is a common way of achieving research objectives, how the overall project idea organized very well. And illustrate about the relationship using identified variables and how those variables are relate to the research efficacy.

Following is about conceptual framework of the system.



3.2 Research Hypothesis

These are the hypothesis relevant to the conceptual framework.

H1 - There is a relationship between NIC Number and customer face emotion recognition when receiving feedbacks to the organization by using this application.

H2 - There is a relationship between face angles and customer face emotion recognition when receiving feedbacks to the organization by using this application.

H3 - There is a relationship between face features and customer face emotion recognition when receiving feedbacks to the organization by using this application.

$H3_1$ – There is a positive relationship between face features and customer face emotion recognition when receiving feedbacks to the organization by using this application

H4 - There is positive relationship between face expressions and customer face emotion recognition when receiving feedbacks to the organization by using this application.

When considering overall project there are four main functions of the system. Above conceptual framework model related with these functions

1. Register to the application

   First of all, customer need to register to the app. Register to the app is not mandatory and if customer like to register to app he can register in the cashier point. Cashier point also explain about the application when a new customer arrives to the cashier. When customer register to the application, he should input a clear picture of his face. All the face images and other details will be stored in the database.

2. Face detected of registered customer

   When a registered customer arrives to the cashier, he will be captured by the camera which is spotted in cashier and detect the customer by system by analyzing the recorded face pictures in database.

3. Examine customer's emotion

   According to the system, emotion detection is ability to recognize the thoughts of customers regarding the products they purchased. This is the outcome that I hope to gain with this proposed system.

4. Get the customer feedback by using customer emotions

   In here, with this system expecting to use 4 classes to predict customer feedback which are, very good, good, bad, disgusting. According to the emotion detection system will analyze the relevant customer feedback to the purchased products.

3.2 Population

In this research, elaborates about the proposed solution that taken the problems at the supermarkets. And I used questionnaire to analyze authenticity of the details about the existing problem. According to the research, I was selected my target audience as customers. And I sent my questionnaire to the particular people. By conducting survey among target popular is important to find exact population regarding to the research area. There can be defined types of customers who currently around in supermarkets. Most customers are frequently come to purchasing products. Like daily customers, random customers and loyal customers too. Therefore, size of the population absolutely depends on the no of customers who come to supermarkets each day. It varies on weekdays and weekdays. Normally morning to noon on weekdays shows a slight decrement but evening it will differ at evening after the office hours. And weekends a lot of customers comes to shopping to buy their essentials. Approximately, as average five hundred customers come to supermarkets at each day. Through this I can get idea about overall population. According to my survey I consider My target population as 88.7% .

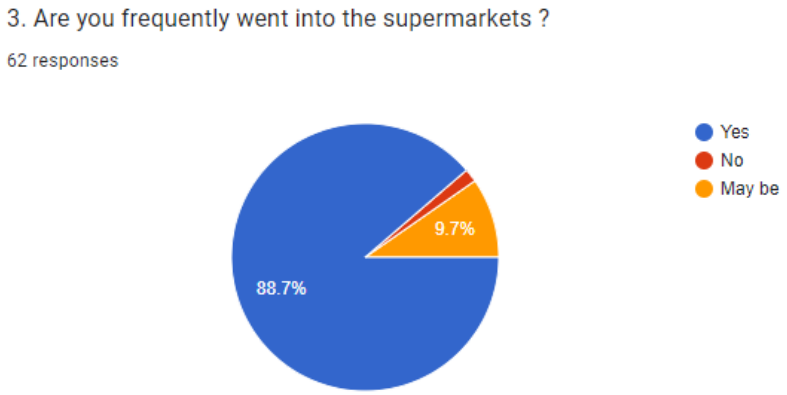


Figure 2.1 population of target audience

3.3 Research Approach

Research approach is much needed when someone doing the research. It is a strategy that use to achieving results relate to the research topic. Which include data gathering, data analysis and interpretation. Basically, these three methods consider under the research approach. Mainly there are two types in research approaches. There are quantitative approach and qualitative approach. In my research I also used these approaches to collect information. According to the target audience of the research we focusing groups to collect data. Here I target customers who frequently come to supermarkets. By using these methods, I can aware about their feelings and experiences. And found required data or no of responses through approaches to evaluating the research.

3.5 Data Collection

Data collection is one of the strategies of research approach. For collect required data to this research I conduct a survey. there are two types of data collection methods. There called primary and secondary. Under the collection category called primary, I used that collection method to find data by prepared the questionnaire with consists close ended questions. And also used secondary data collection methods by referred journals and other sources.

3.6 Data Analysis

This section indicates about data analysis of this research. As per I mentioned I prepared questionnaire including current system and proposed system. I prepared 15 questions used easy ways of answered. I send it via email and share the link. And I got 62 responses from customers. Data analysis is significant part of research. In analysis process, summarized all collected data required way. Those summarized data demonstrated using different method like charts, tables and graphs for convenience to readers. As well as it helps to take decisions easily.

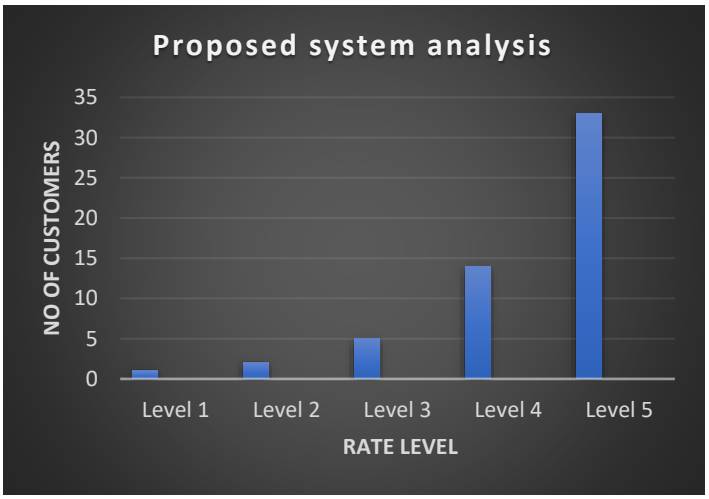


Figure 3.1 Bar chart of responses

According to the above insert chart it is indicates customer preference for the proposed system. Totally I got 62 number of responses to my questionnaire. Among these responses I received more responds. most customers think automatically emotion detection is convenience than current method. Axis of no of customers imply how many customers responds to my qustions. I rate the answer Low to high using 1 to 5 no of levels and that is imply by no of levels. Overall, 56.5% responses got from customers to preference to automation system.

Following is about the percentages that I received during the survey.

Summary of the question	Yes (%)	No (%)	Total
Customer satisfaction about current system	35.5	**64.5**	100
Possibility of expressing feedback under the current system	37.1	**62.9**	100
Customers who expressed their feedbacks	48.4	**51.6**	100

Table 2 Percentages of survey

Chapter 4: BACKGROUND OF THE STUDY

4.1 What is it

The background of the study is about what is the situation based on this research. And I hope to explain about technology that going to use to it. this research that I started the presently captured issues in supermarkets which relevant to expressing feedbacks. I can see there is a gap in relationship with customers droves me to study about the problems and concern them.

AI (Artificial Intelligence), according to the current world everything has been computerized in order to get the accurate and reliable output of some process. So AI means adding an artificial brain to the program, when an AI technology is added to the system program will be able to take decisions according to the fed experiences to the program. Here my project topic is related to AI which is used in the supermarket. Customers who come to buy products in the supermarket. There are so many AIs in the supermarket nowadays with the rapid advancement technology. AMAZON supermarket is the current supermarket which has been built on most advance technology. There are so many supermarkets who use different types of AIs for different purposes.

In supermarkets mainly sales their products to customers in retail method. Automating in-store procedures and lowering operational expenses are two benefits of artificial intelligence in retail businesses. I strongly propose artificial intelligence (AI) to shops who wish to minimize their time while also improving customer service.

The system is based to measure on customer satisfaction to the supermarket level or the status of how customers satisfy about services they provided. Customers are asset to each and every business. Without customers business cannot survive. Through this study hope to gain precious value under the secure environment to express customer opinions and emotions about the supermarket. And creating an AI increase customer interaction system to understanding the interrelation between relevant components of make effective system.

4.2 Why it is important

The background of the study is based on a place where most of them went to buy goods which is supermarket. And process what they presently run on and AI related application which useful to give better result than expected.

The importance of this study can be mentioned in various aspects. It mainly affects two parties' customers and supermarket(seller). Supermarkets will be able to achieve their targets easily by maintain and grow the clientele base. To provide quality customer service which may be fulfill through monitoring customer feedback.

Customer Insights and personalization

Artificial intelligence technologies in retail can provide a tailored shopping experience to customers. By using face recognition like biometric technology may identify people revisiting a business and remember their likes and dislikes. So, they can propose items and develop marketing for them. Advanced AI algorithms can look at demographic data, social media impressions and digital footprint of customers to interpret their preferences. According to research done by the Boston consulting, group " Brands that develop tailored experiences by combining sophisticated digital technologies and proprietary data for consumers are seeing revenue rise by 6% to 10% - two to three times faster that those that don't". From this, emphasis about the importance of this study

4.3 List of all user requirements

Simply, user requirements are needs of users. Considering about user requirements is a vital part of any system. And it is useful for projects. User requirements are most probably affected to fulfill needs and requirements of the users who use the system. Following is about such user requirements according to the research.

Protect privacy of each customer – provide data security(customer personal details)

Accuracy – This system will identify correct emotion of each customer

User friendly – system is easy to use

Timeliness

Reliability

4.4 Explanation of the current system

This section I hope to imply about their current system how does it goes on. This research is mainly based on the system about collecting feedbacks from customers. It emphasis on, how gather customer feedbacks at supermarkets to measure customer satisfaction and achieve their business purposes. Currently they give offers daily and weekends for specific goods or products. A product is change day by day. so, there is no specific method to know customers what are the offers that having daily basis unless they are not come to buy products.

According to the current system supermarkets cannot achieve feedback from every sale of customer. Only required customer will expressing their feedbacks. When customers come to buy products into the supermarkets, they can express their feedbacks. There are some methods of receiving feedbacks in supermarkets. Mostly they arrange by keeping feedback box near the cashier or any selected place to put into customer feedbacks. They expressing by write it on the paper. Another way of collecting feedback is using survey forms. Which contain of series of questions. rather than that they mostly followed the method aforementioned. This is the explanation about the current system.

4.5 Drawbacks of the current system

This section indicates what are the drawbacks or the difficulties that organization have to face using current system. Above section is mentioned about existing system and I can find some issues of system by obtaining their current system. Those are affected to both customers and supermarket.

1 Most customers refrain expressing their feedback under the existing situation. Therefore, supermarket cannot achieve their targets by not receiving.

1 They cannot measure customer satisfaction properly.
2 Every customer is not participating only required customers will do it.
3 It was very time consuming.

4 There are having possibility of risk of losing.

5 Customers cannot expect immediate response through it.

4.6 Explanation of the propose system

The propose system is relevant to their currently collecting feedbacks from customers. This research I was conducted to overcome issues they have. That system will detect emotions of customers by their facial expressions and automatically get it as feedback. First of all, customer need to register to the app. Register to the app is not mandatory and if customer like to register to app he can register in the cashier point. Cashier point also explain about the application when a new customer arrives to the cashier. When customer register to the application, he should input a clear picture of his face.

All the face images and other details will be stored in the database. When a registered customer arrives to the cashier, he will be captured by the camera which is spotted in cashier and detect the customer by system by analyzing the recorded face pictures in database. After that examine customer's emotion. According to the system, emotion detection is ability to recognize the thoughts of customers regarding the products they purchased. Then get the customer feedback by using customer emotions. With this system expecting to use 4 classes to predict customer feedback which are, very good, good, bad, disgusting. According to the emotion detection system will analyze the relevant customer feedback to the purchased products. This is the outcome that I hope to gain with this proposed system.

Chapter 5: Feasibility Study and Requirements Gathering

5.1 Feasibility study

Feasibility study is an analysis which supports to measure the ability to successfully complete a project with including relevant factors. Furthermore, feasibility study we can measure the ability of being a success of decisions at the end of the project by also considering about the other relevant factors such as budget(money), technical support, man power and etc. Therefore, company will conduct feasibility study.

5.1.2 Cost feasibility

Cost feasibility indicates how much of cost needed to success of the overall project. The expected cost estimation for this Intelligent Customer Relationship Management system are as follows

Description	Estimate budget (Rs)
Camera	20000.00
Fitting camera	10000.00
Electricity	4000.00
Server charges	2000.00
Internet usage	10000.00
Total budget	46000.00

Table 3 Cost estimation

According to the system in cost feasibility we consider some analysis to cost estimation.

Return On Investment (ROI) – It measure cost of investment, how it was efficient to utilizing to this specific investment. There is a formula to calculate ROI by putting values to the formula.

Net Present Value (NPV) – This is another way of analysis difference between value of project in market and its cost. It is an analysis to cost benefit.

Payback analysis – This implies period of time that given to pay for an investment until project completion. Counting how many years required to pay for cost to business.

5.1.3 Time feasibility

Time feasibility indicates how long will take to completion of the project and estimate it by creating project timetable by including all tasks. Estimating time is very important to complete project on time. According to this project CRM system scheduled as three months to completion.

5.1.4 Scope feasibility

Feasibility of scope may be well defined one. including process which is going to propose, clear reason for the proposed process and what are the issues going to solve. In here check feasibility in propose AI method and how it affect to feedback receiving and other functions.

5.1.5 Technical feasibility

Technical feasibility involves about technical requirements in proposed system. artificial intelligence is a key technology used in here. I hope to use python language. And other relevant technologies of Flask-API, Cloud-GPU, OpenCV, Deep learning algorithms and database design for use MySQL Server

5.2 Requirements gathering

5.2.1 Selecting the suitable fact gathering technique

There are many fact gathering techniques can be used. Those techniques are useful to gather information in accuracy. Fact gathering technique is important step because it helps to reach better result by understanding problems or drawbacks of existing system. As a techniques, I used observation and questionnaire can be mentioned. The survey conducted as a questionnaire.

5.2.2 Fact gathering using selected techniques

Questionnaire

In this research, I prepared questionnaire as a fact gathering technique to collect information. With consisting questions regarding to current process and proposed system. And I used customers to take responds by answering questions. This is a quick way by selecting choice from multiple options and short answer questions. According to here following mentioned about the facts I was collected through their honest responses.

- Most customers went into the supermarkets and they are not fully satisfied with their service.
- Customers do not like their currently using method for collecting feedbacks.
- Most customers are not express their feedbacks.
- Most of them like to proposed system.

Google form Link - https://forms.gle/6tYr6AZ4Bd45Spjm6

Observation

I went into the supermarket, where the place that I going to do my research. And I see and examined customer behavior. Their satisfaction about service, about issues they faced. Also, obtained it myself as a customer.

Through this I can able to gathered facts which were support for my research to make decisions.

5.2.3 Requirements determination

Requirements determination is considering about current system and collect details what are the things required and how their process goes on presently. further, where the changes needed in system. In this research, determine requirements of customer convenience whenever they come to buy products to the supermarket. Also convenience of supermarkets to achieve their objectives.

5.2.4 Resource identification

5.2.4.1 Hardware

Minimum 4GB RAM

500GB Hard Disk or above

Processor – Intel Core i3 or above

Intel® HD Graphics 620

Web cam

5.2.4.2 Software

Operating System - Windows 8 or above

Visual Studio Code

Flask web framework

Python

MySQL Server

Microsoft Word 2013

Microsoft Project 2013

Visio 2013

5.3 The software process model

Software process model is important to check the progress of software. It consists activities doing in the system. There are many software process models. Selecting software process may differ to project requirements. Project requirements are differed to research topic. Also, it allows to better result through design, develop and testing processes. When selecting the software process model to the project, it should be right and optimal one according to the project. It is effective to manage entire process. To develop this system, Agile methodology I used. There have short phases of work with frequent testing, reassessment, and adaptation throughout. And it is quick and collaborative. Also, this methodology is suitable for AI (Artificial Intelligence) driven projects.

There are six phases in this methodology.

Figure 5.0.1 Agile methodology

1 Requirements

Assess and decide the requirements that need to development process of the system and according to the business value prioritize the functions. According to this system have to identify opportunities to the organization by developing this kind of system to receiving customer feedbacks.

2 Design

This phase collaborates with all of the development team and discuss sequence, identities and tools and about UI.

3 Development

start to developing the product, delivered it in separate sprints

4 Testing

Test the system, taking feedbacks and do the necessary changes if they need

5 Deployment

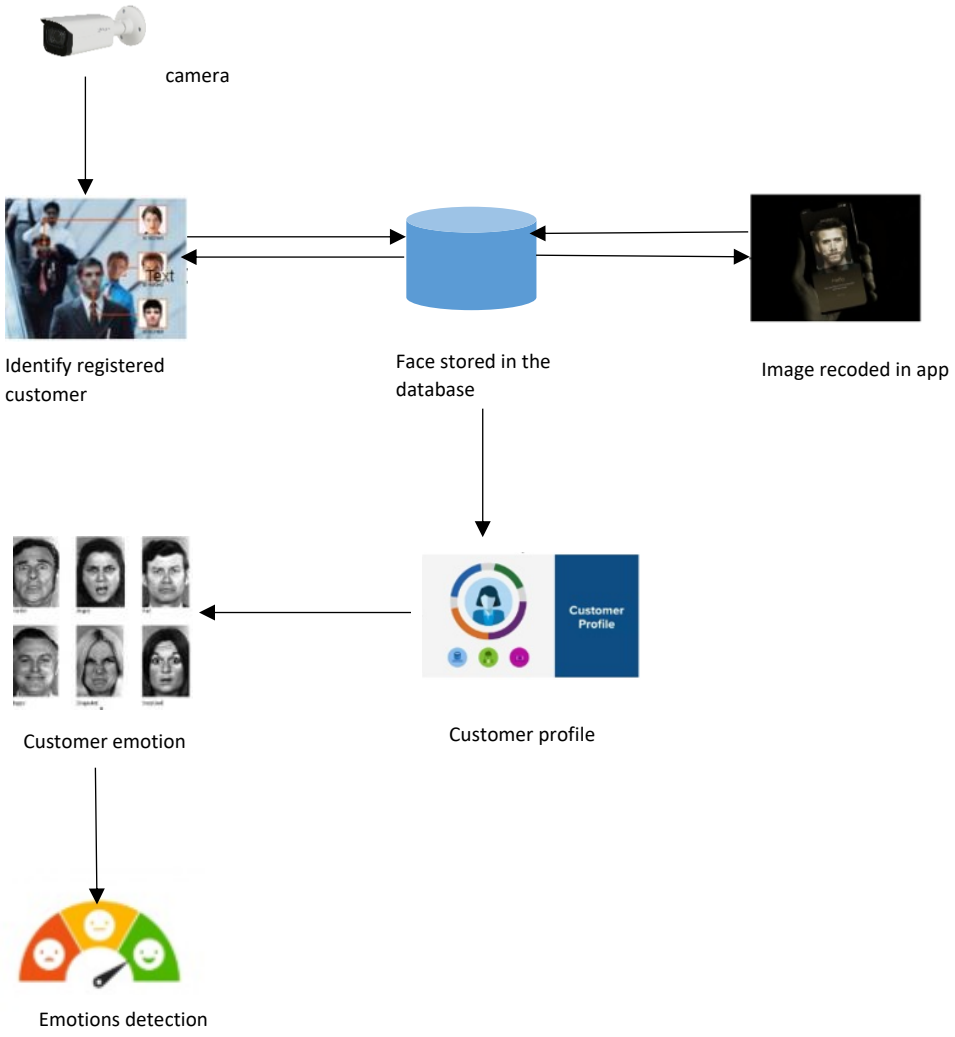
Do the maintenance and provides ongoing support to keep the system running smoothly and fix any new bugs

6 Review

Finally, after completing above all the stages final result achieving, and moving next stage if required. By developing customer feedback system how beneficial to the organization and easily they can achieve their targets.

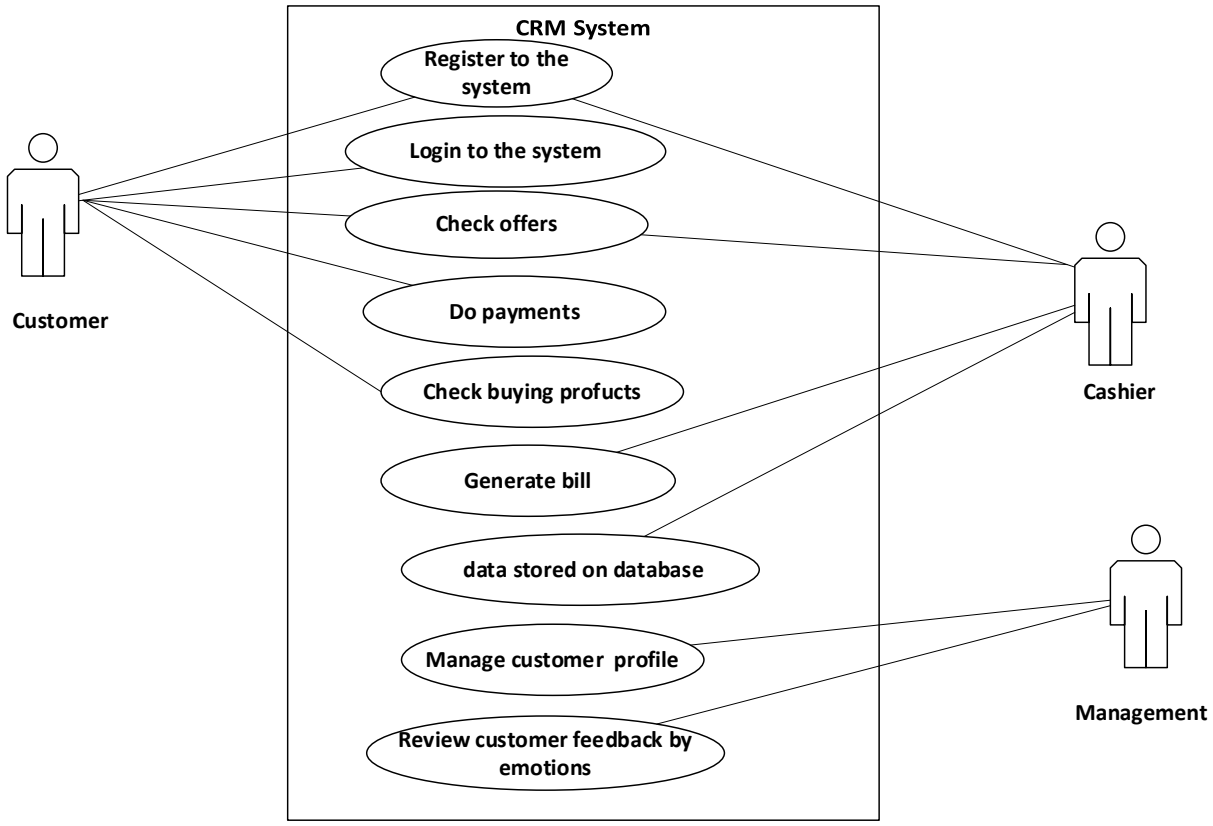
Chapter 6: Design

6.1 Design overview of the system

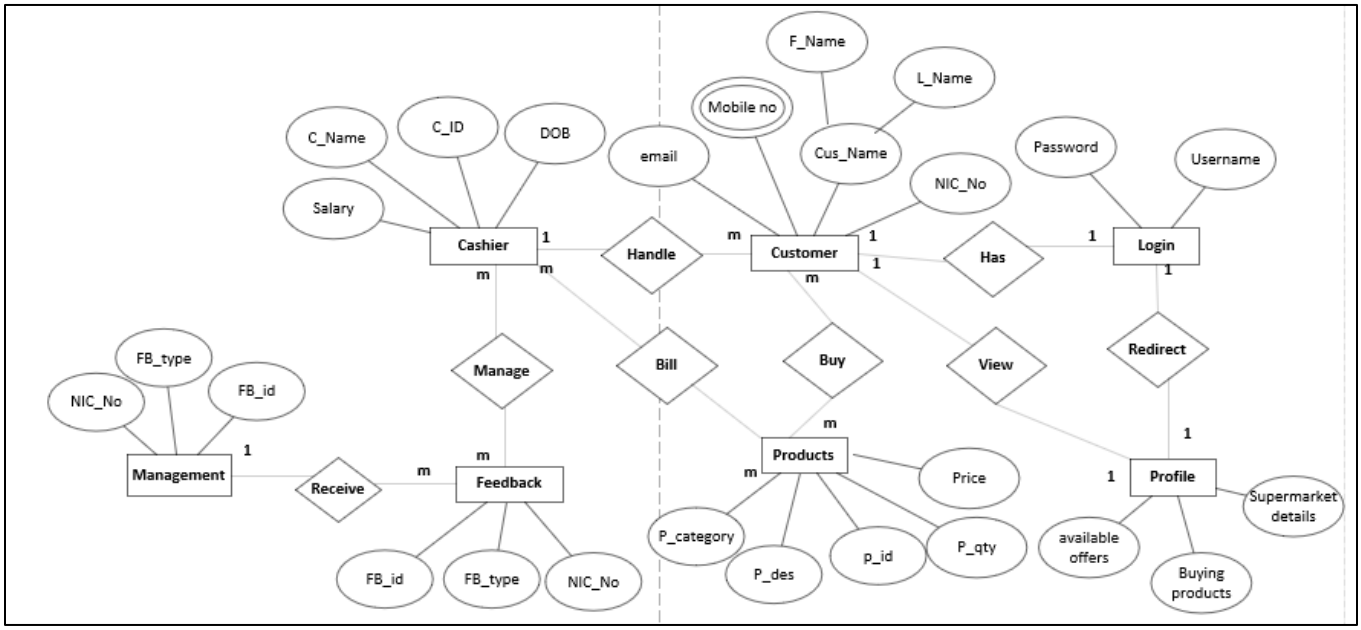


6.2 Design of the system

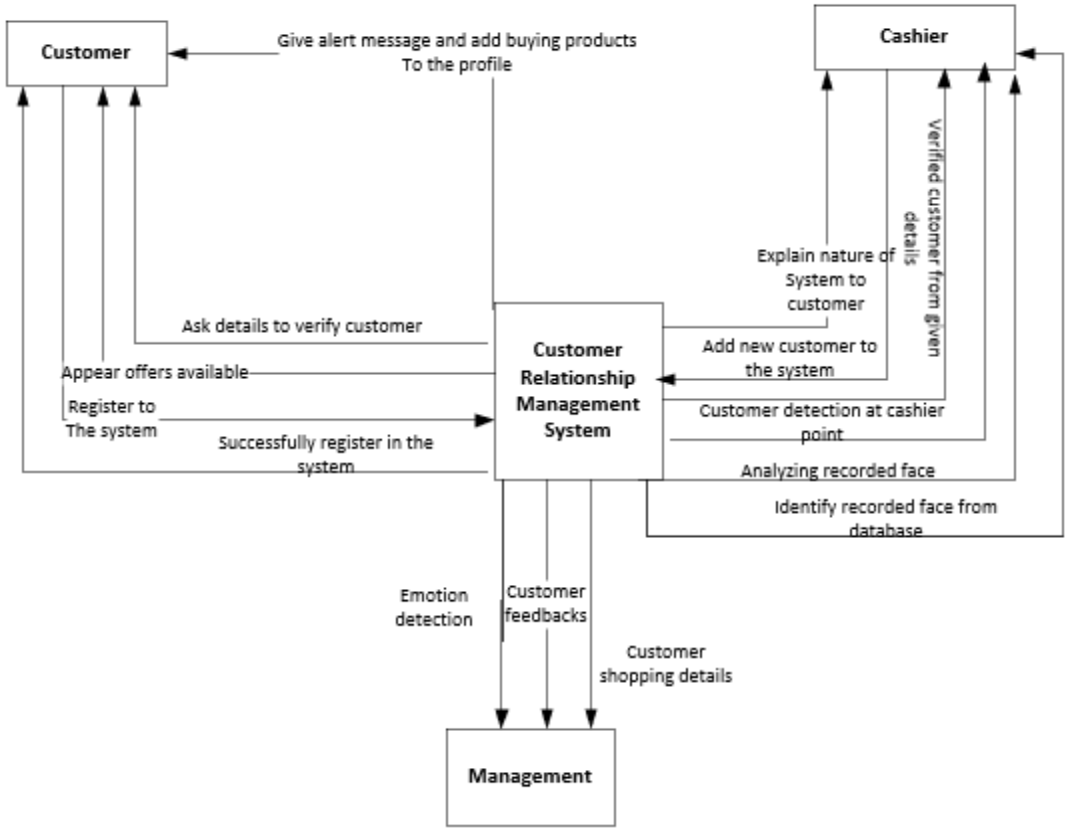
6.2.1 Use case Diagram



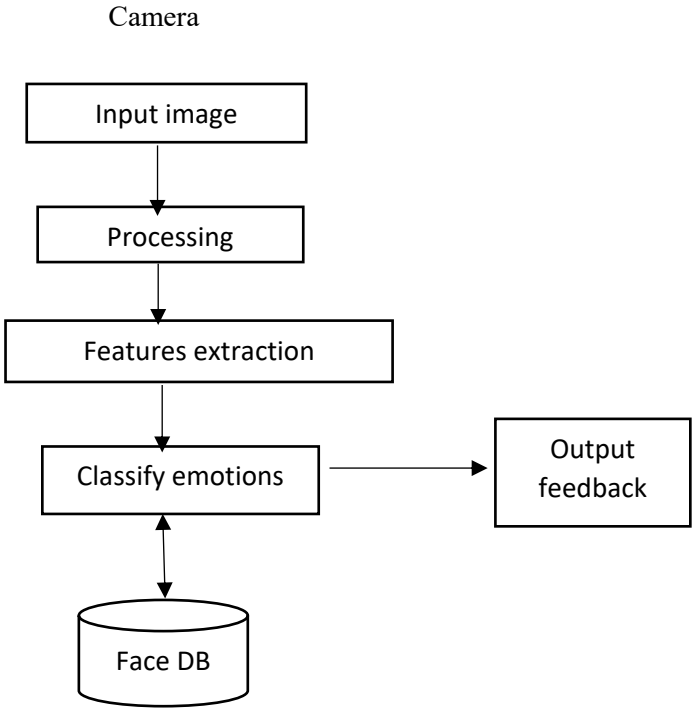
6.2.2 Entity relationship diagram (ERD)



6.2.3 Context Diagram



7.2.4 Architectural Diagram



Chapter 7: Testing

7.1 Testing overview

Testing is the process of evaluate or assess whether the system is work as expected way with having gathered user requirements and specifications of the system. Testing is having benefits of identifying bugs which takes failure to the system, reducing costs and gain improvement in performance. And also including validation and verification.

The testing phase is one of another important stage of the research process. According to this as a result, all customers' real time AI face emotion recognition feedback are used to determine the reliability of the expected product based on the information relevant to the final results as predicted by the prediction model at this point. As previously mentioned, the main expected outcome of this research is to data collected of the customers aid the analyzing and to predict their future goods of supermarket listing based on the information gathered from the data.

As a result, all functions should be tested to ensure that they are fully functional and free of defects or errors. There are levels of testing. Below sub topics is about some testing levels.

7.1.1 Test strategy – Unit testing

Unit testing is the process of testing or checking each unit or an individual module through their paces in preparation for application execution. Unit testing is an initial level of testing. Remaining testing levels are done by after this. Normally, there are two approaches in testing. Approach of white-box testing is used unit testing. Assist in documentation, identify defects and fixes very early are significant reasons of this testing.

The unit tests for each component of the entire analytics subsystem are carried out in this section.

• Verifying that the new system is receiving data from customers' profiles in a proper manner.

• Verifying that information and all the data which related to feedbacks are available or has been received by the application performed.

• Determining whether the final output of the prediction model is correct or incorrect is performed

7.1.2 Test strategy – Integration testing

Integration testing is the process of testing modules by making them into groups. And testing expected performance. Or ensuring components worked together. It is second level of functional testing which comes after unit testing. Purpose of this test strategy is testing defects with having interaction between the modules when integrated.

following is about examples of this testing with relating to this CRM system

- Verify about the customer who having account of their application.
- Test customer sign up and login processes.
- Verify customer face in database of the application earlier he/she was uploaded one with the face when customer come to cashier to pay taken goods.

7.1.3 Test strategy – Functional testing

Functional testing is the process of checking the functionality of an application. It checks, whether the function is properly working which relating to requirement specification. Typically, a team of testers are responsible for this task. This testing level is tested by determining the output and check the correct output with the expected result. Functional testing is performed by using black-box testing technique. Through testing ensure specific objective according to testing level.

In here, objective of functional testing is to checking the functions of the system. Under the test in functional it tests usability of the system. It means user can easily use the screen. And also

tests accessibility and checking errors. According to this research, following is about useful points of testing process to functioning properly.

- Verifying that any mathematical solutions and functions associated with logical components are correctly functioning.
- Verifying that the graphs displayed at various points throughout the Analytics subsystem accurately depict the data produced.

7.2 Test plan and test cases

Test cases for login to the application

Test case ID	Test case description	Pre-conditions	test steps	Test data	Expected results	Actual results
ID01	Check Login functionality with valid username and password	Installed required app on to the phone User must register into the system	Click sign in to login	Username: Bhagya@5 Password: 3245	Login successfully	Pass
	Enter valid username and invalid password Enter invalid username with valid password Enter invalid username with invalid password			Username: Bhagya@5 Password: **** Username ***** Password: 3245 Username: ****** Password: ****	Error Message Error Message Error message	Fail Fail Fail

Chapter 8 : Critical evaluation and conclusion

8.1 Summary of the project

The research title Intelligent customer relationship management system with facial emotion recognition system is a application which allows customers (users of the system) to express their feedbacks. Through this application quickly detect emotions of each customer. Simultaneously supermarket able to identify products wise willingness and satisfaction of customer. The application recorded what they buy at the moment. Therefore, they can identify overall emotions. And provide better shopping experience to customers. AI is the technology that helped to success of the research. This research is based on the problem in customers at the supermarkets. There

are renown supermarkets in our country. But there is no method to currently using technologically system likewise. And I saw lack of actively participation of customers by expressing their feedbacks. So I think proposed system will provide better and reliable solution to this.

8.2 EVALUATION OF THE SOLUTION

This section indicates about evaluation of the solution in this research. This research was conducted to find the solid solution about the difficulties regarding the lack of participation to expressing feedback as I forementioned. And unable to get expected outcome. As a result, it served as an impulsion or drive for the new approach that met requirements. There I can discovered some facts which are interesting on the research for customer feedback which is based on AI technology. Investigation throughout the research was disclosed, current feedback method like filling forms, not consists real feedback of customers. In order with this solution will provide reliable feedback with better performance.

8.3 LESSONS LERANED REPORT

One of the primary goals of this new platform is to increase the efficiency selling goods with receiving feedbacks by implementing new technological strategies so far not used at supermarkets. At the conclusion of the test, it can be confirmed that the analytics subsystem included in the new ai based customer feedback platform, as well as its prediction model, have been developed to be compatible with the entire system under consideration

8.4 CONCLUSION

In conclusion, the findings of this study provide valuable insights into potential benefits of supermarkets. The place where most customers come to buy their required products. Through this study emphasis on the area on how feel customers about their service. Overall, the objective of this research is to provide a most appropriate solution for having deficiency of current system and to raise awareness among supermarket owners about a more useful customer feedback platform. Which carries out benefits to both parties supermarket owners and customers. The AI technology based reliable face recognition customer feedback, is a system based on the Web, is the final outcome of the research

Appendix

Survey questions with responses

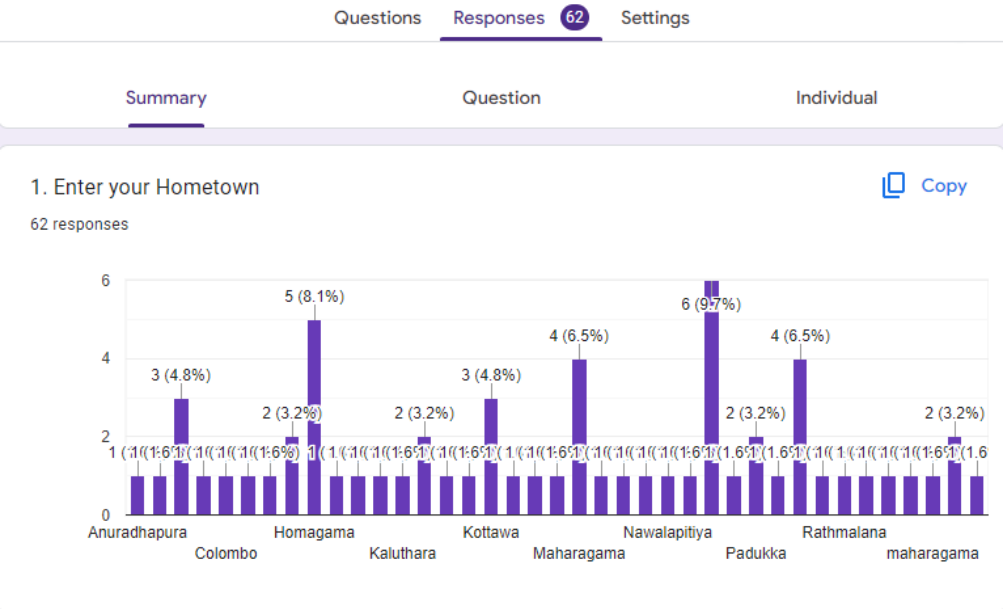


Figure 0.1

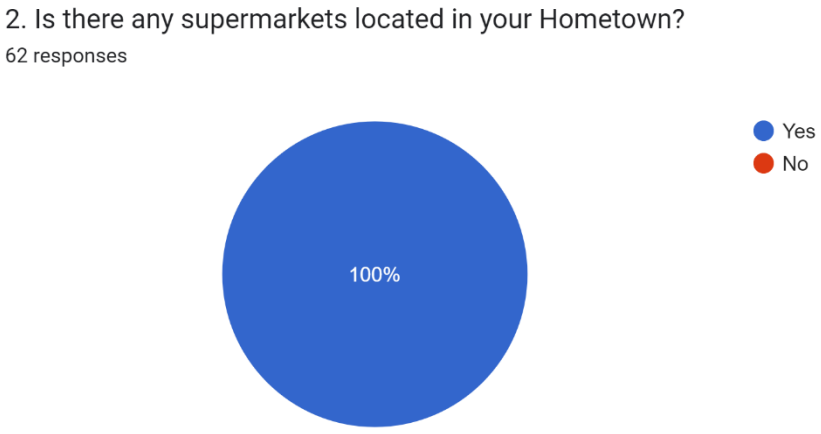


Figure 0.2

3. Are you frequently went into the supermarkets ?

62 responses

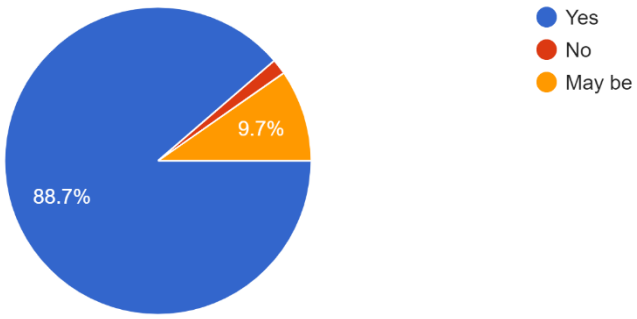


Figure 0.3

4. Are you satisfied about their provided customer service ?

62 responses

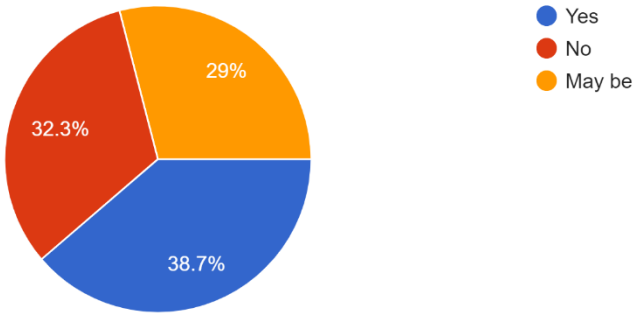


Figure 0.4

5. Why are you select Supermarkets to buy goods ?

62 responses

easy
Because it is easy to buy goods
fresh and easy
Because they are fresh and can get everything from one place.
Convenience
Hygenic and can buy whatever we want
Shoppers can find everything they need in one place, rather than visit multiple stores.
Because it is easy and having all required goods

Figure 0.5

6. Supermarkets provide opportunity to express customer feedbacks. do you ever expressed your feedback?

62 responses

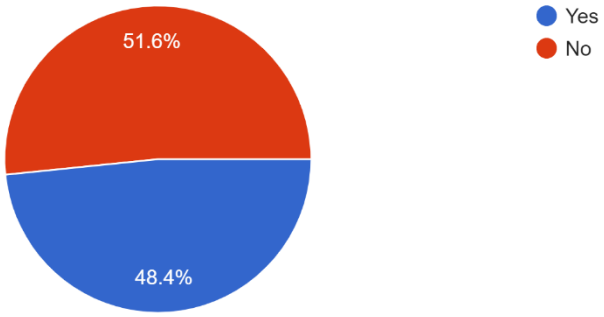


Figure 0.6

7. Are you satisfied currently they following to collect feedbacks ?

62 responses

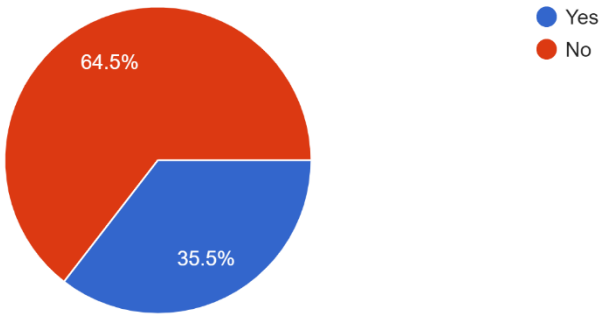


Figure 0.7

8. Do you think is it easy to expressed customer feedback?

62 responses

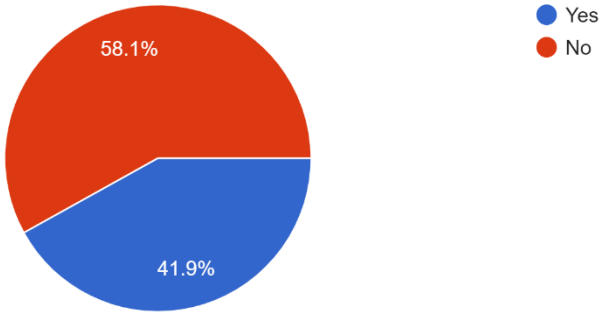


Figure 0.8

9. Did you see most customers expressing their feedbacks without hesitating?

62 responses

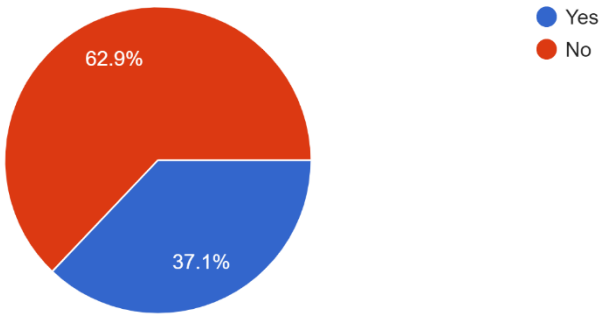


Figure 0.9

10. Are you satisfy if supermarkets having automatically detection system for expressing feedbacks instead of existing system?

62 responses

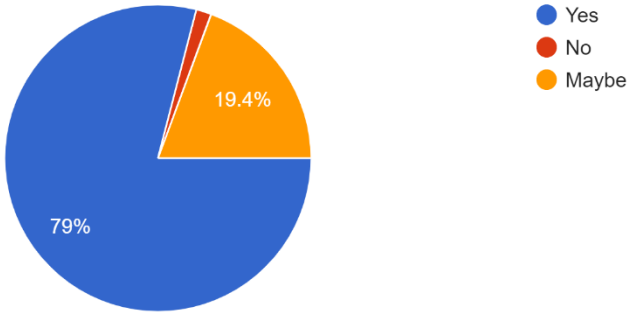


Figure 0.10

12. Do you think is that useful to having better shopping experience in supermarkets ?

61 responses

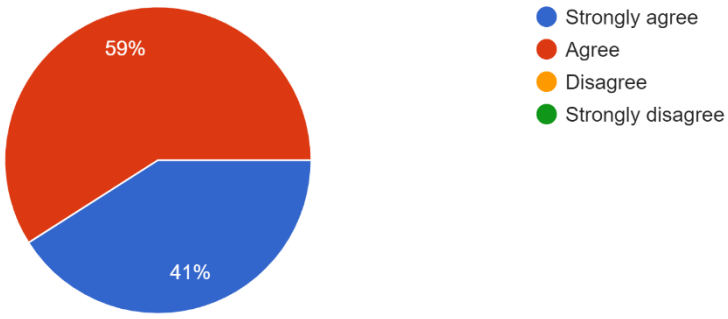


Figure 0.11

13. Are you consider using such technologically improvements in the future ?

61 responses

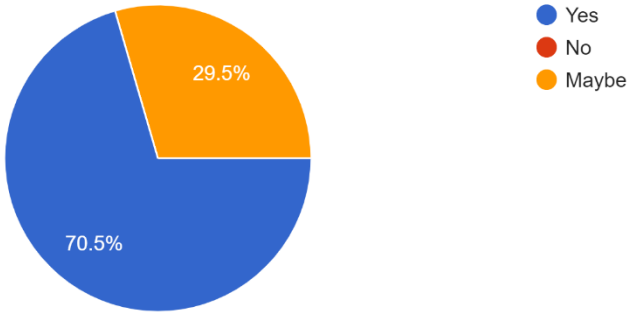


Figure 0.12

14. Do you think getting customer feedbacks helpful to provide better service to customers?

62 responses

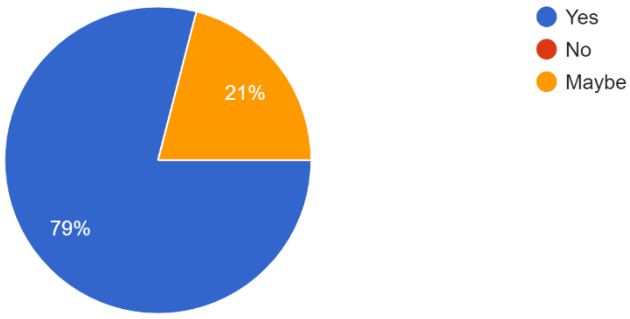


Figure 0.13

15. Getting feedbacks by face emotions is a expected way to gather feedbacks. How much automation system is convenient to you as a customer?

62 responses

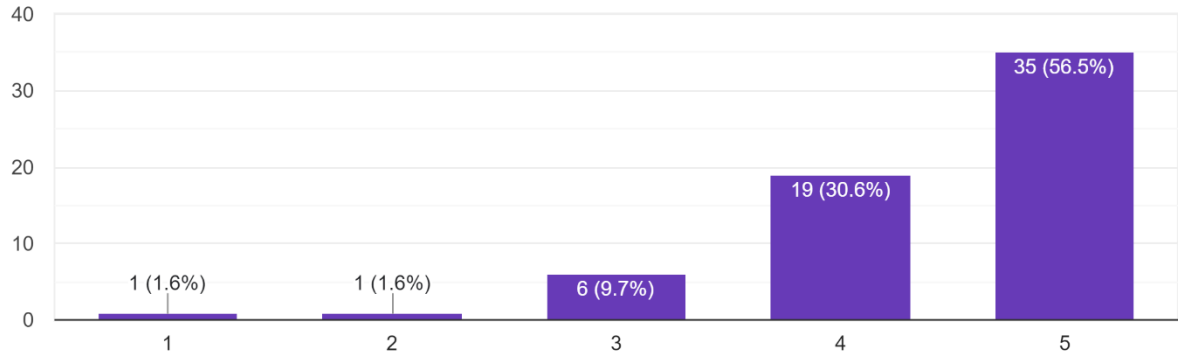


Figure 0.14

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