Innovative Enhancements in Online Delivery Service

Project Proposal Report

Project ID: 24-25J-298

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ABSTRACT

In the logistics and courier service business, customer satisfaction is the main key to its growth and existence. One of the major challenges faced by the industry, however, is the handling of negative feedback in the case of any complaint, where there is no material evidence to support or dismiss it. This project presents a new system, which integrates voice feedback analysis with image-based parcel validation for improved verification of customer feedback and operational transparency. This voice feedback is collected using IVR systems, which are then converted to text using advanced Speech-to-Text technologies. Later, the sentiment of the feedback-that is, if that is positive or negative-is analyzed using Natural Language Processing. It is only in the case of negative feedback that image processing techniques analyze the pre-and post-delivery images of the parcel for damages or discrepancies.

The process cross-validates adverse feedback with the condition of the parcel for further validation of the feedback. In case the feedback has been verified to be genuine, an auto-generated alert is forwarded to the top management for necessary action. The integrated system, with AI, NLP, and computer vision, reduces fake complaints, builds trust with customers, and smoothen processes in handling complaints..

Keywords: Natural Language Processing (NLP), Speech-to-Text, Image Processing, Feedback Validation, Customer Satisfaction, Computer Vision

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INTRODUCTION

Customer satisfaction is important if a company is to thrive, especially within the logistics and courier industry. Timely and safely delivering parcels is at its very core tied to customer experience. One of the key problems in this line involves negative feedback associated with delayed delivery and also damaged goods. It really affects the reputation of the organization and entails operational losses. Current methods of feedback collection involve text-based systems and numerical ratings, which make the customers restricted in their powers of articulation. More often than not, users do not get a chance to explain in detail what ails them, which could lead to a very incomplete picture of customer sentiment.

All of these are traditional feedback systems that lack the scope of finding out what really happened from the customer's complaints and more importantly validating their complaint. Besides, in logistics companies, without verification mechanisms for genuineness or fakeness of the complaint, there is no effective means of sorting out disputes amicably. What's more, very often, there is no cross-referencing between feedback and visual evidence such as images of parcels, which is needed to sort out specific issues, for instance, bad handling of delivery.

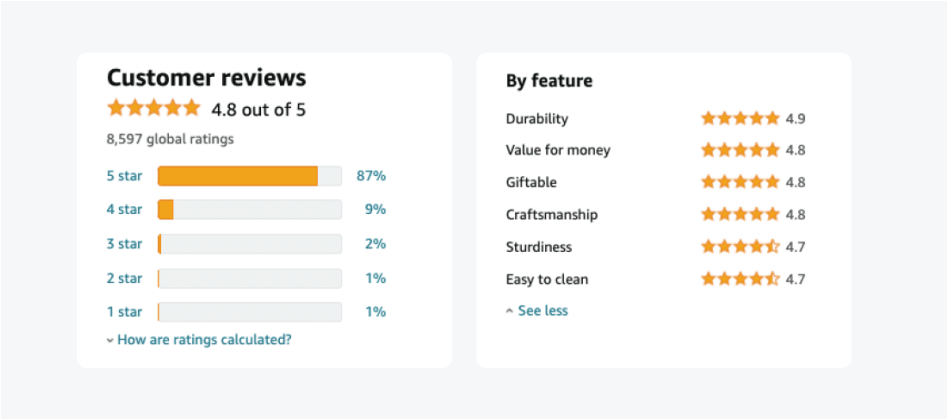

Figure 1- Customer reviews

This solution integrates voice-based collection of feedback, coupled with image validation, so as to increase the accuracy of feedback analysis. The customers will be able to air their concerns through spoken feedback in a natural manner. In turn, the system will enforce voice feedback collection through IVR, Speech-to-Text for converting textual data, and analysis through NLP. On the other hand, if negative feedback exists, it will go one step further by comparing the before and after images of the package using advanced image processing techniques to validate the complaint. The system ensures that any negative feedback is evidence-based, cross-checked against visual evidence to satisfy companies on the legitimacy of the complaint. It focuses on the negative feedback to smoothen the resolution of the feedback in order for customers to be satisfied.

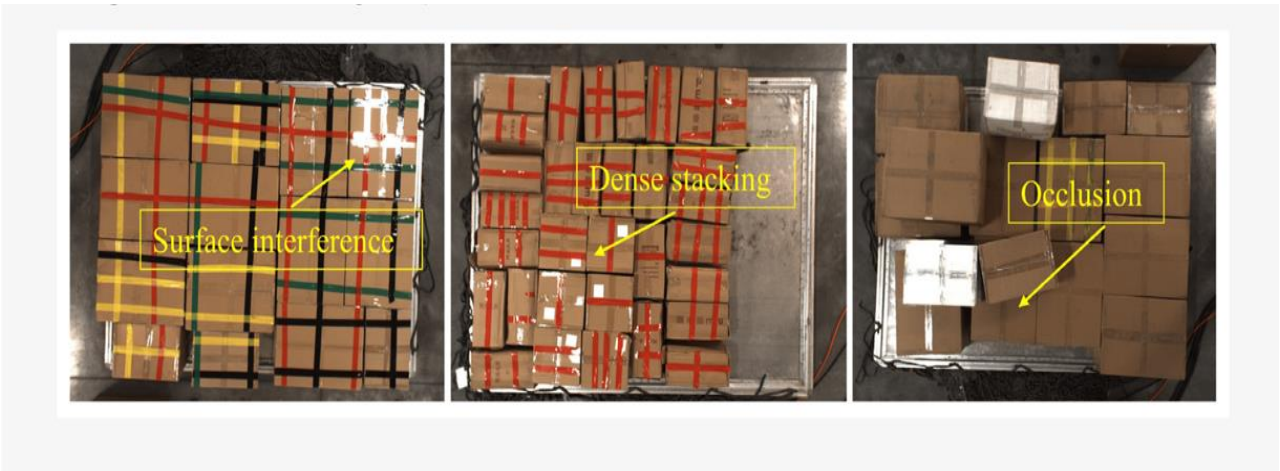

Figure 2 – Types of parcels

1.1 Background and Literature Survey

Customer feedback systems in recent years have relied, by and large, on text-based input and numerical rating systems. These, though giving a general sense of satisfaction or dissatisfaction, reflect neither the full range of emotional experience from being a customer nor even the specific concerns that customers may have [1]. Besides that, NLP-based sentiment analysis has become a common solution in the e-commerce field. For instance, Amazon uses this technology to automatically classify customer reviews into positive, negative, and neutral categories [2].

Parallel to that, image processing technologies have been broadly applied in the sphere of logistics regarding product quality control. The existing systems, built upon two popular OpenCV and TensorFlow, were applied for detecting defects or damages with regard to products during transportation. However, all these technologies so far have been deployed as stand-alone systems not integrated with customer feedback mechanisms [3]. This allows the actual condition of the parcel to be checked against complaints, creating a gap in the resolution process of feedback.

APIs that will be utilized for voice feedback to text are Google Cloud Speech-to-Text and IBM Watson Speech-to-Text. These have proved to be highly effective in many languages and dialects [4]. The project will employ state of the art NLP techniques, including VADER or Google Natural Language API for sentiment analysis to predict the emotional tone of the feedback. These have already seen very effective applications in customer service platforms for categorizing feedback regarding sentiments. This is a advance use of complicated technology.The images of the parcels before and after transit would be compared using technologies like OpenCV and CNNs. These systems can trace even small changes in the condition of a product.It also adapts a supervised learning approach, improving over time from past feedback, making a comparison of given images to predict if the feedback is fair or unjustified [7].

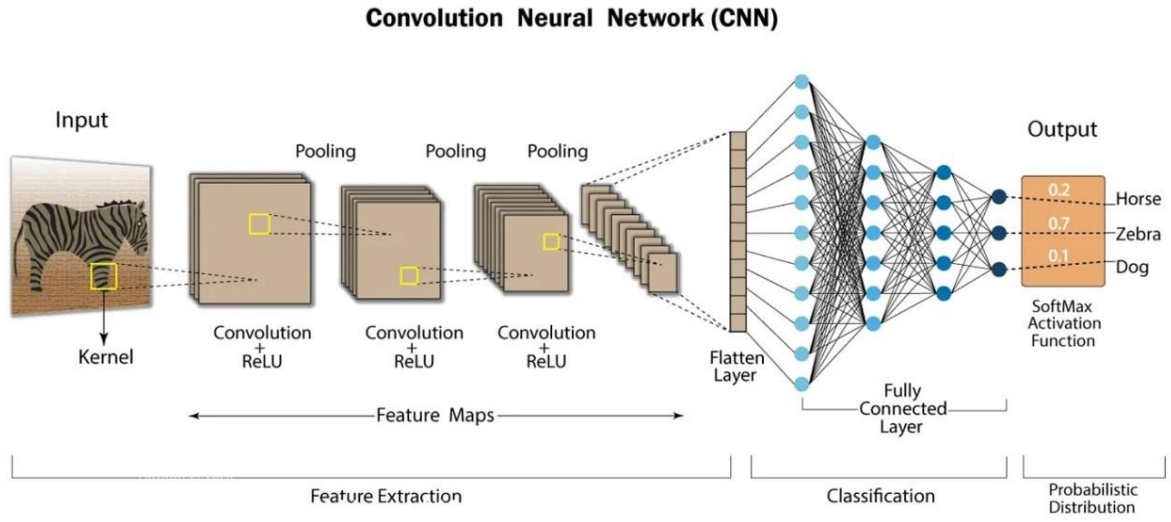

Figure 3- Convolution Neural Network

However, current state-of-the-art feedback mechanisms rely on textual sentiment analysis of customers' feedback. For instance, eBay and Amazon have developed a system whereby customer reviews are automatically classified by their sentiment [8]. However, such systems might be bound to written feedback, which may not give the full insight into the real sentiment or experience of the customer. Also, such mechanisms do not verify the feedback through any physical evidence such as product condition.

In logistics, at the same time, image processing technologies have been strongly enhanced. Fully automated visual inspection systems can identify defective products either during or after shipment, which guarantees that intact goods will be delivered to the customer. However, these stand-alone systems are not integrated with mechanisms for customer feedback; thus, complaints about damage to goods cannot be verified or cross-checked with the real status of parcel condition [9].

While various methods previously proposed to solve the customer satisfaction problem have been mainly either focused on improving text-based feedback mechanisms or automating visual inspections through the use of image recognition, such solutions advance feedback collection and product quality control only piecemeal, not providing a comprehensive approach to complaint validation. While NLP-based sentiment analysis has been helpful for the classification of feedback, it cannot identify whether such feedback is due to a valid issue in the absence of proof to support this fact [11]. Image recognition systems, on one hand, are helpful to identify damage but do not consider customer sentiment.

This project will fill these gaps by integrating voice-based feedback analysis with image validation. Unlike other existing systems, this approach will allow the cross-referencing of customer sentiment with visual evidence-a more accurate and reliable mechanism in resolving complaints. This method not only ensures that genuine complaints get dealt with on time but can also help in avoiding false claims, which can further streamline operations with gains in customer trust.

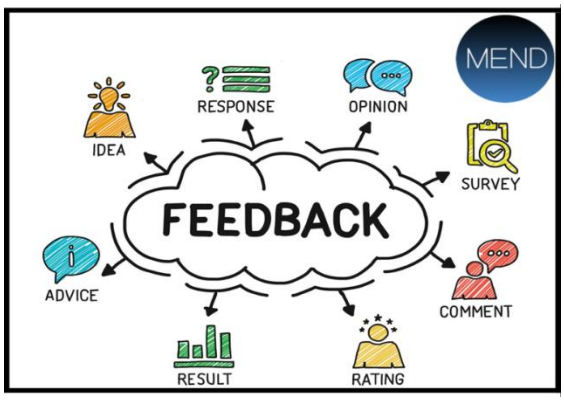

Figure 4 - Feedback

1.2 Research Gap

With the advancement of customer feedback systems and image-based validation technologies, fully integrating technologies to improve customers' satisfaction in logistics and courier service is far from being realized. Most of the existing systems either focus on text-based sentiment analysis or image processing separately, hence limiting their capability to validate customer complaints comprehensively.

Most of the customer complaint systems that exist currently work on purely text information, where a customer manually types out his/her complaints or rates any service provided. While the methods for classifying and analyzing such text-based feedback with the help of NLP techniques have improved significantly, such methods themselves have several limitations. For example, they can often not capture the nuance of emotional tone that can come through in what a customer says. A written review cannot capture the depth and context of a verbal complaint. It may often provide at best only a partial understanding of customer dissatisfaction.

This can be a huge drawback when it comes to logistical and courier service providers. For instance, a customer who has become upset because their package was delivered much later than planned might express this frustration with a certain tone or emphasis that cannot be conveyed solely by text. Because of this, an analysis of the customer sentiment will be incomplete since the text-based system cannot understand subtle speech.

This has been the case, but image recognition systems have recently evolved in their capabilities, specifically in recognizing physical damage issues in goods upon delivery. In this respect, the systems are highly effective in the detection of visual defects in nature, such as package tampering or damage to the product. However, they are also generally set up in a manner that is separate from obtaining customer feedback. In effect, a system link that visually connects proof with customer complaints does not exist at this time, and this is basically the hole in the current validation process.

This means that even though a logistics company may have proof of package damage, they do not have any systematic method to correlate this with specific customer complaints. Logistically, since the two sources do not integrate, companies are stuck with disparate points of data that cannot be used very well to validate whether negative feedback is legitimate or not. Such a lack of a unified system in place makes it hard to really determine if there is a real customer issue at play or a potentially fraudulent claim.

Another very important research gap in the integration of the voice-based feedback mechanism with image validation in logistics studies is that the voice feedback mechanism is increasingly found to be far superior for capturing more expressive customer emotions. This can depict their feelings through things like tone, stress, and intonation, and since it is integrated with NLP tools, this can really enhance the process of sentiment analysis by giving richer and more detailed insight into the state of the customer's mind. That makes identification of the content, but more importantly the context of a complaint, which in text-based systems often gets lost.

This process, in addition to the addition of image validation, provides direct means of vindication with visual proof for customer complaints. Logistics companies can cross-reference issues reported by customers with images of delivered items to validate the veracity of negative feedback. This method further enhances the credibility of the feedback system and allows the company to take precise corrective actions based on actual conditions of goods at delivery.

Other major flaws in existing feedback systems concern the poor use of computational resources in symmetric handling of positive and negative feedbacks. Traditional image-based validation processes, which depend on the analysis of every single entry in the feedback, tend to make such processes unrealistically consumptive of computational power and storage resources, hence unrealistic for large-scale use.

To this end, a much more resource-efficient method needs to be devised-one aimed for the most part at negative feedback with respect to image-based validation. The logistics companies can thereby customize their processes of validation by allocating computational resources only when called upon, thereby averting any extra and unnecessary costs. In that respect, such a strategy would make the process of analyzing feedback not only more efficient but also viable in the long term.

While advanced technologies like Artificial Intelligence, Machine Learning, and Computer Vision are becoming more and more considered for logistics, their full capacity has not yet been leveraged in making complete customer satisfaction courtesy of integrated feedback mechanisms. The integration of AI-based sentiment analysis with image validation would provide a more substantial framework for understanding customer complaints. This would position logistics companies beyond just damage control to being in a place where they are able to handle their customers' issues before they escalate further.

In this regard, the integration of such technologies into a single system would greatly contribute to better handling by logistic companies of customer feedback. From deeper insights provided through spoken and visual inputs, they can get a helicopter view of their

experiences. It is not only about solving current issues but also predicting and preventing future ones to drive higher levels of customer satisfaction.

A hybrid mechanism of feedback in this context can be developed using both voice-based feedback and image validation. It can use the AI and ML algorithms to analyze the voice data, present it as actionable insight, and cross-validate those against visual evidence. If applied to the industry of logistics and couriers, the fraudulent cases of claims will reduce by a significant margin, and the interpretation of customers' feedback will also be closer to reality.

Research Gap

Features	Research A	Research B	Research C	Research D
Voice Feedback Collections	✓	✓	✓	✓
Speech-to-Text Conversion	✓	✓	✓	✓
Natural Language Processing (NLP) for Feedback Sentiment Analysis	✓	✓	✗	✓
Parcel Image Collection and Comparison	✗	✗	✗	✗
Cross-Validation of Feedback with Image Analysis	✗	✗	✗	✗

Table 1- Research gap

This could very well be a new way to redefine the way customer feedback mechanisms work for logistics, as this would fill the gap between sentiment analysis and image-based validation. It might lead to more transparent and trustworthy mechanisms for feedback, since this will be a great help in the overall effective and efficient logistics operations.

1.3 Research Problem

Customer feedback is the engine that drives continuous service improvement in the logistics and courier industry. However, with present reliance on text-based feedback and rating systems, the companies are significantly impaired in capturing the more valuable insights of customers into satisfaction and dissatisfaction. Failure to understand the real nature of complaints affects the ability of companies to track operational issues leading to problematic customer experiences. Thirdly, such feedback systems also lack verification mechanisms whereby a company is likely to fall prey to fabricated feedback and unjust claims that can seriously hamper its goodwill and financially involve companies in undue expenses.

- **Limitations of Text-Based Feedback and Ratings**

The most implemented means of gathering customer feedback today is through text-based forms and numerical rating systems. This has been the case because these are the easiest mechanisms to implement, given that data analysis is also easy to handle. These types of information either lack sufficient depth or detail to be meaningfully acted upon from within the companies. In addition, text-based feedback gives some idea about the opinions of customers but often lacks the elements of emotions, tone, and context.

Expressing Emotion: Through verbal feedback, one cannot express the emotional power of the text. For example, the statement "The delivery was late" does not allow one to ascertain the exact amount of the delay or whether the customer has been in great distress because of such a delay.

Ratings Simplify Experience: The customer experience gets reduced to a 1-5 star numeric form, which reduces the opportunity of the company to understand what specific area needs improvement. A low rating does not show whether this is an issue of delivery time, packaging, or customer service.

Ambiguity in Feedback: The text feedback is not very clear. Customers may not explain the concerns succinctly enough. Therefore, the feedback received will be ambiguous and not understandable. As a result, this hinders the ability of the company in identifying what went wrong and what really needs to be fixed.

Without a means of truly comprehending customer sentiments, companies cannot identify patterns of dissatisfaction, which are usually important operational issues that go unaddressed and, therefore, stall improvement.

- **False Feedback and Competitor Interference**

Another critical issue which arises in the text-based feedback systems is the existence of false feedback. This is usually from competitors or people who have an aim of destroying the good name of the company. Online platforms that allow people to give anonymous feedback give the competition an open forum where they could post hurtful reviews aimed at discrediting a company's performance.

Malice by Competitors: Competitors can, through mechanisms of feedback, demote the image of a company by posting fake complaints of delayed delivery or damaged goods with a malicious intention of scaring potential customers away from the company. The unethical practices may result in uninformed operation decisions such as firings of delivery personnel or changes in routes for no good reason.

Intentional abuse of feedback systems: Sometimes, customers may provide negative feedback as a joke, or even in an attempt to game the system, in situations where they know there is no meaningful check on whether their claim is valid or not. The inability to cross-check this feedback against any objective data leaves companies open to sabotage tactics.

The consequences of false feedback are that it not only can make a firm question its confidence in the responses it gets, but it often results in unnecessary costs when companies act to address problems that are not real problems.

- **Customer Abuse and Injustice to Feedback**

One of the worst aspects is when clients deliberately damage packages themselves after delivery and then claim falsely that their items have been damaged in the process of delivery. Most of the time, customers wanting compensation or refunds tend to take advantage of a lack of verification in text-based systems when filing complaints on unjust reasons.

Sometimes the customers also intentionally damage the parcels after delivery and then complain, accusing the courier service of having caused damage to the contents. Since there is no mechanism in the existing systems to prove the condition of the parcels, in cases of complaint against damage or loss during the delivery process, usually it cannot be proved whether the complaint is genuine or a fraudulent one.

Loss to Company Operations: The claims that are without justification lead to refunds, compensation paid, at times even the goods are replaced. Thus, the company suffers losses. It basically mars the company's trust in its customers, making the customer service relations bitter.

2. OBJECTIVES

2.1 Main Objective

The concept for the project is to develop a system which will collect, analyze, and validate negative customer feedback by using integrated voice feedback and image validation techniques to basically produce an accurate and reliable mechanism for the procedures of handling complaints from customers in logistics and courier service.

2.2 Sub Objectives

- **Voice Feedback Collection**

Implement an Interactive Voice Response (IVR) system that allows customers to leave voice-based feedback after a delivery. The system will capture customer voices and store the audio files for further processing. This feature will enable customers to express their concerns more naturally, providing richer and more detailed feedback than traditional text-based methods.

Speech-to-Text Conversion
Integrate Speech-to-Text (STT) technologies to convert voice feedback into text format. This step is crucial for further processing, as the textual data will be analyzed using NLP techniques to detect sentiment and extract key information from the feedback. Pre-built STT solutions such as Google Cloud Speech-to-Text or IBM Watson Speech-to-Text will be employed to ensure accuracy across different languages and dialects.

- **Sentiment Analysis with NLP**

Develop an NLP-based sentiment analysis system to classify feedback as positive, negative, or neutral. This process will help in identifying negative feedback that requires further investigation. The NLP model will also detect specific themes within the feedback, such as complaints about delivery delays, product damage, or customer service issues.

- **Image Capture and Storage**

Capture before-and-after images of parcels to document the condition of the goods at different stages of delivery. These images will be stored in a cloud-based database for easy retrieval and analysis. By collecting visual evidence of parcel conditions, the system can later cross-check this data against feedback to verify whether the complaint is genuine or unfounded.

- **Image Processing and Validation**

Implement image processing algorithms to analyze the captured images of parcels and detect any signs of damage or discrepancies. Computer vision models, such as Convolutional Neural Networks (CNNs), will be employed to identify differences between

the pre-delivery and post-delivery images, ensuring that complaints related to damaged parcels are validated or refuted based on clear visual evidence.

- **Cross-Validation of Feedback and Images**

Develop an automated cross-validation system that compares negative feedback with the image evidence to determine whether the complaint is justified. This mechanism ensures that only legitimate claims are escalated to management for further action, minimizing the risk of false feedback and unnecessary operational costs.

- **Automated Alerts to Top Management**

Create a notification system that automatically sends alerts to top management when feedback is validated as genuine. This feature will ensure that serious issues are addressed promptly, improving the company's response time to customer complaints and enhancing overall customer satisfaction.

- **Feedback Summary Dashboard**

Build a dashboard that summarizes customer feedback, sentiment analysis results, and the outcome of the image validation process. The dashboard will provide delivery managers with a clear view of all ongoing complaints, highlighting those that have been validated and require immediate attention.

3. METHODOLOGY

3.1 System Architecture Diagram

3.1.1 Overall System Architecture Diagram

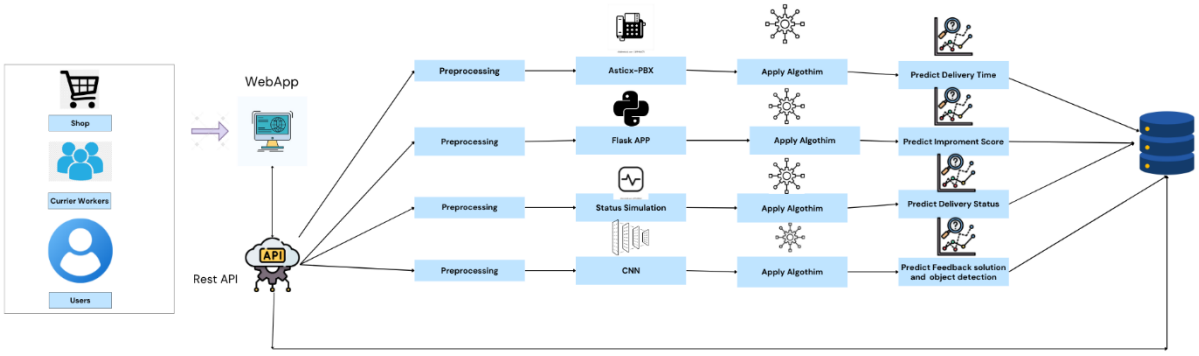

Figure 5- Overall system architecture diagram

The project hereby deals with the development of an integrated system for logistics management to improve both customer satisfaction and operational efficiency by incorporating voice feedback analysis, automated delivery notification, workforce management forecasting, and real-time delivery optimization. This approach involves four members with individual contributions. Each contribution constitutes different aspects of the system and integrates to provide a general solution to the logistics company.

- **Automatic Voice Call Activation System of Delivery**

The module improves the company's communication towards its clients because it automatically detects the date of the scheduled delivery for each parcel and sends an automated call to notify the customer of the same. Confirmations of deliveries are done through calls, which the system sends via the Interactive Voice Response or IVR technology to ensure that the customers are well aware of the coming deliveries and correct delivery details. Moreover, the system continuously monitors the delivery schedule and updates the call timings whenever any change in it takes place. Thus, confirming the delivery details well in advance, the system improves overall customer satisfaction and reduces the errors in coordination of deliveries.

- **Employee Performance Monitoring and Workforce Forecasting**

The workforce management will be optimized using machine learning algorithms with data analytics through this module. This component will collect employee attendance and performance, work schedules, and will feed this data back to the system for further analysis of workforce efficiency at any given time of day and year, including peak hours and holidays. This information is used to forecast the future staffing requirements and based on the previous trends and workload variation suggestions for modification in the staffing level are presented. Through this automation, the company can proactively manage the workforce, ensuring that at proper timings, the right number of employees is available, thus improving productivity and the proper use of resources effectively.

- **Real-Time Delivery Route Optimization**

This component uses real-time data to optimize delivery routes. It keeps a constant update on the weather forecast, live traffic data, and locations of delivery to always recommend the shortest and most efficient routes for each delivery. The system predicts the time of delivery based on historical data and real-time conditions, thus minimizing delays and greatly improving the delivery experience. It also allows for the monitoring of delivery performance, mapping the time spent on delivering all types of documents and reporting with suggestions to enable the delivery process to be even more efficient. With this component, the company is able to adapt in real time and guarantee timely delivery, rendering operations even more efficient.

- **Customer Feedback Collection and Validation**

This feedback validation system focuses on gathering and analyzing customers' feedback to ensure that the company acts upon genuine complaints while filtering out false claims. Customers are first prompted through an IVR system after delivery to give voice feedback. Speech-to-Text technologies convert this text into something readable and understandable, which later goes for analysis by means of Natural Language Processing for identifying sentiment. In case of negative feedback, the system cross-validates the complaint by comparing pre- and post-delivery images of the parcel using image processing techniques. Thus, it ensures the authenticity of the complaint in case any damage is depicted. In case a valid issue arises, the system will trigger an automatic notification to the management so that customer queries would be entertained as soon as possible. This component is necessary to better the handling of feedback through its correctness and to gain better trust from customers by resolving complaints on the basis of solid evidence.

3.1.2 Component Specific System Architecture Diagram

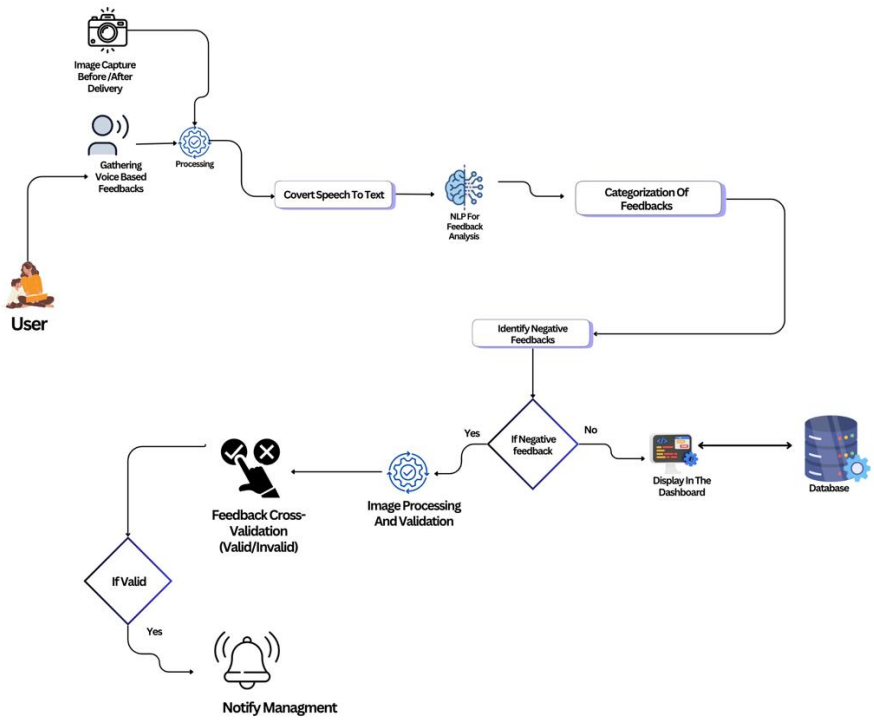

Figure 6 - Component Specific System Architecture Diagram

- **Voice Feedback Collection**

Once this delivery is done, the IVR setup prompts the customer for their feedback regarding the service. The customer can call in and give voice-over feedback wherein he will air his complaints, his satisfaction, and even grievances. Why this would be a preferred choice over text is that voice can convey so much more naturally than text and the emotions and details might not come across as they often do in the written word.

- **Speech-to-Text Conversion**

All gathered voice feedback is treated with the help of STT technologies, like Google Cloud Speech-to-Text or Azure Speech-to-Text. The voice recording thus gets converted into textual data, which is much easier to work on for the system. This must be done highly accurately since it will ensure that all details expressed by the customer are taken down correctly. The resultant text provides a basis for further steps of analysis.

- **Sentiment Analysis**

Once the text of the voice feedback has been obtained, sentiment analysis by means of Natural Language Processing, or NLP, follows. In this regard, the system analyzes the text to decipher the emotional tone of the feedback whether it is positive, negative, or neutral. The process of sentiment analysis is powered by NLP models that scan the feedback keywords, phrases, and context classification. In the event of negative feedback, it sets off the same process to validate the complaint made by the customer. Sentiment analysis will be used to prioritize which feedback needs deeper investigation.

- **Image Capture Before and After Delivery**

In the cases where the feedback has come out to be negative, the system retrieves the captured images of the parcel before and after it is delivered. These are images stored by the system as a form of delivery, documenting the real visual condition of a parcel. Having an image both before and after the delivery of a parcel, the system checks whether any damage occurred during delivery. This stage in reviewing at a critical layer is necessary to ascertain that customer complaints on the status of their merchandise are validated against objective evidence.

- **Image Processing and Validation**

These algorithms image-processing, for example, OpenCV or TensorFlow, examine the images taken both prior to and after the delivery. It scans the images to find any damage, tampering, or issues that may have happened during transportation. The system automatically compares the two sets of images, underlining remarkable changes in the look of the parcel, which can be substantial enough to ultimately turn out to be the valid reason for the customer's negative feedback. In this way, this validation ensures that only genuine issues related to parcel condition are addressed.

- **Feedback Cross-Validation**

The cross-validation of the feedback comes after sentiment and image processing. In case the analysis of sentiment has come up as negative, and the processing of images too shows that there is some visible damage to the parcel, then the feedback can be considered valid. In case there is no major damage in the images, the feedback can be highlighted as unjustified which will help the company in filtering those claims that are false or established with exaggerated facts. This ensures that only valid complaints go upwards for further action and limits the potential disrupting effects that false feedback might have on corporate operations.

- **Management Notification**

On the validation of the feedback that, yes, damage indeed occurred to the parcel, an automated alert will get triggered in the system, going right up to top management. This informs relevant teams that something real has been picked up here that needs their attention. The automated notification system sends the complaint immediately after being validated, which speeds up the response of the company and makes customers trust once more as the problems are being resolved quickly. In the case of complaint issues that are not justified, no alerts take place, so no waste of management and valuable resources takes place.

3.1.3 Flow Chart

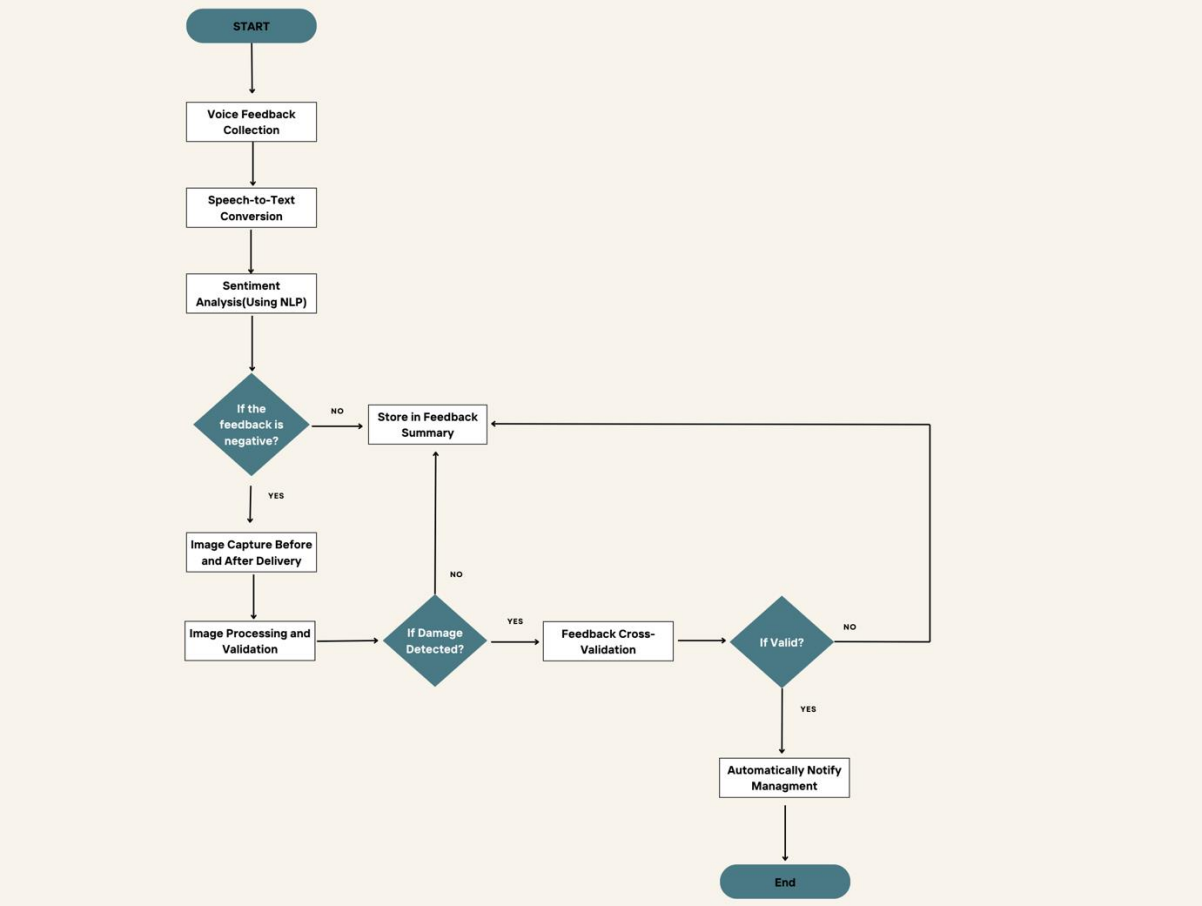

Figure 7 - Flow chart

3.2 Software Solution

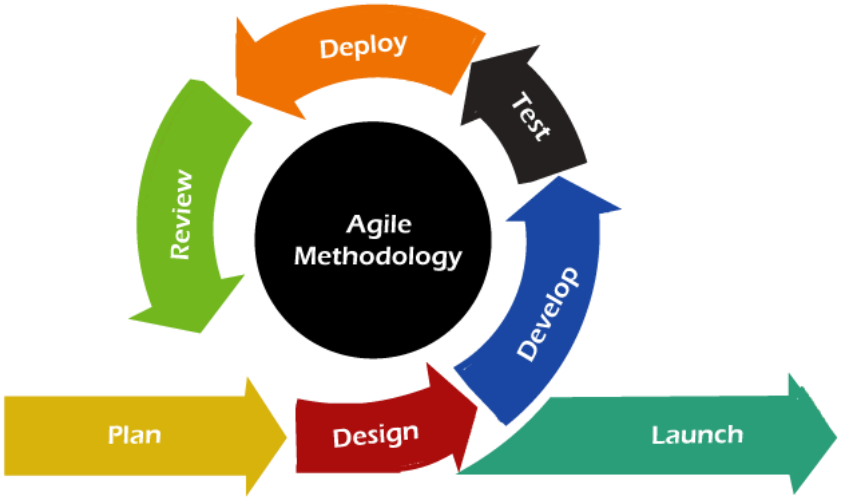

Figure 8 - Agile methodology

Planning

This phase is all about defining the scope of the project for a system that relies on voice-based feedback analysis and image validation. The phase deals with requirement gathering, the feasibility assessment of Speech-to-Text and NLP integrations, and hence the planning of development resources.

System Design

It describes the architecture of the system design, thereby showing how different components like automated notifications, validation of feedback, and route optimization will be integrated. This includes voice feedback containing integrated Speech-to-Text APIs and NLP models, with image processing to validate customer complaints.

Development

The development of the frontend dashboard in React.js and the development of the backend in Node.js to handle data and integrate it with third-party services are done side by side. Implementing NLP models will help analyze the feedback effectively, and image processing tools will help validate the conditions of the parcels.

Testing

Testing will include the unit tests of individual components, integration test for data flow between modules, and system testing in terms of overall performance.

Deployment

The system shall be deployed using a scalable cloud platform such as Google Cloud or AWS. Databases for feedback and performance data shall be set up. Furthermore, these shall be implemented in phases, first a pilot phase to fine tune the implementation of the system.

Maintenance

Keep constant check, regular updating, bug fixing, and performance tuning also form part of post-implementation maintenance to ensure the system remains efficient, responding to ever-growing demands.

3.3 Requirement Gathering

The process of gathering the requirements is very crucial since it will help the system meet the company's operational needs and respond to customer feedback and problems in delivery management. Interviews with different stakeholders in the organization were conducted, including the delivery manager, operational staff, customer service teams and our friends to identify the needs. These interviews also provided an insight into some of the main issues faced by the company while handling customer feedback, delivery routes, and workforce performance optimization.

- **Conducting Interviews**
  Interviews are chosen as the primary tool of requirement gathering, as they can record in-depth qualitative responses from people who directly interact with the different systems and processes of the company. Such interviews will help in the detailed study of challenges and pain areas being experienced by the organization.

  Key Stakeholders Interviewed:

- Delivery Managers: Operational challenges with respect to managing the delivery schedule, customer interaction, and complaint resolution processes.

- Customer Service Representatives: It will explain the most common complaints their customers call in for, how they presently handle them, and where the gaps are in the validation of feedback.

- IT Department: This is deemed necessary for analyzing the infrastructure in current use and assessing what possibilities there are for integrating Speech-to-Text, NLP, and picture processing.
- Employees and Couriers: These will help to reveal information from their daily practices about delivery operations, route planning, and customer service at a personal level, and their opinions on how to improve operational efficiency.

Interview Process:

Interview Design: Semi-structured interviews were designed to allow for flexibility in responses while maintaining focus on key topics. Interview questions were open-ended to encourage stakeholders to provide detailed insights.
Sample Questions:
"What are the biggest challenges you face when addressing customer complaints?"
"How do you currently manage delivery routes and optimize delivery times?"
"What is your experience with the current customer feedback system? What improvements would you suggest?"

Recording and Analysis: The interviews were recorded (under the stakeholder preference) and transcribed for analysis. Key themes and requirements were extracted from these transcripts to inform the system's design and functionality.

4. PROJECT REQUIREMENTS

4.1 Functional Requirements

- **Collection of Voice Feedback**

The system shall provide the facility to the customers to provide voice feedback with the help of an IVR system when the delivery of the parcel is complete

- **Speech to Text Conversion**

The system shall utilize Speech-to-Text technologies, such as Google Cloud Speech-to-Text, in order to convert recorded voice feedback into text. The text is then used for other analytical purposes.

- **Sentiment Analysis**

The system's NLP module should identify if the sentiment of the transcribed feedback is positive, negative, or neutral.

- **Image-based validation**

If the feedback belongs to the negative class, then the system will retrieve the pre- and post-delivery images of the parcel and perform image processing to detect damages or discrepancies.

- **Cross-Validation of Feedback**

The negative feedback has to be cross-validated with the outcome of the image analysis done by the system to determine whether it is valid or not.

- **Automated Alerts**

In case the feedback is validated to be legitimate, the system should automatically send out an alert to management for further action.

4.2 Non-functional Requirements

- **Performance**

This system needs to process and perform voice sentiment analysis within 30 seconds of receiving feedback.

- **Scalability**

This system should be able to scale the demand for its services with a growing volume of feedbacks and images for an increasing customer base.

- **Security**

All data either in voice feedback or image records is to be encrypted to enable secure data transmission and storage. Access to sensitive information should be given only to legitimate users.

- **Reliability**

The system should ensure that it achieves 99.9% uptime in order to have the services of feedback and image validation available anytime for both the customers and management.

- **Usability**

The interface of the system should be user-friendly, and this will therefore enable the users to access the results of the feedback and its validation reports with simplicity and without complication.

4.3 System Requirements

Natural Language Processing:
NLP is essential to making sure that customer feedback analysis goes the right way. NLP works in determining the sentiment of the feedback through analyses of tone, context, and emotional weight of the customer's voice. This approach is unlike the more fundamental ways of text analysis, whereby NLP techniques can tackle various nuances in speech, including emphasis, tone, and specific complaints. This will ensure that the feedback is classified correctly, whether positive or negative, and helps flag the important ones for validation. Precision, ensured by using either Google Cloud Natural Language API or SpaCy, makes NLP the most apt technology to handle such fine-grained and context-sensitive feedback.

OpenCV:
OpenCV is used as an image processing library to analyze before-and-after images of parcels. It processes high-quality images and detects even the minutest discrepancies in the condition of the parcels upon delivery. Few, if any, other image processing libraries provide the real-time performance and depth of analysis that OpenCV does; hence, it is uniquely positioned to check the validity of customer complaints based on visual evidence. With OpenCV handling a wide range of image formats, it stands out as the perfect tool in cross-verifying parcel integrity with efficiency.

Convolutional Neural Networks (CNNs):

Employing CNNs can be done under the grounds of exceptional capabilities concerning the analysis of visual data to extract usable features. They are quite useful in recognizing minor changes within the images of the parcels by comparing visuals pre- and post-delivery. While other machine learning models can be more intractable due to the complexity of image data, convolutional neural networks have proven really great at finding a hierarchy of patterns, key to correctly validating customer complaints about damaged parcels. Their strong performance in image-based classification makes them ideal for the task.

TensorFlow:
For scalable machine learning, it will be used to build and deploy models that automate parcel damage detection. TensorFlow natively supports a wide range of machine learning models flexible to adapt to any changing requirements. Unlike other simple machine learning libraries, TensorFlow will provide the ability for the system to process large data and make continuous improvements in model accuracy to make sure each customer complaint is thoroughly and precisely analyzed.

Hardware Requirements

Devices:

The system requires computers or servers with a microphone for voice feedback collection and cameras for capturing images of the parcels. They need to support real-time processing**.**

Processing Power:

For far better real-time speech-to-text conversion, sentiment analysis, and image processing, we recommend using at least an Intel Core i7 or higher series CPU.

Network Requirements

Internet Connection:
A stable and high-speed internet connection is required for interacting with **cloud services**, and for uploading/downloading **feedback data** and **parcel images**.

Cloud Connectivity:
The system must have seamless connectivity to cloud platforms for **data storage** and **processing**, ensuring fast access to feedback, image data, and sentiment analysis results.

4.4 User Requirements

- **Customers:**

Customers providing feedback through the system should find it friendly and engaging, and the steps to leave voice feedback must be minimal. The system should make it simple and natural for customers to give their concern with their voice without any complex navigation.

User-Friendly IVR: Voice feedback must be uncomplicated and clear to enable the customer with ease to provide feedback using Interactive Voice Response.

- **Delivery Managers:**

Delivery managers will monitor customer feedback and quickly take corrective actions where necessary. Their key requirements are listed below:

Real-Time View: Managers must be able to view real-time summaries of the feedback, with the results of sentiment analysis clearly drawing attention to which items of feedback need urgent attention.

Automated Notifications: The system will need to automatically notify the managers once negative feedback has been validated through image processing in order to act quickly on genuine complaints.

Visual Validation Tools: The managers need the before-and-after images of delivery for cross-verifying any complaint regarding the damage of the parcels.

- **Customer Service Representatives**

Customer complaints and support will be handled by customer service representatives. They require the following:

Access to Feedback History: The reps can access the entire history of feedback left by a customer, including transcripts from voice-to-text systems and sentiment analysis.

Validation Support: Representatives should be given the facilities for helping them in validating the feedback based on the results of image processing so that actual complaints would show up as legitimate and are escalated.

- **Top Management**

Top management requires an insight into the general trends of customer satisfaction and operational performance. Their needs include:

Performance Reports: Management should receive regular reports that summarize feedback trends, with an explanation of the number of validated complaints and the level of overall customer satisfaction.

Alert Systems: Top management should highly be notified in cases where serious customer complaints arise. This will ensure that if there is something seriously affecting the performance of a business, they have an idea about it.

4.5 Use Case Diagram

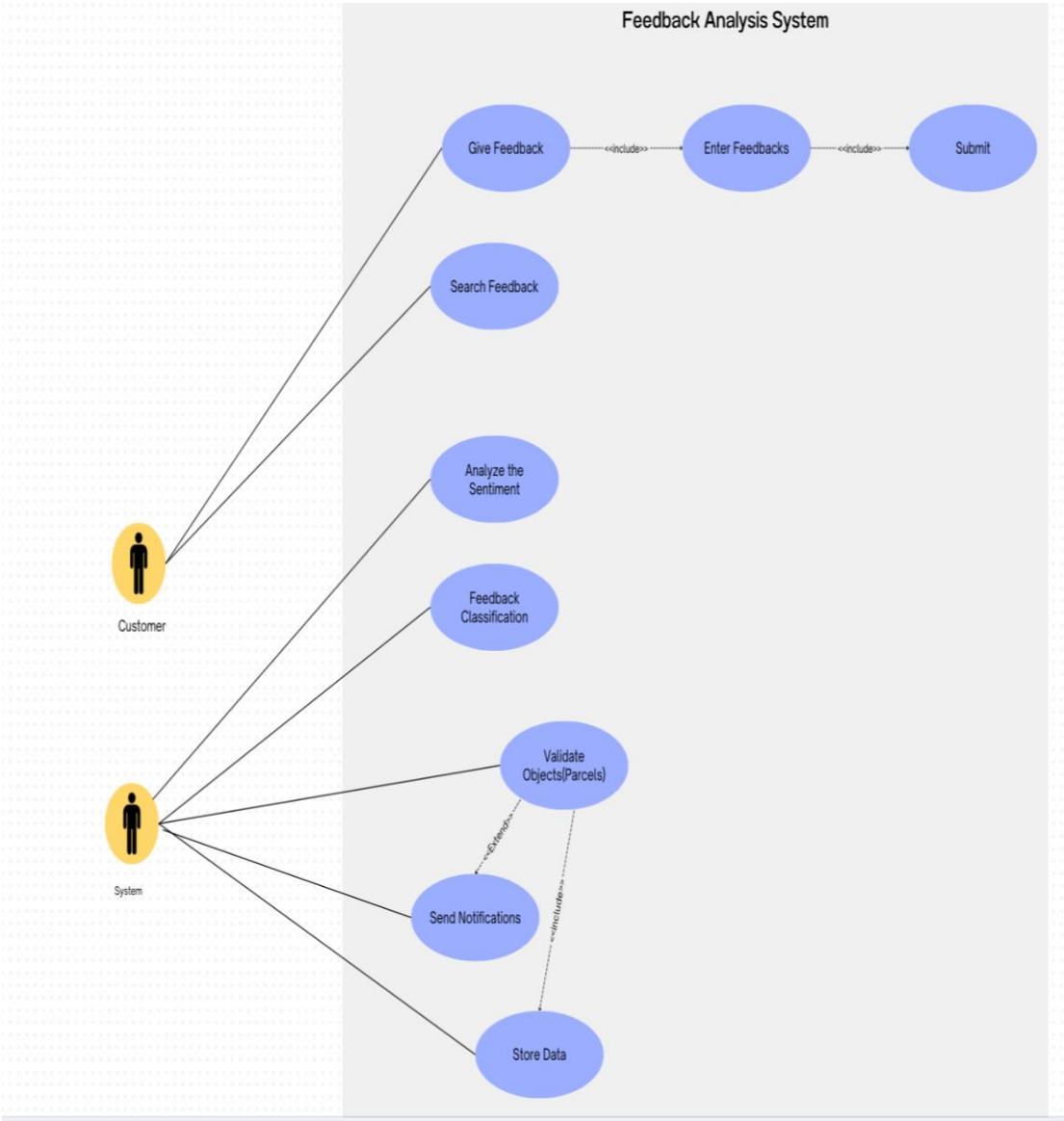

Figure 9 - Use case diagram

4.6 Test Cases

Test case ID: Test_01				
Test title: Voice Feedback Collection Test				
Test priority (High/Medium/Low): High				
Module name: Voice Feedback Collection Module				
Description: It ensures in this test case that the voice of customer feedback, which is collected by the system through the IVR after every delivery, gets stored correctly.				
Pre-conditions: The system has established a connection with the IVR setup, and the voice feedback module works				
Test ID	**Test Steps**	**Expected Output**	**Actual Output**	**Result (Pass/Fail)**
Test_01	1. Customer leaves voice feedback using the IVR system. 2. System stores the audio file. .	• System successfully records and store the relevant feedback.	• System successfully records and store the relevant feedback accurately.	Pass

Table 2 - Test cases 1

Test case ID: Test_02				
Test title: Speech-to-Text Conversion Test				
Test priority (High/Medium/Low): High				
Module name: Speech-to-Text Conversion Module				
Description: This test case performs that the system correctly converts voice feedback into text using Speech-to-Text.				
Pre-conditions: The system has collected voice feedback, and the Speech-to-Text module is active.				
Test ID	**Test Steps**	**Expected Output**	**Actual Output**	**Result (Pass/Fail)**
Test_02	1.Convert voice into text format. 2.Display texts for the review.	• The system successfully converts voice feedback into text..	• The system successfully converted the voice feedback into text format.	Pass

Table 3 - Test case 2

Test case ID: Test_03				
Test title: Sentiment Analysis Test				
Test priority (High/Medium/Low): High				
Module name: Sentiment Analysis Module				
Description: This test case ensures that the system correctly identifies the type of the customer feedback(positive, negative or neutral).				
Pre-conditions: The text of the voice feedback has been successfully generated.				
Test ID	**Test Steps**	**Expected Output**	**Actual Output**	**Result (Pass/Fail)**
Test_03	1. Perform sentiment analysis on the converted text. 2. Categorize feedback as positive, negative, or neutral.	• The system accurately classifies the feedback sentiment..	• The system correctly identified the sentiment as negative.	Pass

Table 4 - Test case 3

Test case ID: Test_04				
Test title: Image Processing and Validation Test				
Test priority (High/Medium/Low): High				
Module name: Image Processing Module				
Description: This test case ensures that the system analyzes and compares before-and-after images of parcels to detect any damages/disabilities.				
Pre-conditions: The images of the parcels before and after delivery are available and stored in the database.				
Test ID	**Test Steps**	**Expected Output**	**Actual Output**	**Result (Pass/Fail)**
Test_03	1. Access the images before and after delivery. 2. Analyze and compare the images using image processing algorithms.	• The system correctly classifies the feedback sentiment.	• The system correctly identified the feedback as negative.	Pass

Table 5 - Test case 4

Test case ID: Test_05				
Test title: Cross-Validation of Feedback Test				
Test priority (High/Medium/Low): High				
Module name: Feedback Validation Module				
Description: This test case ensures that negative feedback is cross-validated with the image analysis results to verify the legitimacy of the complaint.				
Pre-conditions: Negative feedback and analyzed images of the parcel are stored in the system.				
Test ID	**Test Steps**	**Expected Output**	**Actual Output**	**Result (Pass/Fail)**
Test_05	1. Compare the negative feedback with the image. 2. Check if the complaint is genuine based on visual evidence.	• The system accurately verifies the validated feedbacks.	• The system proved the complaint to be actual with the image evidence.	Pass

Table 6 - Test case 5

4.7 Wireframes

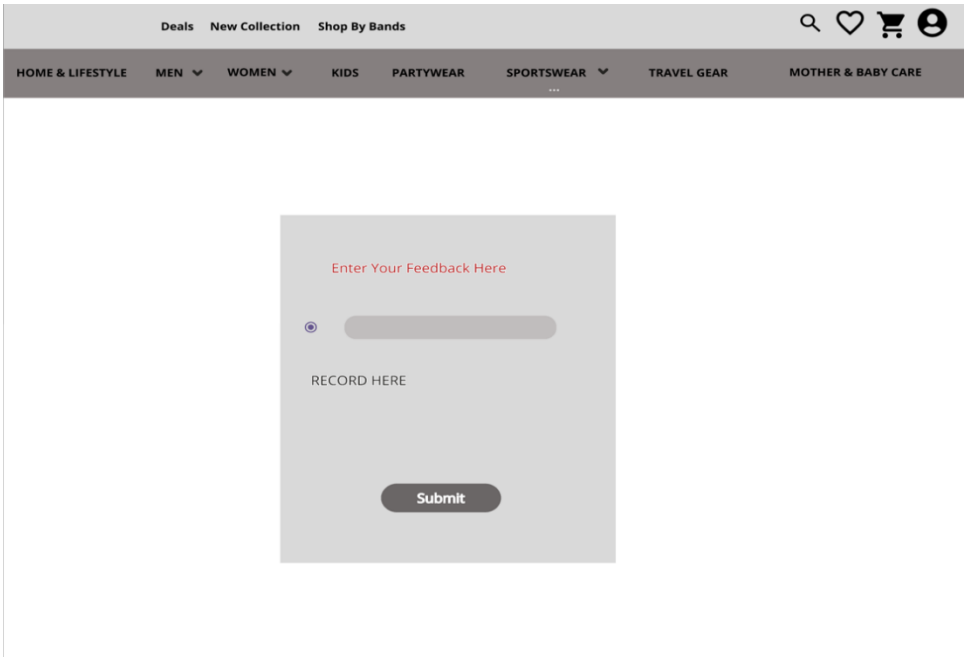

Figure 12 - Wireframes 1

Figure 13 - Wireframes 1

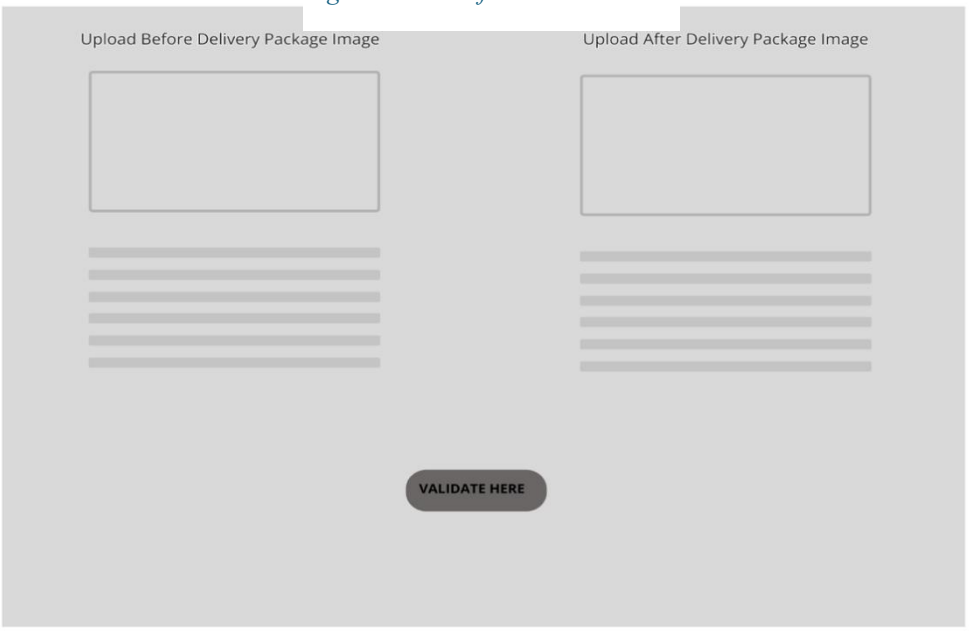

Figure 10 - Wireframe 2

Figure 11 - Wireframe 2

5. COMMERCIALIZATION PLAN

1. Market Analysis

- **Target Group**: The target market would encompass courier service providers, large-scale electronic commerce businesses, and small and medium-sized enterprises.
- **Market Trends**:
- Increasingly important customer satisfaction in courier services, it is the key of the success.
- Growing demand for AI-driven solutions for the optimization of customer complaint handling and reduction of cases of false complaints.
- Integration of Sentiment Analysis and Image Validation, This will further enhance operational efficiency by offering validated input to automate decisions.

2. Revenue Model:

Freemium Model:

- Sell the fundamental components of the system for free, where users can have limited access to the following:
- Collection of voice feedback.
- Basic sentiment analysis, such as classifying feedback into positive or negative comments.
- Image validation, in case of a small number of feedback cases, say up to 100 feedback cases in a month.
- Designed for small businesses or startups that require only basic handling of feedback.

Subscription-Based Model:
Tiered Pricing for different feature levels:

The basic subscription :is designed for small businesses with as many as 500 feedback cases a month and usually provides advanced sentiment analysis with image validation.

Premium Subscription:
Aimed at mid-sized businesses dealing with up to 1,500 feedback cases every month. This includes much more than what has been said: in-depth reports, AI-driven predictions, with automated management alert.

Enterprise Subscription:
This plan is for large -scale courier Companies, which are generating upwards of **5,000 +** feedback cases in a month. This would include customized solutioning, integrated existing CRM systems, and real-time monitoring dashboards.

3. **Pay-per-Feedback Case:**

For companies willing to pay for usage:

Sample Pricing: Rs. 25,000 for handling 500 feedback cases, Rs. 40,000 for 1,000 cases, and Rs. 60,000 for 1,500 cases.

Ideal for the organization that has a fluctuating feedback volume and is looking for a usage-based model instead of a fixed subscription.

6. BUDGET

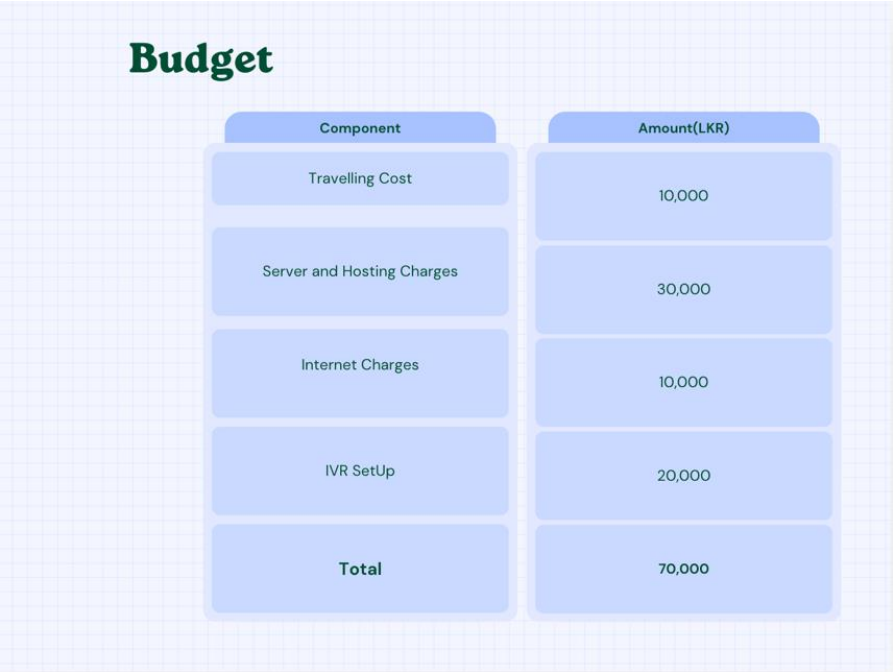

Figure 14 - Budget

The "Innovative Enhancements in Online Delivery Service" project budget comprises all the critical areas of a budget so that the whole project runs smoothly and efficiently. The budget majorly concentrates on infrastructural needs, which are required essentially to make it not only sustainable but also equipped with tools related to the voice-based feedback system.

Traveling Cost: LKR 10,000 This is an estimate to be used for travels in developing and deploying the project. The travels can include team meetings, consultation with clients, or the setting up of hardware at the clients' locations and visiting to companies to gather information.

Server and Hosting Charges (LKR 30,000): Cloud service costs for hosting the IVR system along with the feedback application to provide 24x7 access to a reliable and scalable system that will handle a large number of feedback received from customers. Hosting services selected are at reasonable costs with stability in the processing environment.

Internet Charges: LKR 10,000.00: High-speed internet is an absolute necessity, especially when the feedback system has to work without breaks and handle real-time communication and data processing in respect of voice feedback collection. This will ensure that no development or testing process gets hindered.

IVR Setup: One of the major elements for this project is the setup of an IVR. This budget has been allocated for buying and configuring all necessary software and integration tools that will be required to collect and process voice feedback coming in from customers. Costs include but are not limited to any third-party API integrations for voice recognition and speech-to-text functionalities.

7. GANT CHART

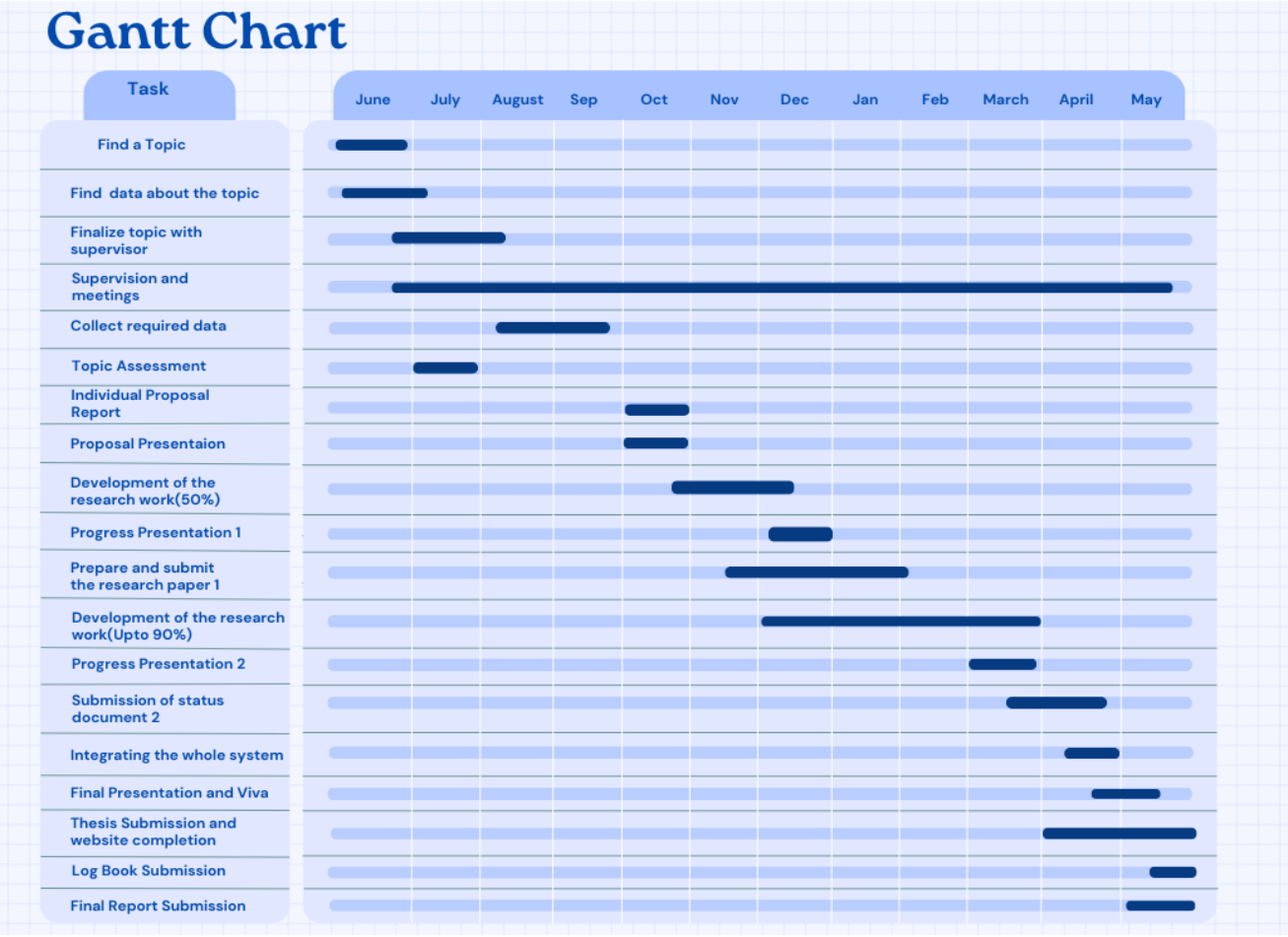

Figure 15 - Gannt chart

8. WORK BREAKDOWN CHART

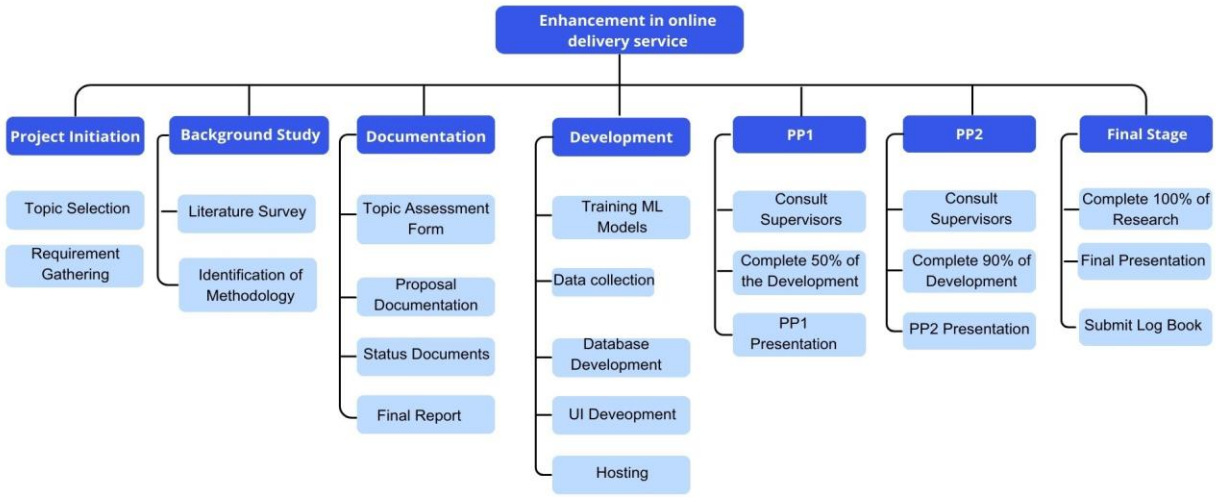

Figure 16 - WBC

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