

**CHAT BOT SYSTEM FOR COMPUTERS,
ACCESSORIES & REPAIR CENTER
RECOMMENDATION**

TMP-23-283

Project Proposal Report

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B.Sc. (Hons) Degree in Information Technology

Specializing in Data Science

Department of Information Technology

Sri Lanka Institute of Information Technology

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
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DECLARATION

I declare that this is our own work, and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. Also, I hereby grant to Sri Lanka Institute of Information Technology, the nonexclusive right to reproduce and distribute my dissertation, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

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02/11/2022

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Date

ABSTRACT

The increasing use of computers for personal and professional purposes has increased the demand for computer accessories and repair services. However, with so many options on the market, the process of identifying the right accessories and repair services can be daunting for many users.

To address this issue, our research proposes developing a chatbot that can provide personalized recommendations for PC accessories and repair services. The Chatbot will be designed to interact with users and understand their specific needs, such as PC type, usage, and budget.

As part of this research, the chatbot uses Natural Language Processing to understand user needs and artificial intelligence & machine learning algorithms to recommend the best accessories and repair services based on user needs. Chatbot will also be able to identify computer parts using image recognition model so the user will be able to upload an image of the part of their PC and get suggestions of better parts to improve the performance of their PC. The proposed chatbot has the potential to revolutionize how users find and select computer accessories and repair services, simplifying their decision-making process.

This research proposal report provides a detailed overview of the proposed chatbot, its features, and the methodology used in its development. The report also discusses the potential benefits of chatbots and the challenges that may arise during the development process.

Keywords - Chatbot, Natural Language Processing, Machine Learning, Artificial Intelligence, Recommendation System

TABLE OF CONTENTS

DECLARATION	1
ABSTRACT.....	2
TABLE OF CONTENTS	3
LIST OF FIGURES	4
LIST OF ABBREVIATIONS	4
1. Introduction.....	5
1.1. Background Literature.....	5
1.2. Research Gap	7
2. Research Problem	8
3. Research Objectives.....	9
3.1. Main Objectives	9
3.2. Specific Objectives	9
4. Methodology	10
4.1. System Overview.....	10
4.2 Commercialization of the product.....	14
5. Software Specifications and Design Components	16
6 Budget And Budget Justifications	18
7 Work Distribution.....	19
Reference List.....	21
Appendices.....	22

LIST OF FIGURES

Figure 1: System overview	10
Figure 2: Component Diagram	11
Figure 3: Types of RAM	12
Figure 4: Types of storage.....	12
Figure 5: Product Logo	14
Figure 6: Gantt Chart	19
Figure 7: Work Breakdown Structure	20

LIST OF ABBREVIATIONS

Abbreviation	Description
SLIIT	Sri Lanka Institute of Information Technology
NLP	Natural Language Processing
RAM	Random Access Memory
CPU	Central Processing Unit
SSD	Solid-State Drive
HDD	hard disk drive
R-CNN	Region-based Convolutional Neural Network
YOLO	You Only Look Once

1. Introduction

1.1. Background Literature

Chatbots have become increasingly popular in recent years as a means of providing customer service, sales, and marketing assistance. Chatbots are computer programs that can simulate conversation with human users. The use of chatbots in e-commerce has proven to be particularly effective due to their ability to provide personalized recommendations, answer customer queries, and provide real-time support.

In the context of computer parts and repair center recommendation systems, chatbots can offer several benefits. A chatbot system for computer parts and repair center recommendations can provide customers with immediate support and advice on their computer-related issues. Customers can receive recommendations for the best computer parts and repair centers based on their specific needs and budget. Furthermore, chatbots can provide customers with information on the latest technology and trends in the computer industry, as well as answer frequently asked questions.

One of the main challenges faced by customers in the computer industry is the complexity of computer hardware and software components. Customers often struggle to understand the technical jargon and specifications of computer components, which can lead to confusion and frustration. A chatbot system for computer parts and repair center recommendations can help customers navigate this complexity by providing clear and concise explanations of technical terms and offering personalized recommendations based on the customer's specific needs.

Another benefit of chatbots in the computer industry is their ability to provide round-the-clock customer support. Customers may require assistance with their computer-related issues outside of regular business hours, and chatbots can provide them with

the support they need at any time. This can improve customer satisfaction and increase customer loyalty, as customers feel that their needs are being always met.

The use of chatbots in e-commerce has been extensively researched, and several studies have shown their effectiveness in improving customer service and satisfaction. Chatbots have gained immense popularity in recent years, owing to their potential to improve customer engagement and increase sales in various industries. In the e-commerce industry, chatbots have been extensively used to provide a personalized shopping experience to customers, leading to increased customer satisfaction and loyalty [1].

According to the Chatbot Report 2019, chatbots have become increasingly popular across various industries, with the retail and e-commerce sector being the biggest adopters [2]. The report highlights that chatbots have been able to significantly improve customer engagement, reduce customer support costs, and increase sales for businesses. Furthermore, chatbots have been shown to improve customer satisfaction and loyalty by providing personalized recommendations, answering queries, and facilitating transactions.

In the computer parts and repair center industry, chatbots have the potential to improve customer experience by providing personalized recommendations for computer parts, troubleshooting computer issues, and suggesting appropriate repair centers. Chatbots can also help customers track their repairs, estimate repair costs, and provide updates on the repair status.

Several brands have already adopted chatbots to improve their customer engagement in the computer industry [3]. For example, Intel's virtual assistant, "Intel Assistant" [4] helps users troubleshoot computer issues by providing step-by-step guidance. Similarly, Microsoft's "Zo" [5] chatbot provides personalized recommendations for computer parts and accessories based on user preferences.

In addition, image-based search applications have been developed to improve e-commerce search experiences. These applications use artificial intelligence and computer vision technologies to identify products in images and recommend related products to customers [6]. Such technologies can be incorporated into chatbots to improve the recommendation process for computer parts.

1.2. Research Gap

In recent years, there has been a lot of study being done on the application of image processing methods for object detection and classification. Nevertheless, most of the works that are now available in this subject concentrate on recognizing common items like humans, animals, and automobiles. Research that is explicitly devoted to applying these methods to identify PC hardware components is lacking. Due to the need for effective techniques of identifying and diagnosing issues with these components, there is a large research deficit in this area.

Although considerable study has been done on identifying electrical parts like resistors and capacitors, there hasn't been much work done on identifying PC hardware parts. Because Computer components can have a wide range of aesthetics, it takes sophisticated algorithms to identify and categorize them correctly. Moreover, PC components are sometimes partially or completely covered by other components, which might complicate identification. Moreover, several components could seem the same, which might make the detecting procedure challenging.

Another difficulty is the requirement for specialist knowledge to precisely identify and classify Computer components. A high degree of skill is needed to discover PC components since it's crucial to appropriately classify each component in addition to

identifying it. Each type of computer component, including Memory, graphics cards, CPUs, and motherboards, has distinct characteristics that must be understood.

A huge research gap exists since there are no reliable ways for applying image processing to identify PC hardware components. This knowledge gap emphasizes the demand for specialized algorithms that can precisely identify and categorize PC components, taking into consideration their variety in appearance and the difficulties associated with their detection.

2. Research Problem

The absence of efficient and accurate methods for identifying PC hardware components using image processing techniques is the research issue this project's proposal seeks to solve. The methods used today to identify Computer components take a lot of time, money, and are prone to human errors. PC component manual examination is challenging and ineffective, requiring specialist knowledge of the many versions of components on the market.

The development of specific algorithms for PC hardware component detection utilizing image processing methods is the suggested remedy for this issue. These methods would be improved to handle difficulties specific to PC component detection, such variation in component appearance, occlusion, and component similarity. To increase accuracy, several feature extraction techniques and machine learning algorithms would be explored.

We will also be integrating the image processing component to a chatbot to provide the user with a very intuitive and friendly user experience. In addition to identifying the component we will be able to give the user some recommendations using the proposed recommendation model which will be built by a team member.

3. Research Objectives

3.1. Main Objectives

- Provide a web scraping component that can extract information about product and repair centers reviews from numerous online sources.
- Provide a component for natural language processing (NLP) that can precisely recognize user queries about computer parts and repair shops.
- Provide an image processing module that can accurately recognize computer components from pictures.
- Create a recommendation algorithm that uses user searches and review data to produce precise and individualized suggestions for computer components and repair shops.

3.2. Specific Objectives

- Gather a dataset of photos of various computer components from different angles and with different lighting conditions, then use machine learning algorithms to train the image processing model to detect each component precisely.
- Comparing the results to those of human specialists and accepted standards can help determine how accurate the model is.
- After the part is identified send it to the recommendation model and evaluate the results.
- Integrate the image processing component into the chatbot system to enable the chatbot to detect computer parts in user queries.

4. Methodology

4.1. System Overview

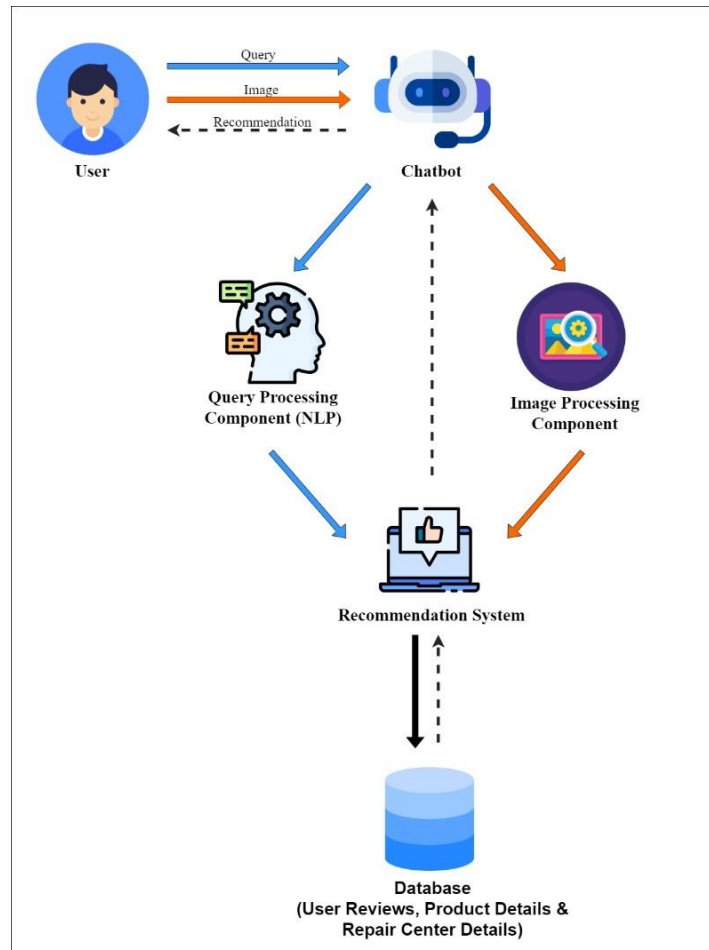


Figure 1: System overview

The high-level architecture diagram of the proposed chatbot system is depicted in figure 4.1. It contains the main five subcomponents, namely:

- Chatbot Interface
- Query Processing (Natural Language Processing)
- Image Processing (Computer Hardware Identification)
- Recommendation Model (For Computer Parts & Repair Centers)
- Database (Populated by Web Scraping)

The chatbot interface, which will be accessible to the user, will be implemented via Preact, which is a JavaScript library. The backend of the system will be mainly composed of Python with Flask Framework. The database will be MongoDB.

User can enter a query and/or upload an image of computer part through chatbot interface the query will go to the query processing component where the user need will be identified, and the image will go through the image processing component where computer part will be identified the results of these two components will be merged and sent to the recommendation model.

The recommendation will use the database which is populated by the data extraction component by Scraping product reviews and repair center reviews on the web. The data extraction component will also get video reviews and use a speech to text algorithm to extract the text from it.

The output of the recommendation model will go to the chatbot interface where the user can see it.

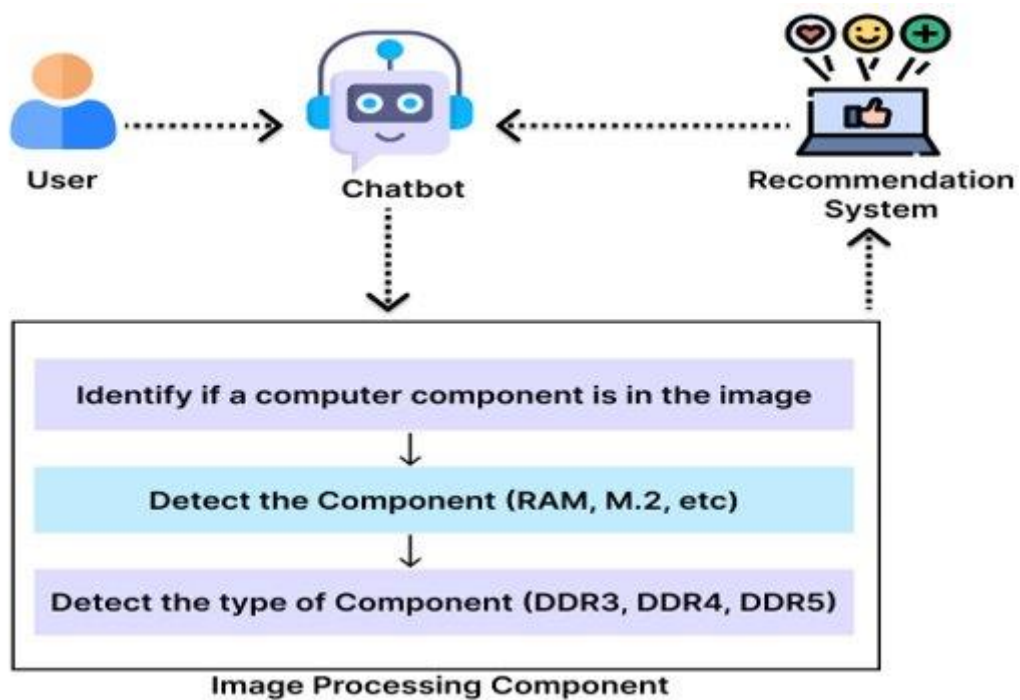


Figure 2: Component Diagram

I will be mainly focusing on the image processing component so here is the proposed methodology which we plan to use in the image processing component. This component will comprise of mainly 5 phases which are,

i. Data Gathering

Creating a large dataset of labeled images of PC hardware components is the initial stage. Images of various component types, including Storage devices (such as HDD, SSD, M.2), RAM, graphics cards, CPUs, and motherboards, from various manufacturers should be included in the collection. To reduce variation in image quality, images should be taken using high-resolution cameras under regulated lighting circumstances. To create training, validation, and testing sets, split the dataset.

ii. Preprocessing:

The second step is to preprocess the photos to get rid of any noise or artifacts that can hinder the detection algorithm's effectiveness. Applying various image processing methods, such as resizing, cropping, and filtering, can accomplish this. Another aspect of preprocessing is the elimination of any background noise or picture artifacts.

iii. Training:

The final stage entails using the preprocessed photos to train an object detection model. Several object detection methods, such as Faster R-CNN, YOLO, or SSD, can be used to do this. To maximize the model's performance, it should be trained on the training set and verified on the validation set.

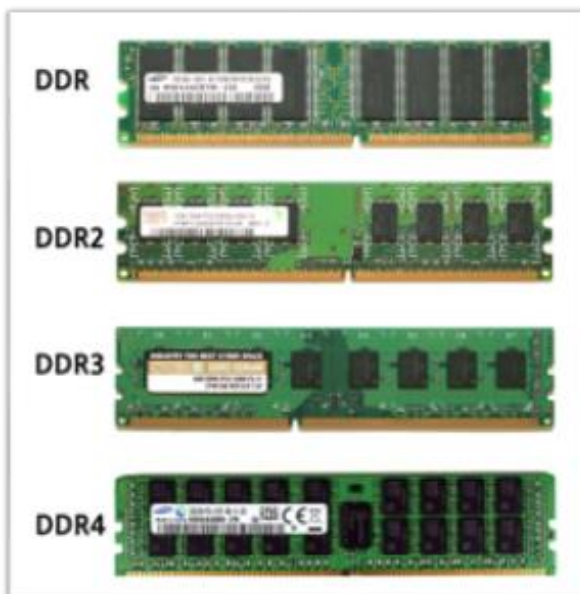


Figure 3: Types of RAM



Figure 4: Types of storage

If we compare figure 4 and figure 5 we can see there is a clear difference between RAM and Storage types. And Among RAM types we can see a difference in the notch placement in the gold area of the RAM. In the earlier generation it is in the right, and it moves towards the left in the newer generations. Among the storage types if we look at the M.2s there is a clear size difference in the M.2 series (2260, 2280) and SSDs are larger than the M.2s. We will be using these visual differences to identify different components.

iv. Evaluation and testing:

Testing the trained model's performance on the testing set is the fourth phase. The model's performance may be assessed using several measures, including precision, recall, and F1-score. By visually examining the components in the photos that have been discovered, the model's precision may also be evaluated.

v. Optimizing and Improving:

The performance of the model is enhanced and optimized in the fifth stage. This may be done either by changing the model's hyperparameters, such the learning rate or number of epochs, or by applying transfer learning to enhance the model's performance on all kinds of components.

4.2 Commercialization of the product

Commercializing a Chat-Bot system for laptops, accessories, and service center recommendations can be a successful business venture if handled effectively. To do so there are certain factors to be considered.

The most initial and crucial factor is identifying the target market and potential buyers of the developed product. In that case, we propose this system towards computer selling companies. In such ways, they will be able to increase their sales & customer base as well.

In comparison to the competition seen in the available market, there are none to rare instances where we see Chat-Bot systems. Hence, commercializing such a product would be very useful. In addition, we don't see such system in the Sri Lanka market as well. So, implementing such a system would raise customer satisfaction and raise develop the competition in the Sri Lankan market as well.

As proposed, shown below is our product logo.

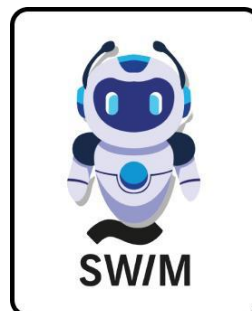


Figure 5: Product Logo

As we are newcomers to the market, we will have to market our product through various channels such as social media, search engine optimization, paid advertising, and content marketing. We'll also have to offer promotions and discounts to attract early adopters and build a loyal customer base.

Our target is to integrate the chatbot into platforms like Barclays.lk, nanotek.lk which provides a wide variety of laptops, desktops, computer parts, and computer maintenance and repair services. But we will not be limited to a few but will expand beyond that.

To build a loyal customer base we will have to Monitor the chatbot system's performance, user feedback, and usage patterns. Update the chatbot system regularly to ensure that it stays relevant and meets the changing needs of your customers. Also Evaluate the results of the chatbot system in terms of revenue, customer satisfaction, and return on investment. Use this information to refine your business strategy and improve the chatbot system over time.

5. Software Specifications and Design Components

5.1 Software Specifications

The system will be developed using programming languages such as Python and JavaScript.

The front-end of the software will be developed using HTML, CSS, and JavaScript, or a suitable front-end framework such as Preact which is a lightweight version of React and will be using Vite as our build tool which is gaining popularity because of its modern features and performance.

The backend of the software will be developed using a suitable back-end framework such as Flask, and a suitable database such as MongoDB which will be designed to allow for easy querying and updating of information.

The UI will be user friendly and intuitive. And backend will be well optimized to give the user near real time responses. Also, will be designed to scale as needed, with consideration given to factors such as load balancing.

Google Cloud will be used to host the servers and deployments will be done through Continuous Integration / Continuous Development pipelines.

IntelliJ Idea, VS Code and Google Colab will be used as the IDEs and Cde editors for this project.

Programming Language	Python
Tools	LabelImg
IDE(s)	Google Colab, Visual Studio Code
Version Controlling	GitHub
Algorithms	R-CNN, YOLO, FasterSqueezenet

5.2 Design Components

- **User interface:** The chatbot system will have a user-friendly interface that allows users to easily input their queries and receive relevant recommendations.
- **Product and service database:** The chatbot system will have a database of products, parts, and repair centers that can be queried to provide recommendations.
- **query processing:** The chatbot system will use NLP algorithms to understand user queries and generate appropriate responses.
- **Recommendation engine:** The chatbot system will have a recommendation engine that uses machine learning algorithms to generate personalized recommendations based on user preferences and past interactions.
- **Object detection engine:** The chatbot system will have an image processing component which will be able identify computer hardware and provide recommendations accordingly.
- **User feedback:** The chatbot system will allow users to provide feedback on the recommendations provided, which will be used to improve the accuracy and relevance of future recommendations.

6 Budget And Budget Justifications

The total budget for this proposal is Rs.8,000, which will cover the expenses necessary for the project. Members of our team will bear this cost.

Materials and Supplies:

The materials and supplies cost are estimated to be Rs. 5,000. This includes the cost of Google Cloud and other infrastructure costs, printing costs, and cost of other necessary supplies.

Other Expenses:

The remaining budget of Rs. 3,000 will be allocated for any other expenses that may arise during the research project, such as unforeseen costs related to the research design or implementation.

7 Work Distribution

7.1 Gantt chart

A Gantt chart is a type of bar chart that is commonly used in project management to illustrate the schedule of a project. Our proposed project Gantt chart is as follows,

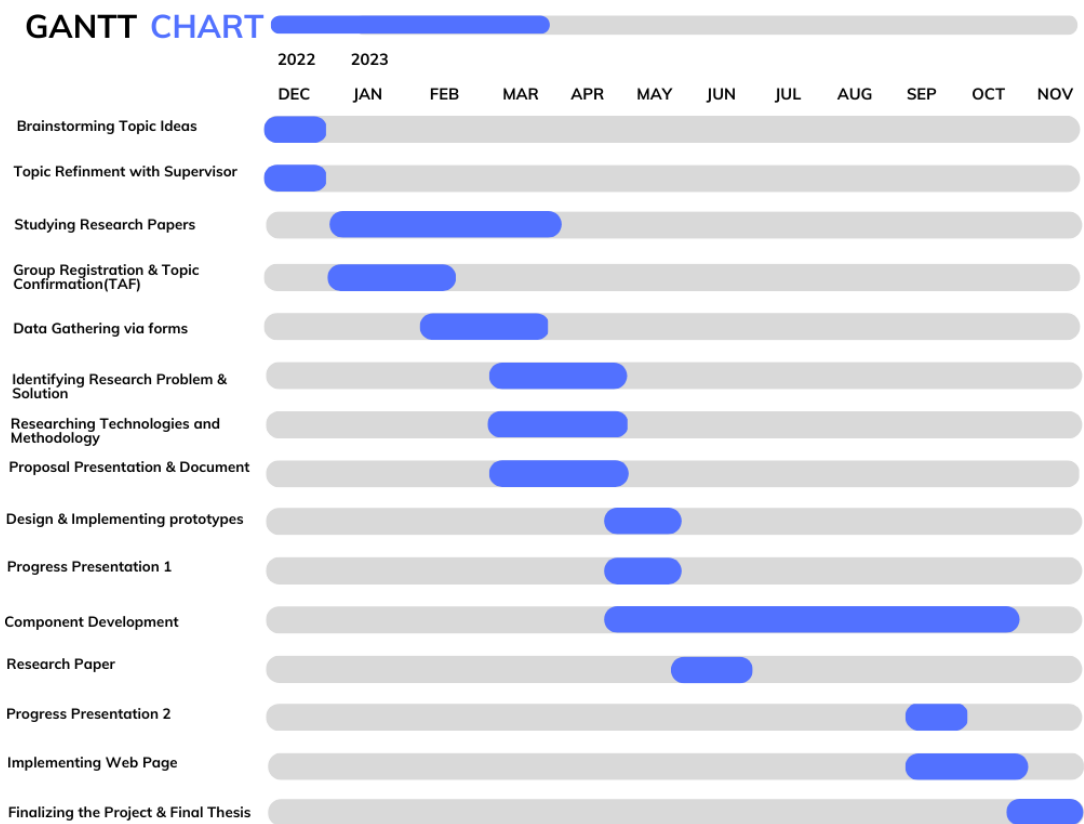


Figure 6: Gantt Chart

7.2 Work Breakdown Structure

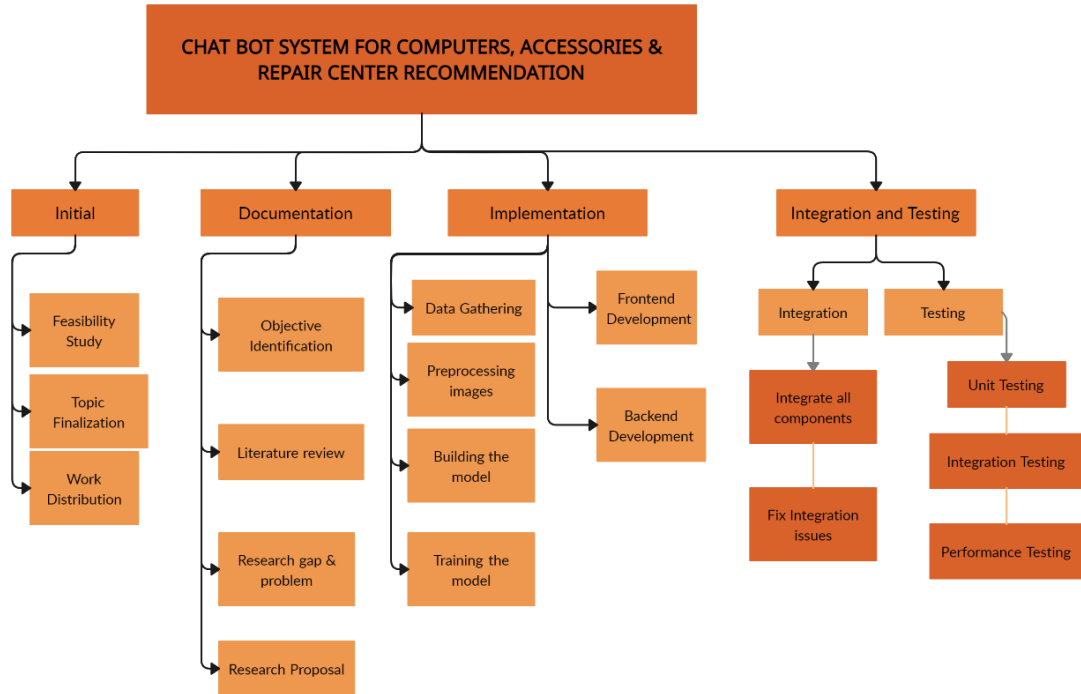


Figure 7: Work Breakdown Structure

Reference List

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Appendices