REAL-TIME CARBON NEUTRALITY MANAGEMENT AND OPTIMIZATION USING NATURAL LANGUAGE PROCESSING

Project ID 2022-175

Project Proposal Report

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February 2022

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DECLARATION

I declare that this is my own work, and this proposal does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any other university or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgment is made in the text.

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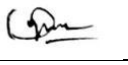
M.Mathanika	IT19005218	

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The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor: ……. Date: ……

ABSTRACT

Carbon emission reduction must be a worldwide priority. Businesses that refuse to change will almost surely face problems in the future. Reduced greenhouse gas emissions should be a key priority for every firm, large, medium, or small. Many rules are also enforced by governments to control GHG emissions. Companies, on the other hand, tend to limit their carbon emissions. They must first determine their daily carbon emission value. Every employee must provide information about their emissions. Collecting and keeping emission factors is a vital responsibility for every firm. A single business analyst (BA) or a small BA team is normally in charge of this. Collecting data about emission activities from a variety of sources is a time-consuming effort for a business analyst, and it can be inaccurate at times. They usually capture emission data after the emission process has been finished for a longer period of time, and most of these procedures are done manually. There will be no real-time data on the organization's emissions, and there will be no real-time data on the organization's emissions. With the implementation of the solution of a voice and text input in a mobile application that takes the emission details from the employee's voice or their text and if employee send voice then, converts to readable text, if text send that to next phrase. From the text emission factors, named entity recognition techniques will be extracted. The extracted factors will be forwarded to the search system to search for emission factors and provide ranked results.

Keywords: carbon emission, Business Analysist, emission factors, Voice Recognition, named entity recognition, search system

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LIST OF ABBREVIATIONS

Abbreviations	Description
NLP	Natural Language Processing
AI	Artificial Intelligence
NER	Named Entity Recognition
RP	Research Project

1. INTRODUCTION

1.1 background and literature survey

Artificial Intelligence (AI) has made great development in recent years, and its potential is expanding. Natural Language Processing is one of AI's applications (NLP) [20]. Voice extractor employs cloud computing to combine AI and can converse with users in natural language. Because voice converters are simple to use, there are millions of devices in homes today that include them [21].

Emerging technologies such as virtual reality, augmented reality, and voice interaction are modifying people's interactions with the world and altering digital experiences. Thanks to advancements in cloud computing, artificial intelligence (AI), and the Internet of Things, voice control is the next step in human-machine connection (IoT). Due to the widespread usage of smartphones in recent years, voice assistants such as Apple's Siri, Google's Assistant, Microsoft's Cortana, and Amazon's Alexa have emerged. Voice assistants deliver services to consumers using technologies such as voice recognition, speech synthesis, and Natural Language Processing (NLP). For IoT devices that lack touch capabilities, a speech interface is required (Metz, 2014). Voice assistants are increasingly included in devices that have a microphone and a speaker, to communicate with the users in addition to smartphones [21].

Voice assistants are already available in millions of households thanks to cloud platforms. Because data must be transmitted back and forth to centralized data centers, voice assistants rely on a cloud-based architecture. 474 G. Terzopoulos, M. Satratzemi The basic concept is that the user makes a request via a speech-activated device, and the spoken request is then transmitted over the cloud, where it is transformed to text. The text request is then sent to the backend, which processes it and responds with a text response. Finally, the text response is translated into speech and broadcast back to the user through the cloud. The Amazon Echo Show and Echo Spot, the Facebook Portal, and the Google Home Hub are examples of smart speakers with screens. Since 2017, these devices' popularity has been steadily increasing. According to Canalys, the installed base of smart speakers will reach 225 million by 2020 and 320 million by 2022. According to Juniper Research, Amazon Echo and Google Home devices will be in more than half of US households by 2022, and global ad expenditure on voice assistants would reach $19 billion by then (2017).

Voice assistants have several fascinating features, including the ability to answer queries posed by users.

- Use streaming music services to listen to music.
- Set timers or alerts if necessary.

- Play video games.
- Make phone calls or send text messages.
- Other smart gadgets can be controlled (lights, locks, thermostats, vacuum cleaners, switches).

Voice assistants' skills are always evolving. Amazon and Google have made platforms available to developers in order to expand the capabilities of their virtual assistants. Amazon Skills and Google Actions, like smartphone apps, drastically increase assistants' repertory, allowing users to execute additional actions with voice control. Sheppard claims that (2017),

The research has investigated the similarities and differences of voice assistant devices and services (López et al., 2017; Kpuska and Bohouta, 2018). Furthermore, as with any new innovative technology, scientific study and the educational community are debating whether these new devices can assist in the educational process. With personal computers and tablets, something similar has happened before (Algoufi, 2016; Gikas and Grant, 2013; Herrington and Herrington, 2007) [21].

The term "Named Entity (NE)," which is widely used in Information Extraction (IE), Question Answering (QA), and other Natural Language Processing (NLP) applications, originated in the Message Understanding Conferences (MUC), which influenced IE research in the United States in the 1990s [Grishman and Sundheim 1996] (to be precise, it was first used in MUC-6 in 1995). MUC's concentration at the time was on IE tasks, which involved extracting structured information about company activities and defense-related activities from unstructured text, such as newspaper articles.

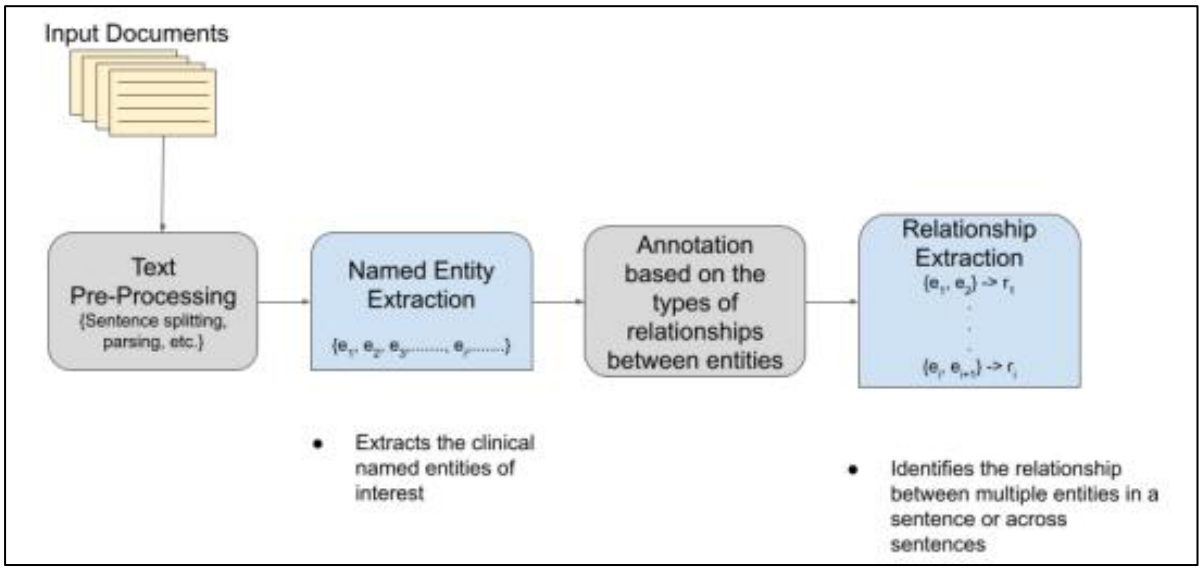

Figure 1.1: Association Between Named Entity Recognition and Relationship Extraction

Every day, the amount of text generated in various fields such as health care, news articles, scientific publications, and social media skyrockets. The International Data Corporation (IDC) has forecast that by 2020, the volume of data will have increased 50-fold to 40 billion gigabytes [22]. Textual data is relatively frequent in most disciplines, but due to its unstructured nature, automated comprehension is difficult, which has led to the development of numerous text mining (TM) algorithms in the recent decade [22].

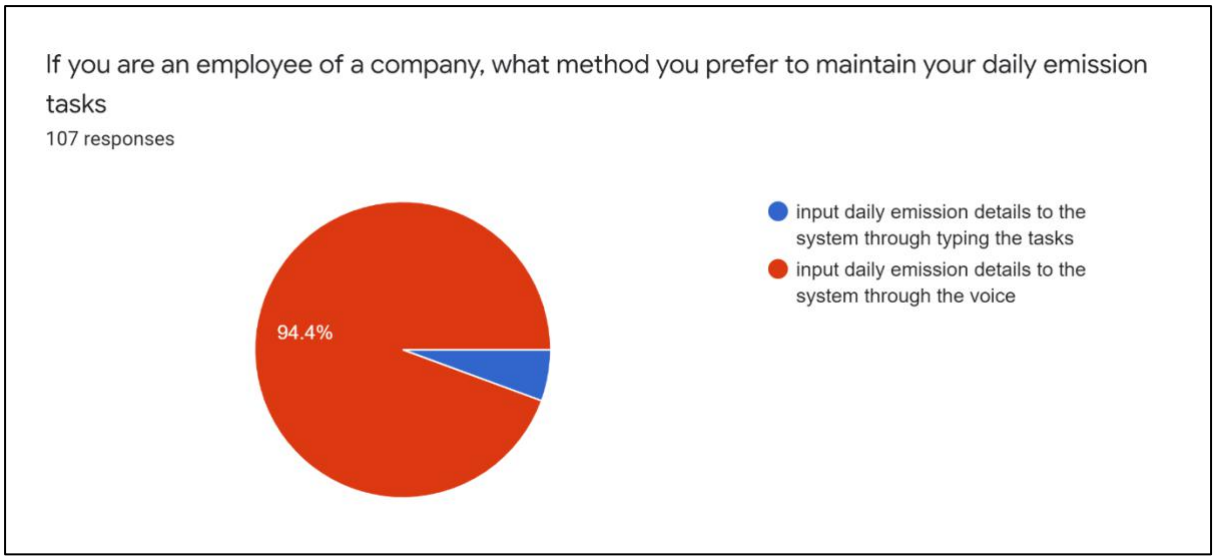

Figure 1.2: summary of employee's response about the emission task reporting

In this project, we used a voice assistant and NER to input real-time emission data into the application in order to compute the organization's emission value. It needs more manpower and time to collect emission specifics from invoices, surveys, and historical data. Collecting data from employees' voices is a more effective way than this.

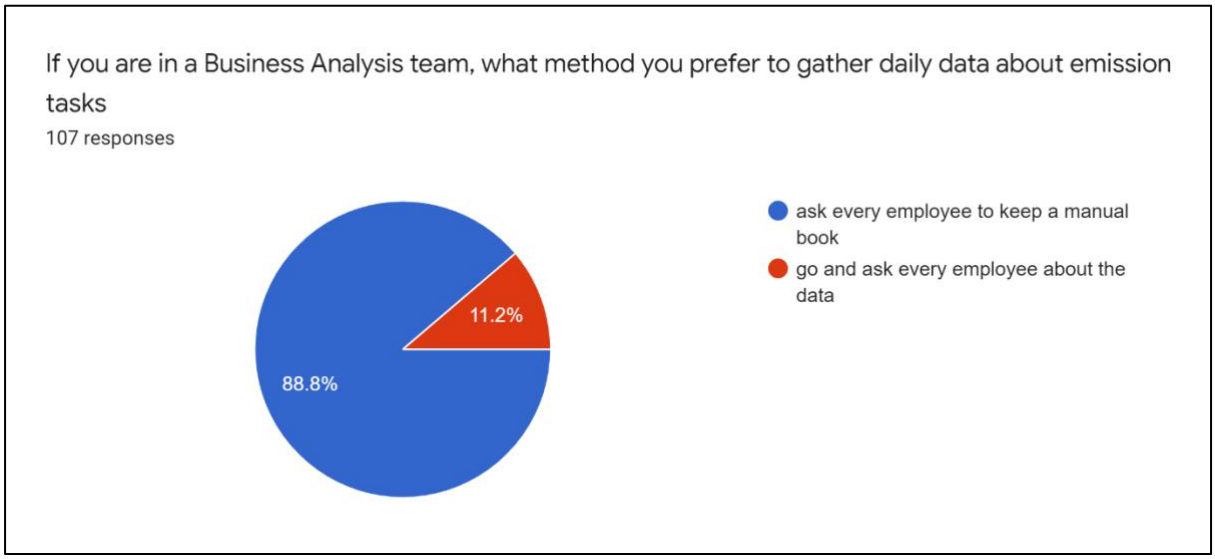

Figure 1. 3 : Summary of BA team's response about the emission task reporting

From above survey we can come to a conclusion. That is gathering emission data from employee's voice is more effective way than gathering data from the manual records.

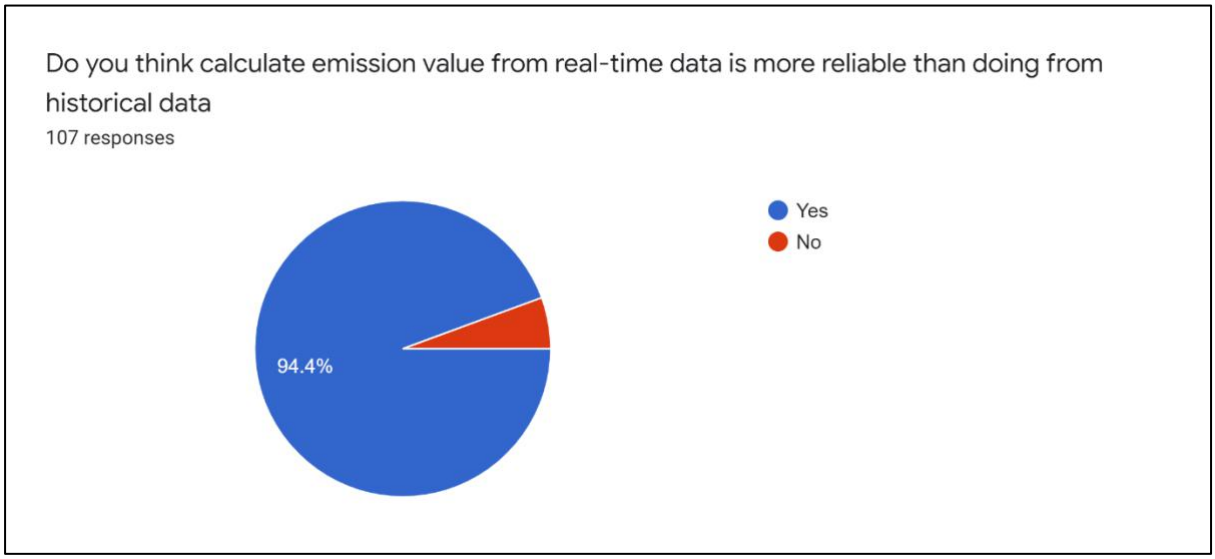

Figure 1.4: summary of employee's response about the reliable method of gathering emission records

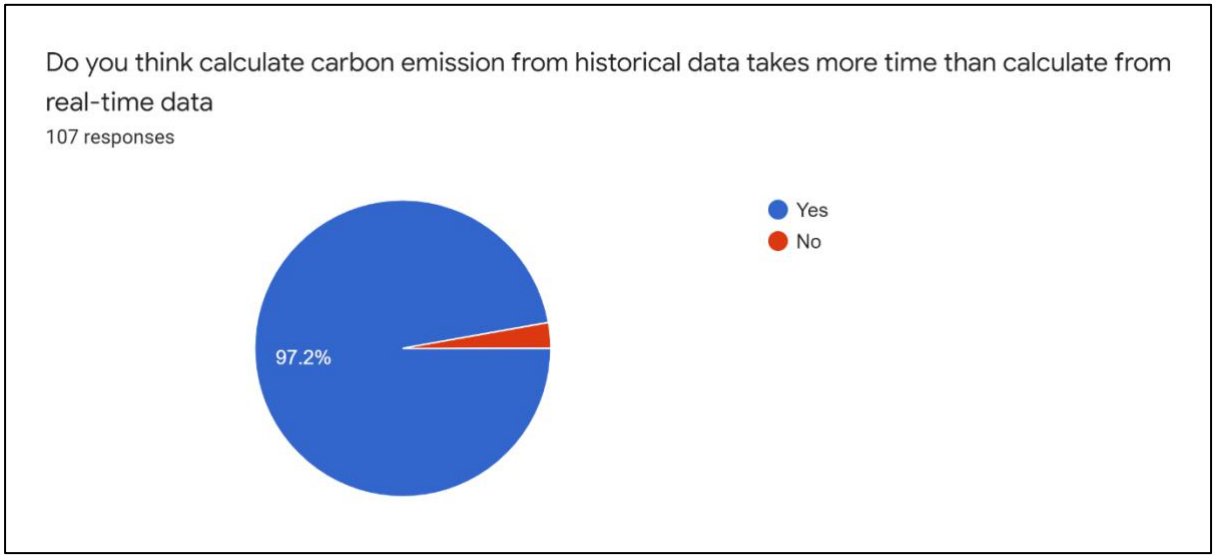

Figure 1.5 : summary of employee's response about time consuming factor in emission tasks

As per the above mentioned reading it was crystal clear that the real time emission calculating concept will be of many advantages and that many issues will be addressed, and an efficient solution would be provided. Although there are researchers prevailing in the area of the emission calculation concept but there is no research prevalent regarding the real time emission calculating using real time employee's emission data.

1.2 research gap

Several studies have been conducted in this area, and several products are currently in use by various organizations and governments. Furthermore, all the programs rely on employee surveys and manually maintained reports to obtain emission data [7],[8]. The most essential point is that none of the applications use real-time data. They use past emission data to calculate the emission value. This suggested system's main goal is to determine emission values utilizing real-time emission data. Employees can input their emission tasks through their voice or text into the program. The emission factors will be extracted from that text and sent to the search system.

Before we begin integrating system features, we must do a thorough examination of relevant systems or goods currently on the market. Implementing a new application with the same features will be a waste of time. It is most beneficial to reduce the workload by studying the applications that are already accessible on the market.

	Research 1 [1]	Research 2 [2]	Research 3 [3]	Research 4 [4]	Our Proposed System
Gather daily emission activity	✗	✗	✗	✗	✓
Calculate real-time emission value	✗	✗	✗	✗	✓
Emission data collection from employees	✗	✓	✗	✗	✓

Figure 1.6: Comparison with similar products

The proposed structure will serve as a form of viewpoint for programs that use speech and text to calculate carbon neutrality. This will eliminate the requirement for a large number of people as well as the time it takes to collect data.

The confirmation of a voice to text extractor model in the illuminating zone is shown in this research. The fundamental explanation includes an arrangement of specific designs, a model for regulating correspondence, and outfitting the appropriate responses to the understudy [16].

Extracting emission variables from converted speech (voice to text) is a difficult problem that has received a lot of attention. We use the Names Entity Recognition technique in this study to extract the exact emission components from the employee's voice.

These characteristics have generated a research gap, which has allowed us to develop a fashioned application employing Natural Language Processing.

1.3 research problem

In the existing circumstances Global CO2 emissions from fossil fuels have increased dramatically in recent decades, generating a variety of issues such as global warming, health effects, and climate change, all of which have economic and environmental implications. Scientists believe that if the world's population continues to release carbon dioxide at its current rate, the globe will warm to unacceptable levels within 20 years [7], posing an environmental risk to everyone. Carbon emissions have climbed by roughly 90% since 1970, and according to recent study, carbon emission footprints will increase by 20% by the end of 2020 [10].

Limitation of carbon emission from the organizations is the most wanted thing these days. Most of the countries' governments that part take in the Paris agreement [18] release quite an extensive emission factor document for various activities, annually [19]. These factor values are used to calculate final emission values for the activities performed over the reporting period [19]. but most of the governments/ companies using historical data, bills, and surveys to calculate the emission value. This approach takes more time to calculate emission value and these calculations not doing for real-time emission data. so, making decisions using these results may not be very useful.

Research is actively involved in the development of voice to speech conversion and NER applications. Both are currently in use on a variety of company websites around the globe. Speech to text conversion is rarely used, especially when collecting real-time emission data. Organizations can calculate their emission value in real time using this method. As a result, they can maintain their emission value current. They can readily make decisions with this information. These decisions will be more precise and dependable as a result.

2. OBJECTIVES

2.1 main objectives

The main objective of implementing the carbon neutrality management system from the real-time voice data and text data is, there is substantial evidence that anthropogenic activities are responsible for the majority of this warming. Calculating carbon emission is an important first step toward quantifiable emission reduction since it shows how individuals, organizations, countries, and the entire planet react to global warming. Universities, fire departments, rescue services, food businesses, hotels, and hospitals have all calculated their CFP in recent years.

We provide an intelligent, user-friendly carbon neutrality management system for employees to input their daily carbon emission duties through their voice or text in this research. This study is primarily concerned with calculating emission calculations and optimization systems using natural language processing.

2.2 sub objectives

Natural language processing

NLP serves as a form of translator between employees and application. Employees can just input the emission details through their voice or text. If employee input through their voice then, NLP converts the speech to readable text. Therefore, NLP enables employees to input emission data to the application through their speech or text without having to know how to program.

Named Entity Recognition

NER is also simply known as entity identification, entity chunking and entity extraction. Here we use Custom NER for extract emission factors from the employee's input. This input could be speech or text. If it is speech system will convert to readable text. From the text NER will extract the necessary emission factors for the emission calculation.

Easy and Efficient

This end product makes easy to calculate emission value of the organization. Therefore using this application employee can just easily input their daily emission task through their comfort input method (voice /text).

3. METHODOLOGY

3.1 Complete System Architecture

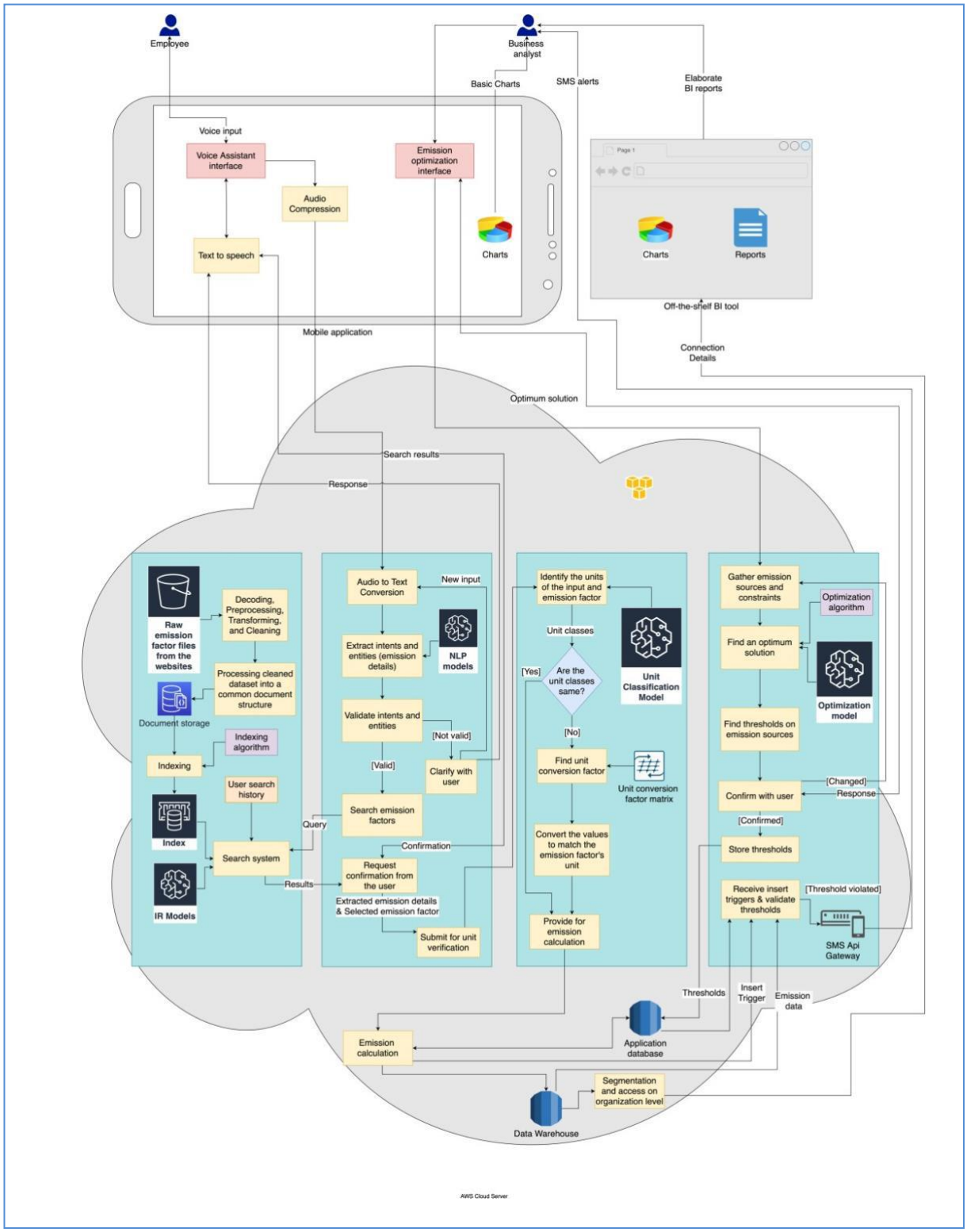

Figure 3.1: complete system architecture

3.2 Functional Requirements

3.2.1 Component Architecture

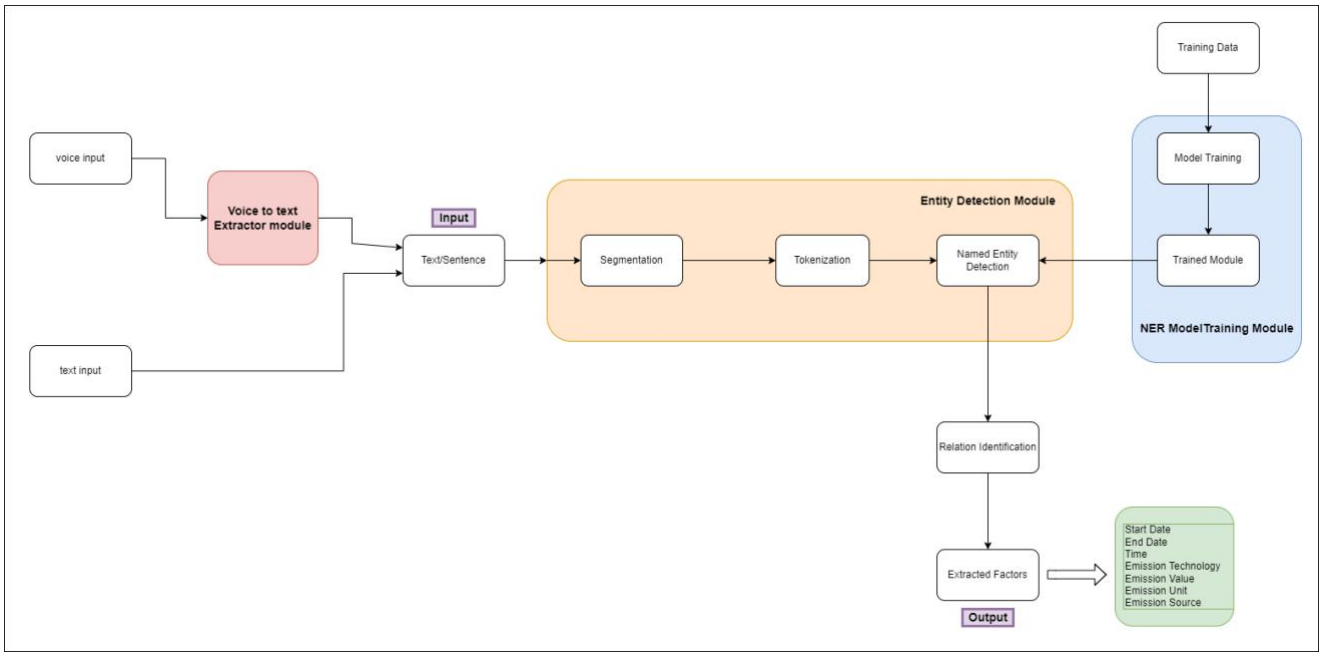

Figure 3.2: component architecture

3.2.2 Technology Selection

- **Speech to Text**

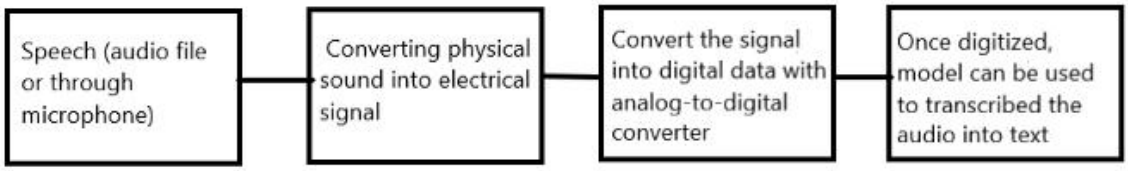

Figure 3.3: speech recognition process

As I mentioned above my first task is to implement a speech to text extractor. For implement this, I'm going to use python's **Speech Recognition** Library. This is an open-source library.

- **NER**

NER is the most important part of my component. there are many freely available NER tools using by industries.

▪ Stanford NER

▪ spaCy

▪ Alias-i Ling Pipe

▪ Natural Language Toolkit (NLTK)

The purpose of the evaluation was to see if the tool could discover the boundaries of names and their correct types. They graded NER systems based on exact boundary and type matching. They discovered that Sandford NER and spaCy perform better in each data set for both exact and partial matching, based on these two scoring procedures.

So, I choose spaCy for my Emission factor extraction part.

- **Communication**

Communicating with the team members is most important to deliver a good product. We are using Zoom, Teams, slack for communication purpose with the RP Team.

3.3 Non – Functional Requirements Security

- Performance
  - This proposed system is an independent and open-source system.
  - The response and processing time of each interface are within a minutes
- Safety
  - Maintain unique username and the password for every employee of the organization for logging the system.
  - Did not share any information regarding the employee or company out of the system environment.
- Security
  - Only registered employee can access this proposed system.
- Software Quality attributes
  - The system available in the 24x7 for the registered employees
  - User friendly notification system
  - The system developed considering user mental health
  - High accuracy outcomes
  - Good functionality performance

3.4 Gant Chart

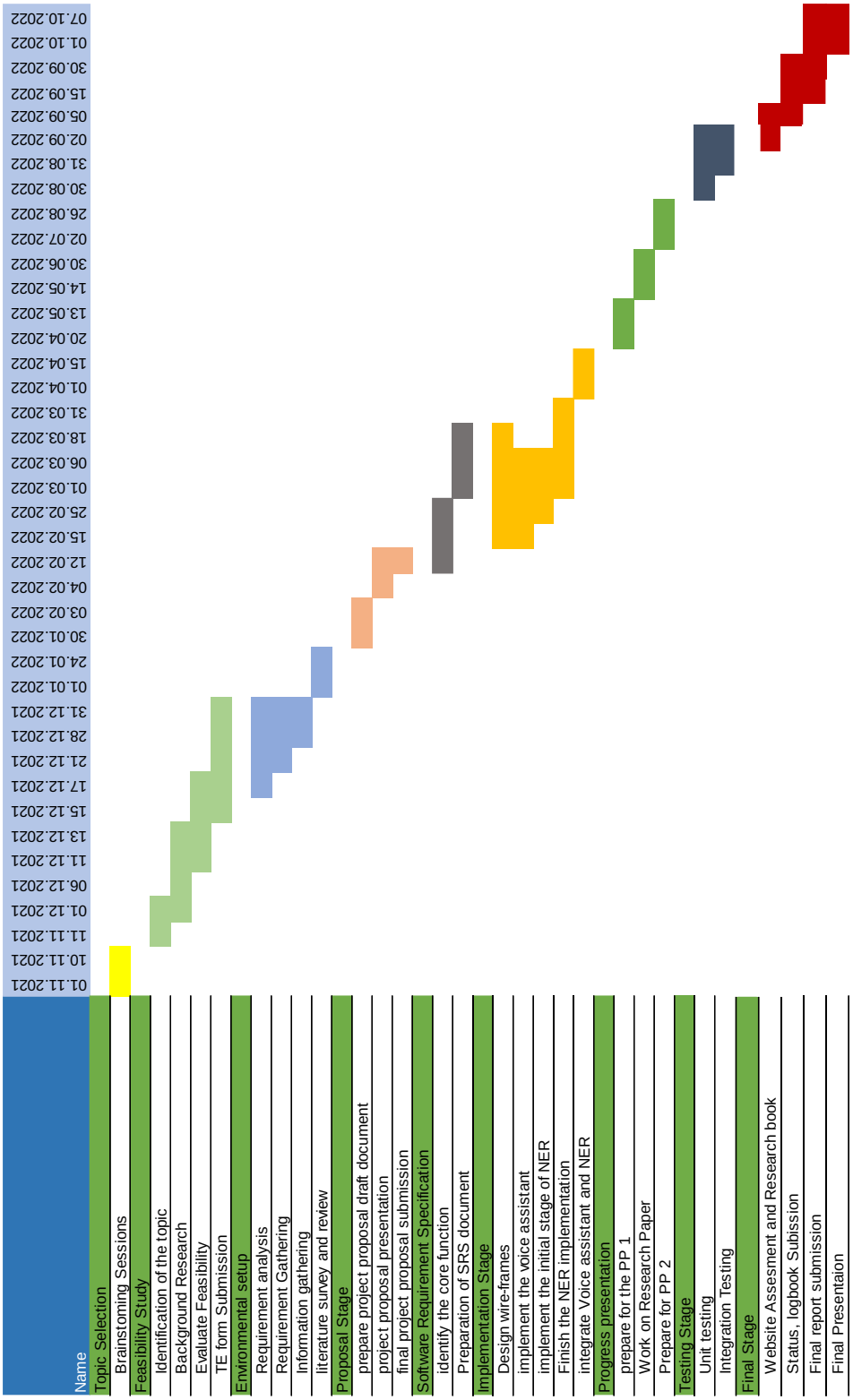

Figure 3.4: Gantt Chart

3.5 Work Breakdown Structure

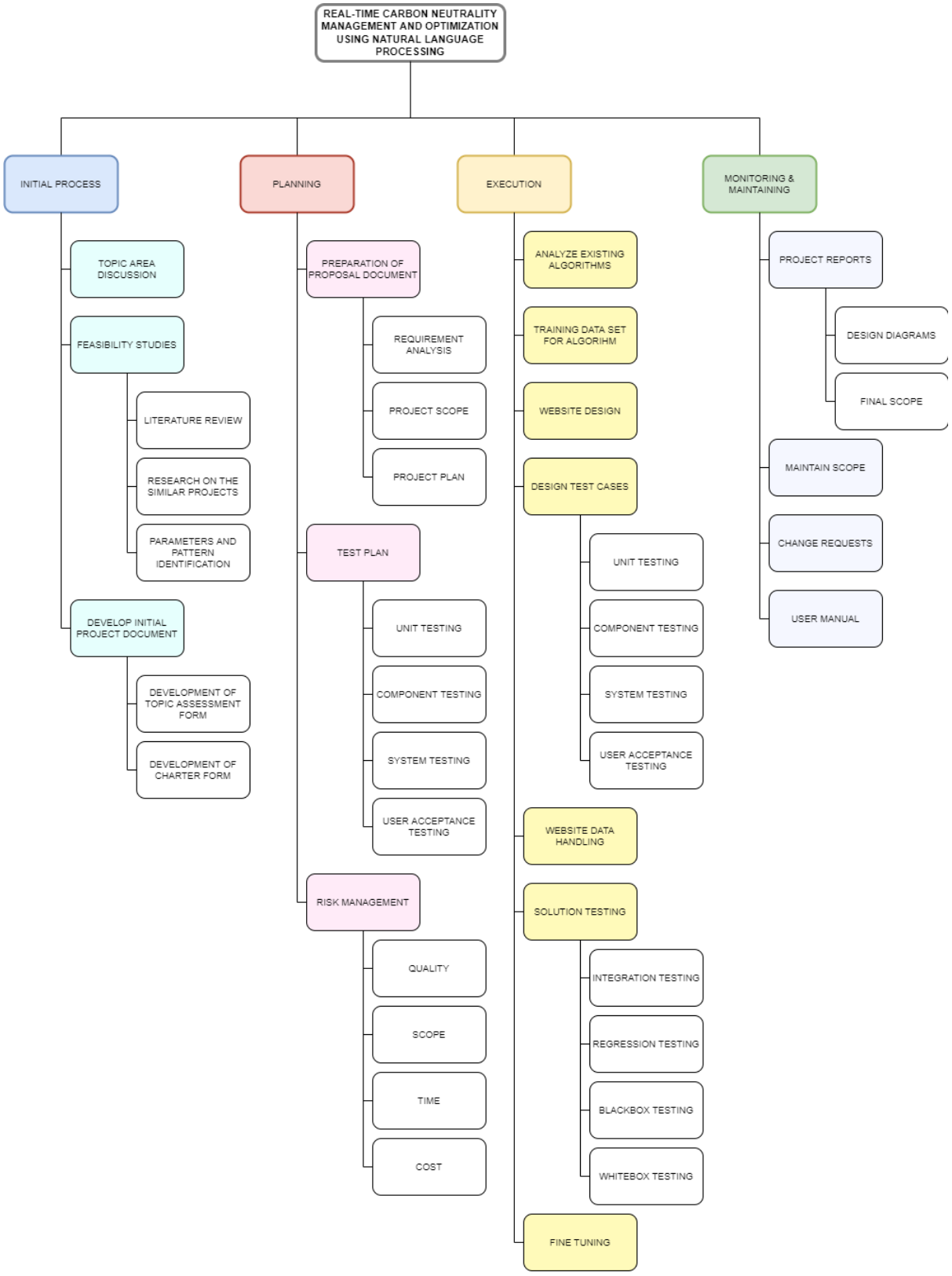

Figure 3.5: Work Breakdown structure

4. DESCRIPTION OF PERSONAL FACILITIES

This part illustrates the individual workload

Table 4.1:Description of personal facilities

Tasks	
Initial data gathering	• Gather data from the various employees of the organizations about the emission tasks using a survey.
Product implementation	• Implement speech to text converter
	• Implement NER module by training the collected dataset
Testing	• Test the product with the real data and calculate the accuracy of the product

5. BUDGET AND BUDGET JUSTIFICATION

Table 5.1: Budget justification

Resource	**Cost ($)**	**Cost (Rs)**
Cloud space purchase (annual)	90$/Mo	Rs .17498.85/Mo
internet	20$/Mo	Rs .2888.64/Mo
Total For one Month	110$/Mo	Rs 21387.49/mo.
Total For 10 Month	1100$/Yr.	Rs 213874.9/Yr.
Free	300$/Yr.	Rs 58329.51
Total	800$	Rs 155545.36

6.CONCLUSION

Maintaining carbon neutrality is the most crucial factor in today's globe. If we refuse, we shall reach a critical juncture. As a result, all governments should take action to make the planet a healthier place, every nation should set limits on carbon emissions of every organizations. Our proposed system will be quite useful in solving this problem. Every organization can calculate their daily emissions and regulate the amount of emissions within their control utilizing our technology.

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