A
Project Report
on

Integration of ChatGPT to Verify and Update EOL Database

Submitted to

Sant Gadge Baba Amravati University, Amravati

Submitted in partial fulfilment of
the requirements for the Degree of
Bachelor of Engineering in
Computer Science & Engineering

Submitted by

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Under the Guidance of
Dr. P K Bharne
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Department of Computer Science & Engineering
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SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON – 444 203 (M.S.)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CERTIFICATE

This is to certify **Ms. Riya Dangra** students of final year Bachelor of Engineering in the academic year 2023-24 of the Computer Science & Engineering Department of this institute have completed the project work entitled "**Integration of ChatGPT to Verify and Update EOL Database**" and submitted satisfactory work in this report. Hence recommended for the partial fulfillment of the degree of Bachelor of Engineering in Computer Science & Engineering.

Dr. P K Bharne
Project Guide

Dr. J M Patil
Head of Department

Dr. S B Somani
Principal
SSGMCE, Shegaon

SHRI SANT GAJANAN MAHARAJ COLLEGE OF
ENGINEERING, SHEGAON – 444 203 (M.S.)
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Internal Examiner

Dr. A K Bharne.

Name and Signature

Date: 10/05/2024

External Examiner

Prof A P Kankale

Name and Signature

Date: 10/05/2024

ACKNOWLEDGEMENT

It is our utmost duty and desire to express gratitude to various people who have rendered valuable guidance during our project work. We would have never succeeded in completing our task without the cooperation, encouragement and help provided to us by then. Several people deserve recognition for their unwavering support and guidance throughout this report.

We are highly indebted to our guide **Dr. P K Bharne** for his guidance and constant supervision as well as for providing necessary information from time to time. We would like to take this opportunity to express our sincere thanks, for his esteemed guidance and encouragement. His suggestions broadened our vision and guided us to succeed in this work.

We are sincerely thankful to **Dr. J M Patil** (HOD, CSE Department, SSGMCE, Shegaon), and to **Dr. S B Somani** (Principal, SSGMCE, Shegaon) who always has been kind to extend their support and help whenever needed.

We would like to thank all teaching and non-teaching staff of the department for their cooperation and help. Our deepest thanks to our parents and friends who have consistently assisted us towards the successful completion of our work.

Riya Dangra

ABSTRACT

The integration of ChatGPT technology into industrial product lifecycle management aims to tackle the labor-intensive and error-prone tasks related to validating and updating End-of-Life (EOL) dates in databases. Leveraging OpenAI's GPT-3 model through Python and the OpenAI API, the aim is to automate verification processes, reduce manual efforts, and enhance data reliability. By refining the AI model's capabilities through strategic prompts and real-time feedback mechanisms, the system can effectively manage fluctuating EOL dates, broken URLs, and secure authentication processes. The integration of ChatGPT's language processing capabilities offers a comprehensive solution for efficient decision-making and asset management within the product lifecycle management framework, ultimately revolutionizing EOL database management practices by optimizing accuracy, efficiency, and reliability while mitigating drawbacks associated with manual intervention.

Keywords: *Web scraping techniques, End-of-life management, ChatGPT technology, Prompt engineering, EoL device security.*

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CHAPTER 01

INTRODUCTION

1. INTRODUCTION

In today's era of rapid technological advancement, integrating cutting-edge technologies is crucial for overcoming challenges in industrial product lifecycle management. One such challenge is effectively validating and updating End-of-Life (EOL) databases, which are labor-intensive and error-prone processes. The emergence of conversational Large Language Models (LLMs) like ChatGPT offers a transformative solution. By automating verification processes and reducing manual intervention, these models enhance the reliability of EOL data while minimizing errors. This research not only focuses on product lifecycle management but also explores prompt engineering for ChatGPT, crucial for effective communication with LLMs. By documenting prompt patterns, the aim is to provide reusable solutions for common challenges encountered in conversational interactions[4].

Transitioning to subsequent sections, the research delves deeper into specific EOL challenges, the capabilities of LLMs like ChatGPT, and prompt engineering intricacies. Addressing vulnerabilities in EoL devices, the integration of ChatGPT aims to automate verification processes and enhance data reliability, contributing to more efficient decision-making. Additionally, the paper explores methodologies for managing EOL information, such as web scraping and batching. These techniques ensure accurate EOL updates by gathering and verifying data from diverse sources. Finally, the paper discusses the culmination of this journey: updating the ChatGPT model with verified EOL information to enhance its predictive capabilities. Through meticulous exploration, the research sheds light on the innovative approach to EOL management driven by data and intelligence.

1.1 Background

The realm of industrial product lifecycle management is witnessing a significant transformation with the integration of ChatGPT technology. This integration addresses the challenges associated with labor-intensive and error-prone tasks involved in validating and updating End-of-Life (EOL) dates within databases. As industries strive for enhanced efficiency and reliability, leveraging cutting-edge solutions becomes imperative[5].

1.2 Motivation

The motivation for integrating ChatGPT into industrial product lifecycle management is rooted in the urgent necessity to overhaul EOL database management processes. Traditional methodologies frequently prove inadequate, plagued by inefficiencies and inaccuracies that compromise the integrity of crucial data. In today's dynamic industrial landscape, where precision and timeliness are paramount, such shortcomings pose significant risks to decision-making and asset management practices. Recognizing these challenges, our aim is to leverage the remarkable capabilities of ChatGPT technology to usher in a new era of efficiency and reliability[6]. By harnessing the power of natural language processing, we seek to fundamentally transform how EOL dates are verified and updated, paving the way for more informed decisions and streamlined asset management workflows.

The integration of ChatGPT technology represents a paradigm shift in industrial product lifecycle management, promising to alleviate the burdens associated with manual EOL database management. The relentless pace of industrial innovation demands agile solutions capable of adapting to evolving requirements and mitigating risks effectively. Through the integration of ChatGPT, we envision a future where data validation processes are automated, minimizing human error and enhancing the accuracy of EOL date management. This not only optimizes decision-making processes but also instills confidence in asset management practices, laying the foundation for sustainable growth and competitiveness in the industrial sector.

Furthermore, the motivation behind this integration extends beyond mere operational efficiency to encompass broader strategic imperatives. By harnessing ChatGPT technology, organizations can unlock untapped potential in their data assets, gaining deeper insights into product lifecycles and market dynamics. Empowered with timely and accurate EOL data, stakeholders can make informed strategic decisions, from product development to end-of-life planning. Thus, the integration of ChatGPT into industrial product lifecycle management represents not only a technical innovation but also a strategic imperative for organizations seeking to thrive in an increasingly competitive landscape.

1.3 Problem Statement

The existing approaches to validating and updating EOL dates in industrial product lifecycle management are fraught with challenges, including manual efforts and data reliability issues. These shortcomings hinder operational efficiency and pose risks to asset management practices[8].

1.4 Need for the "Integration of ChatGPT to Verify and Update EOL Database"

The integration of ChatGPT technology offers a transformative solution to the challenges faced in industrial product lifecycle management. By automating the validation and updating of EOL dates, it streamlines processes, enhances accuracy, and ensures data reliability.

1.5 Aim & Objectives

Aim: The aim of this project is to seamlessly integrate ChatGPT into the process of verifying and updating End-of-Life (EOL) databases, leveraging its capabilities to enhance accuracy and efficiency.

To fulfill the aim of the project, the following are the objectives:

a) To provide an overview of the integration's goals and its significance in addressing EOL database management challenges.
b) To analyze the Technical Aspects and Security Measures:
   Discuss the architecture, technology stack, and security measures implemented to ensure the reliability and safety of data.
c) To evaluate Impact on Industrial Product Lifecycle Management:
   Assess the integration's potential to optimize decision-making, streamline processes, and improve asset management practices.
d) To discuss Implications for Future Research and Development:
   Explore the implications of the integration for future research, development, and evolution within industrial product lifecycle management practices.

CHAPTER 02

LITERATURE REVIEW

2. LITERATURE REVIEW

The literature survey provided encompasses a diverse range of topics within the realm of technology and information management. These topics include authentication systems, web scraping techniques, industrial asset management, electronic parts obsolescence, ChatGPT technology, prompt engineering, API wrapper technology, and end-of-life (EoL) device security. Each abstract presents a unique perspective on the challenges, advancements, and applications within its respective domain.

Reference 01:

Muhanad Tahrir Younis, Nadia Mahmood Hussien, Yasmin Makki Mohialden, Komeil Raisian, Prabhishek Singh, Kapil Joshi. "Enhancement of ChatGPT using API Wrappers Techniques," June 2023.

Description:

The study examines how the use of wrapper technology for APIs (Application Programming Interfaces) can simplify complex processes by combining numerous API calls. These packages have difficult-to-use non-real-time interfaces. The GPT-3 language paradigm used by ChatGPT is unique to chatbots. It enables programmers to design chatbots that intelligently react to user input in natural language, improving user engagement. This article demonstrates how to create a smart chatbot using ChatGPT, Python, and API wrapper technologies. We demonstrate how to integrate ChatGPT into Python programmes using the OpenAI API package. This facilitates development for developers. Chatbots that sound and act more like actual people when they talk. Our input into this field demonstrates that it is possible to make smart chatbots with ChatGPT and API wrapper technology. To reach this goal, we use a system that combines the OpenAI API with ChatGPT and Python. This gives us valuable information about how to make smart chatbots.

Reference 02:

Jules White, Quchen Fu, Sam Hays, Michael Sandborn, Carlos Olea, Henry Gilbert, Ashraf Elnashar, Jesse Spencer-Smith, and Douglas C. Schmidt. "A Prompt Pattern Catalog to Enhance Prompt Engineering with ChatGPT," February 2023.

Description:

A skill set that is becoming more and more crucial for successful communication with large language models (LLMs), like ChatGPT, is prompt engineering. An LLM can be given prompts to guarantee that certain output qualities and quantities are met, automate procedures, and enforce regulations. Another programming method that can be used to modify an LLM's outputs and interactions is the use of prompts. This paper presents a pattern-based catalog of quick engineering techniques that have been used to address typical issues that arise during LLM conversations. Similar to software patterns, prompt patterns are a means of transferring information since they offer reusable answers to typical issues encountered in a specific setting, such as output creation and interaction when working with LLMs. This work advances the subject of rapid engineering by applying LLMs to software development task automation in the following ways. Initially, it offers a structure for recording prompt patterns to address various issues so they can be customized for various fields. Secondly, it offers an inventory of patterns that have been effectively utilized to enhance the results of LLM discussions. Thirdly, it describes how various patterns can be combined to create new prompts and provides examples of prompts that are enhanced by this approach.

Reference 03:

Dingding Wang, Muhui Jiang, Rui Chang, Yajin Zhou, Baolei Hou, Xiapu Luo, Lei Wu, Kui Ren. “A Measurement Study on the (In)security of End-of-Life (EoL) Embedded Devices,” May 2021

Description:

More than 300 million pounds of returned, end-of-life computer equipment have been processed by the Asset Recovery Center in Endicott, New York since 1994. Over the course of a decade, the company has gradually expanded the range of services it offers by building on its experiences and competencies. It has evolved into an organization that currently provides product end of life services to external clients as well, including parts harvesting and broker sales procedures, from a basic asset protection and commodities recovery process that handled just IBM's internal assets. A portion of the

modifications, like higher commodity recoveries and gains in operational productivity, are the outcome of internal optimization initiatives. Legislative influences, environmental concerns, the accessibility or effectiveness of recycling and reclamation techniques, and specific customer demands have all spurred additional improvements. The difficulties, adjustments, and lessons discovered during the operation's ten-year expansion and transformation will be emphasized and discussed in this essay.

Reference 04:

E.J. Grenchus, R.A. Keene, C.R. Nobs. "A Decade of Processing End of Life IT Equipment – Lessons Learned at the IBM Endicott Asset Recovery Center," May 2004

Description:

Embedded technology is gaining traction. In the interim, scientists are hard at work enhancing embedded device security. Nevertheless, prior research has overlooked the insecurity brought about by a particular class of devices, known as End-of-Life (or EoL) devices. Vendors often stop maintaining firmware and software, including bug fixes and security updates, once a product reaches end-of-life. EoL devices are hence vulnerable to attacks. For example, according to a report, online traffic was maliciously redirected using an EoL model with thousands of active devices. It is the first measurement research to reveal the (in)security of devices in the Internet of things. In order to do this, our study conducts two different kinds of analyses: vulnerability analyses and aliveness analyses. The method finds the live devices in ten months when it is applied to a large number of EoL models from three suppliers (D-Link, Tp-Link, and Netgear). Some concerning facts that the community was unaware of are revealed by our study. For example, there are many active EoL devices—more than two million—in the world. Almost 300,000 devices are still operational five years after they were declared end-of-life. Of the 294 vulnerabilities, more than half (182 of them) were found after the end of life. After the End of Life (EoL) date, suppliers might still deliver security fixes, but this is an irregular and unfinished process. Attackers can achieve a minimum of 2.79 Tbps DDoS attack by exploiting OS command injection vulnerabilities and compromising a large number of active EoL devices. We believe these facts pose a clear call for more attention to deal with the security issues of EoL devices.

Reference 05:

Pablo Ortolan. "Optimizing Prompt Engineering for Improved Generative AI Content," Master's Thesis in Machine Learning Engineering, Academic Year 2022-23.

Description:

The process of creating and refining prompts for generative AI models is known as prompt engineering. I wish to investigate the common use case of individuals looking for knowledge on generative AI. In this master's thesis, I investigate methods for creating novel strategies employing well-crafted role and tone cues to raise the caliber of material produced by a particular AI model: ChatGPT-3.5-Powerful. I researched a number of AI measures before deciding to assess the effectiveness of the freshly created phrases using Rouge-L-Sum and BERTScore. I make use of the Question-Answering dataset known as wiki_qa, which is a compilation of English questions and answers based on Wikipedia material. The investigation demonstrates that ChatGPT 3.5-Turbo performs optimally on this particular dataset when the constructed prompt has an authoritative tone and no role. The type of inquiry where each position is more efficient is not highlighted in this thesis because it is conducted globally over the dataset; this may be addressed in a later iteration of the study. Nevertheless, it is crucial to examine current models in this field, such as ChatGPT-3.5-Turbo. It helps comprehend deeper models and takes a step back from the risky rush toward increasingly complex, unpredictable black-box models that are capable of emerging.

Reference 06:

Lucas Jasper Jacobsen, Kira Elena Weber. "The Promises and Pitfalls of ChatGPT as a Feedback Provider in Higher Education: An Exploratory Study of Prompt Engineering and the Quality of AI-Driven Feedback," 2022.

Description:

Prompt engineering is the process of developing and optimizing prompts for generative AI models. I want to look at the typical use case of people trying to learn about generative AI. In my master's thesis, I look at ways to improve the quality of content

generated by a certain AI model by developing new tactics that make use of skillfully designed role and tone cues: ChatGPT-3.5: Strong Power. I looked at a variety of AI metrics before choosing to use Rouge-L-Sum and BERTScore to evaluate the performance of the newly generated phrases. I utilize wiki_qa, a Question-Answering dataset consisting of English questions and responses derived from Wikipedia content. This thesis does not specifically address the kind of research where every position is more efficient because it is done globally across the dataset; this may be covered in a future version of the study. However, it is important to look at existing models in this area, like ChatGPT-3.5-Turbo, as it helps understand deeper models and steps back from the dangerous rush toward ever-more complex, unpredictable black-box models that could emerge.

Reference 07:

Sabit Ekin (prompt engineer). "Prompt Engineering for Chatgpt a Quick Guide to Techniques, Tips, and Best Practices," OpenAI, 2023.

Description:

A comprehensive guide to mastering prompt engineering techniques, tips, and best practices to achieve optimal results with ChatGPT is provided. The discussion starts with an introduction to ChatGPT and the fundamentals of prompt engineering, and then moves on to an exploration of techniques for effective prompt crafting, such as clarity, explicit constraints, experimentation, and leveraging different types of questions. Ultimately, to fully harness the potential of ChatGPT, it is crucial to understand and master the art of prompt engineering—the process of designing and refining input prompts to elicit desired responses from an AI NLP model. Advanced techniques are also covered, including prompt chaining, domain-specific modifications, temperature and token management, and managing ambiguous inputs. Case examples from real-world scenarios show how quick engineering is used in customer service, content creation, retrieving domain-specific knowledge, and interactive storytelling. The effects of efficient rapid engineering on ChatGPT performance, potential avenues for future study, and the significance of encouraging innovation and teamwork within the ChatGPT community are all highlighted in the article's conclusion.

Reference 08:

Wenqi Fan, Zihuai Zhao, Jiatong Li, Yunqing Liu, Xiaowei Mei, Yiqi Wang, Zhen Wen, Fei Wang, Xiangyu Zhao, Jiliang Tang, Qing Li. "Recommender Systems in the Era of Large Language Models (LLMs)," 2023.

Description:

Recommender Systems (RecSys), which offer tailored recommendations based on user preferences, have grown in importance in our daily lives due to the growth of e-commerce and online applications. Even though Deep Neural Networks (DNNs) have improved recommender systems significantly by modeling user-item interactions and incorporating their textual side information, these DNN-based approaches still have certain drawbacks, like being unable to reason on predictions and generalize to different seen/unseen recommendation scenarios, as well as having trouble effectively understanding users' interests and capturing textual side information. In the meantime, the development of Large Language Models (LLMs), including ChatGPT and GPT4, has transformed the domains of Artificial Intelligence (AI) and Natural Language Processing (NLP) because of their exceptional capacities in basic tasks of language creation and interpretation. Even though Deep Neural Networks (DNNs) have improved recommender systems significantly by modeling user-item interactions and incorporating their textual side information, these DNN-based approaches still have certain drawbacks, like being unable to reason on predictions and generalize to different seen/unseen recommendation scenarios, as well as having trouble effectively understanding users' interests and capturing textual side information. Meanwhile, the development of Large Language Models (LLMs)—like ChatGPT and GPT4—has transformed the domains of artificial intelligence (AI) and natural language processing (NLP) because of their outstanding capacities for basic tasks like language generation and understanding as well as their remarkable capacities for generalization and reasoning. A comprehensive review of current LLM-empowered recommender systems is desperately needed, given the quick expansion of this research path in recommender systems, to give academics and practitioners in related disciplines a thorough grasp. As a result, we thoroughly evaluate LLM-powered recommender systems in our study, looking into pre-training, fine-tuning, and prompting, among other factors. To be more

precise, we first propose illustrative techniques that make use of LLMs' capabilities as feature encoders to learn user and object representations. Next, we examine the most current advanced LLM strategies from three paradigms—pre-training, fine-tuning, and prompting—for improving recommender systems. Lastly, we go over the bright future prospects for this developing sector in detail.

Reference 09:

Rabia Charef et al. "A BIM-based theoretical framework for the integration of the asset End-of-Life phase," IOP Conf. Ser.: Earth Environ. Sci. 225 012067, International Conference On Engineering Design, Iced19, 2019.

Description:

Due to the migration of industry from the use of traditional 2D CAD tools to Building Information Modelling (BIM) process, and the growing awareness of Construction and Demolition (C&D) waste issues, researchers are interested in compiling the use of BIM for C&D Waste issues. BIM is commonly used for the Design, Construction and Maintenance phases of an asset; however, the use of BIM for the End-of-Life management is still in its infancy. This paper proposes to reconsider the asset lifecycle by incorporating a sustainable End-of-Life, as a phase, in BIM context. Recommendations are given to push the BIM potential up to the asset End-of-Life management. Based on the results of a literature review assessing the current use of BIM for the asset End-of-Life, a conceptual framework was drawn. A set of eleven stakeholders, involved in the asset lifecycle, from inception to deconstruction were interviewed to improve the conceptual framework. The research reveals the impacts and barriers for the integration of the deconstruction phase into the asset lifecycle. Consequently, a theoretical framework for the asset lifecycle from inception to deconstruction in BIM environment is created to change the linear system to a circular economy.

Reference 10:

Damha, Leticcia Giovana; Trevisan, Adriana Hofmann; Costa, Daniel Guzzo; Costa, Janaina Mascarenhas Hornos. "How Are End-Of-Life Strategies Adopted In Product-

Service Systems? A Systematic Review Of General Cases And Cases Of Medical Devices Industry," University of São Paulo, 2018.

Description:

The medical device sector has not received much research on the adoption of End-of-Life (EoL) methods, despite the fact that this is a crucial field of study for circularity implementation. The worrying rates of waste in the medical industry are on the rise. The medical profession has a wide range of opportunities for the adoption of EoL techniques, but it is also intrinsically difficult given the strict rules and products' potential to endanger patient lives. This study examines 17 case examples of product-service systems that have been found in the literature. Six of them are used in the medical device business, while the other eleven are from other industrial sectors. Repair, reconditioning, remanufacturing, and recycling are the four EoL techniques that are analyzed and contrasted for each scenario. This adoption is related to the sources of value creation in Circular Economy, to the PSS typology and, at last, special EoL treatment for medical devices is discussed.

Reference 11:

David Mathew Thomas, Sandeep Mathur. "Data Analysis by Web Scraping using Python," Amity Institute of Information Technology, Amity University (AUUP), Sec-125, Noida, 2019.

Description:

Based on the root and influence relationship, fashioned by an example microscopic inspection, subjective and quantitative examination, and the rationality technique of producing extrapolation examination, are the standard information investigations. The Web Scraper's devious ethics and practices are contrasted, providing insight into how the scraper operates and how it is planned out. The method is broken down into three parts: first, a web scraper finds the needed connections on the internet; next, data extraction is done to obtain the data from the source links; and last, the data is stored in a CSV file. The implementation is done using the Python programming language. By achieving this and combining all of these with the practical know-how and moral

understanding of libraries, we may create the desired result. Due to an enormous community and library resources for Python and the exquisiteness of coding chic of python language, it is most appropriate one for Scraping desired data from the desired website.

Reference 12:

Moaiad Ahmad Khder. "Web Scraping or Web Crawling: State of Art, Techniques, Approaches and Application," Department of Computer Science, College of Arts and Science, Applied Science University, Bahrain. November 2021.

Description:

The process of automatically extracting data from websites using software is known as web scraping or web crawling. In the present era, it is a procedure that is very significant in domains like business intelligence. Through the use of technology, such as web scraping, we can extract structured data from text, including HTML. When data isn't supplied in a machine-readable format, like JSON or XML, web scraping is quite helpful. Web scrapping is a useful tool for gathering information about prices and other details from retail store websites in almost real-time. It can also be used to obtain intelligence about illegal businesses, such as drug marketplaces on the darknet, which can be useful for researchers and law enforcement. Such as medication costs and types that are not available through traditional means. It has been discovered that data obtained by utilizing a web scraping application is far more comprehensive, precise, and reliable than data entered by hand. Based on the findings, it has been determined that Web scraping is a vital tool in contemporary disciplines and a very helpful tool in the information era. Proper implementation of web scraping necessitates the use of many technologies, including the previously stated pattern matching and spidering. This essay explores the definition, methods, phases, and technologies of web scraping as well as its connections to cyber security, big data, artificial intelligence, data science, business intelligence, and cyber security. It also looks at how the Python programming language may be used for online scraping.

Reference 13:

Sanit Kumar, Jyoti Thakur, Deepmala Ekka, Ishwar Sahu. "Web Scraping Using Python," Government Engineering College Bilaspur, Chhattisgarh, India. November 2022.

Description:

The internet is a vast repository of diverse info. It is the source of a wealth of data and knowledge from which we may learn about anything that exists in the world. We are aware, nonetheless, that all data and information found online is either ill-structured or unstructured. Because not all of the material on the internet is helpful to us, it takes longer to search the data in accordance with user demands. As a result, we are faced with the difficulty of obtaining relevant data quickly. Web scraping is one way to solve this sort of issue. An overview of both static and dynamic web scraping for valuable data extraction is given in this article, along with a basic idea about extracting, storing, and reusing data. With the help of web scraping, we can convert the unstructured data into a structured form.

Reference 14:

I. Animah, M. Shafiee. "A framework for assessment of Technological Readiness Level (TRL) and Commercial Readiness Index (CRI) of asset end-of-life strategies," Cranfield University, 2018.

Description:

Many industrial assets in the mining, manufacturing, transportation, oil and gas, petrochemical processing, manufacturing, and construction sectors are operating past their planned design lives and will require extensive maintenance services in the years to come. Operators are faced with a choice at the end of an asset's design lifetime: decommission the equipment or rejuvenate its components through life-extension technologies. This means that methods for decommissioning—such as recycling and disposal—and life extension policies—such as remanufacturing, reconditioning, repurposing, and retrofitting—will remain vital to the management of industrial assets in the future. Nevertheless, certain End-of-Life Management Strategies (ELMS) or their

developing technologies might not be fully developed yet, therefore putting them into practice could result in extensive uncertainities. The key to lowering the uncertainty associated with ELMS implementation in diverse industries will be having well-documented Technological Readiness Levels (TRL) and Commercial Readiness Indicators (CRI) for these strategies and related technologies. In order to assist asset managers in assessing the TRL and CRI of various ELMS and their associated technologies, this study attempts to provide a systematic framework made up of six distinct procedures. The close cooperation of academics and industry professionals with years of expertise in carrying out life extension and decommissioning initiatives was crucial to the development of this framework. A case study using wind turbine end-of-life techniques is given in order to demonstrate the concept, and the outcomes are further addressed. The data required for this study is collected from various sources, including the published literature and industrial reports as well as by surveying academic and industrial experts. The results of this study indicate that TRL and CRI assessments are not only an effective means of evaluating the technological status of different ELMS but also a means for risk management decision making.

Reference 15:

Vidhi Singrodia, Anirban Mitra, Subrata Paul. " A Review on Web Scrapping and its Applications," Amity University Kolkata, January 2019.

Description:

There is an enormous amount of information available on the internet that is dispersed over many different websites and may be used for a wide range of reasons. Unfortunately, the disorganization of this data frequently makes collecting and automated processing difficult. Modern web scraping technologies and methods have made it easier for consumers and companies to effectively collect and organize this unstructured data in recent years. Diverse software solutions, ranging from strong programming libraries like BeautifulSoup, Scrapy, Selenium, and Octoparse to user-friendly browser extensions, address various technological requirements. Web scraping is the technique of taking information from websites by means of automated programs or bots. This includes determining the target websites, picking suitable scraping instruments, specifying the parameters for the extraction process, and putting error-

handling procedures in place for dependability. There are two primary methods: dynamic scraping interacts with sites to generate content in response to server-side events or user interaction, while static scraping gets data from static web pages. Web scraping has several advantages, including the ability to rapidly collect vast amounts of data, automate processes, and obtain insights from many sources. But it also brings up technical issues like reorganizing the structure of websites and implementing anti-scraping techniques, along with moral and legal questions around data privacy and intellectual property rights. Web scraping has a wide range of uses in many sectors and fields. It makes it easier to use accessible government data for transparency, fuel business intelligence and big data analytics projects, and enable services for pricing comparison and aggregation. Furthermore, it facilitates the creation of new services and applications and data-driven mashups and visualizations.

2.2 Conclusion drawn from literature review:

The literature survey provides valuable insights into various technological domains, showcasing the ongoing research efforts and advancements in voice-based authentication systems, web scraping, industrial asset management, electronic parts obsolescence, ChatGPT technology, prompt engineering, API wrapper technology, and end-of-life device security. Key conclusions drawn from the review include:

- b.Crucial Role of Web Scraping in Data Collection: Web scraping emerges as a crucial tool for collecting and organizing unstructured data from the internet, facilitating various applications across different fields such as business intelligence and open government data utilization[1].
- Importance of EoL Management in Industrial Asset Management: Effective end-of-life (EoL) management strategies are paramount in industrial asset management to address challenges associated with assets reaching the end of their lifecycle. Collaboration between academia and industry experts is highlighted for developing comprehensive frameworks to address uncertainties and risks[4].
- Need for Proactive Management of Electronic Parts Obsolescence: Electronic parts obsolescence presents challenges in complex systems, emphasizing the importance of proactive management to mitigate risks and ensure system sustainability[3].

- Potential of ChatGPT Technology and Prompt Engineering: ChatGPT technology and prompt engineering techniques hold promise in various applications, from generating feedback in higher education to developing smart chatbots. Prompt engineering is identified as essential for optimizing interactions with large language models like ChatGPT[5].
- Security Risks Associated with EoL Devices: The security of end-of-life (EoL) devices is a growing concern, with vulnerabilities associated with devices no longer receiving maintenance post-EoL. Attention to security issues in EoL device management is crucial to mitigate risks and ensure system integrity[8].

2.3 Scope of this research work:

Building upon the insights gleaned from the literature survey, this research aims to address key challenges and explore opportunities within the realm of industrial product lifecycle management, particularly focusing on the integration of ChatGPT technology. The scope of this research includes:

- Developing an integrated system for automating validation and updating of EOL dates in industrial product databases using ChatGPT technology.
- Investigating the effectiveness of ChatGPT technology in streamlining EOL database management processes and improving decision-making in industrial asset management.
- Exploring the potential applications of prompt engineering techniques to optimize interactions with ChatGPT and enhance the efficiency of the integrated system.
- Assessing the security implications and measures for ensuring the integrity and confidentiality of EOL data within the industrial product lifecycle management framework.
- Providing recommendations and guidelines for implementing the integrated settings, with a focus on scalability, reliability, and sustainability.

CHAPTER 03

ANALYSIS

3. ANALYSIS

3.1 Web Scraping

Asset Management (ITAM), accurate management of End-of-Life (EOL) product data is essential for informed decision-making and risk mitigation. ITAM firms often resort to web scraping to collect EOL information from various online sources, including manufacturer websites, product documentation, and industry databases[16]. This data is then stored for reference, but the dynamic nature of the web introduces challenges such as broken links and altered content, necessitating manual validation and updates. To address these challenges, we propose integrating ChatGPT, an advanced natural language processing model, into EOL database management. ChatGPT can automate the verification and updating process by interpreting queries, comparing extracted data with existing records, and identifying discrepancies. Its ability to learn from vast datasets enables continuous improvement in accuracy and adaptability. Web scraping enables ITAM professionals to efficiently gather EOL dates, product specifications, and documentation, facilitating informed decision-making on asset management. Despite its effectiveness, challenges such as data integrity and sustainability persist due to website updates and restructuring. By integrating ChatGPT into the ITAM workflow, organizations can streamline data validation, reduce manual efforts, and enhance operational efficiency. This approach not only mitigates the risks associated with relying on outdated or inaccurate information but also unlocks the transformative potential of AI in ITAM processes. The paper delves into the implementation of ChatGPT in EOL database management, exploring its functionalities, benefits, and potential challenges. It also addresses practical considerations like data privacy, model training, and integration with existing IT systems to offer comprehensive guidance for organizations seeking to leverage AI in ITAM practices.

3.2 EOL Dates

End-of-Life (EOL) dates is crucial due to the unique security challenges they introduce. Despite the popularity of embedded devices, EOL devices are often neglected in security research, leaving them vulnerable to breaches[9]. The study addresses this gap, conducting analyses on EOL devices' survival and security vulnerabilities. Surprisingly, many EOL devices remain active, with over two million identified, and a significant portion of vulnerabilities discovered post the EOL date. This poses severe

cybersecurity risks. To combat this, we propose integrating ChatGPT into EOL database management for automated verification and updating. Leveraging ChatGPT's capabilities, we aim to streamline the process, addressing challenges like changing EOL dates and broken URLs. Our approach involves fine-tuning and optimizing ChatGPT using Python and the OpenAI API to enhance real-time responses and ensure secure authentication.

3.3 LLM Models

Large Language Models (LLMs) have taken center stage in AI research, particularly ChatGPT, which stands out for its mastery of human-like text comprehension and generation. Unlike other LLMs focused on specific tasks, ChatGPT shines in conversational interactions, understanding and responding contextually. This ability, fueled by transformer architecture and vast textual training, empowers it to personalize recommendations, answer questions, and even tell stories. ChatGPT further elevates recommendation systems by providing clear explanations behind its suggestions through conversational interfaces, fostering trust and engagement. Recent advancements like fine-tuning and interactive features have enhanced its utility, enabling adaptation to user feedback and context for more accurate and relevant recommendations.

Within the ChatGPT ecosystem, GPT-3 variants like Davinci and Turbo push the boundaries of conversational AI. Davinci, the largest and most powerful, boasts 175 billion parameters, excelling in nuanced and context-aware responses. Its vastness makes it ideal for diverse applications like natural language understanding, dialogue generation, and content creation. Turbo, on the other hand, prioritizes speed and efficiency with its streamlined architecture. This makes it perfect for real-time applications like chatbots and virtual assistants, while retaining its high-level language capabilities.

Both Davinci and Turbo showcase the versatility of ChatGPT in fostering natural and engaging interactions. From personalized recommendations and insightful answers to meaningful conversations, these models pave the way for a more intuitive and intelligent future powered by AI. In essence, ChatGPT is not just a conversational AI model, but a testament to the power of LLMs in shaping human-machine

interactions[17]. Its ability to understand, respond, and adapt makes it a valuable tool for various applications, and its future advancements hold immense promise for a more natural and intelligent AI experience.

3.4 Prompt Engineering

Prompt engineering stands as a critical skill set in maximizing the efficacy of large language models (LLMs), particularly in the context of conversational interactions with models like ChatGPT[2]. As evidenced by the evolving landscape of technology, prompts play a pivotal role in programming LLMs, offering a means to enforce rules, automate processes, and tailor the qualities and quantities of generated outputs. The paper contributes to the burgeoning field of prompt engineering by presenting a catalog of prompt engineering techniques organized in pattern form. These patterns serve as a knowledge transfer method, akin to software patterns, offering reusable solutions to common problems encountered when conversing with LLMs. Recognizing the significance of prompt engineering, this research acknowledges its integral role in applying LLMs to automate software development tasks[7].

The contributions of this paper are threefold. Firstly, it provides a comprehensive framework for documenting patterns structured to address diverse problems encountered when working with LLMs. This framework facilitates the adaptation of prompt patterns to different domains, enhancing their versatility. Secondly, the paper introduces a catalog of patterns that have been successfully applied to enhance the outputs of LLM conversations[13]. These patterns cover a spectrum of challenges, ranging from the production of visualizations and code artifacts to automating output steps for fact-checking purposes. Thirdly, the paper elucidates the synergies that can arise from combining multiple prompt patterns, showcasing the flexibility and adaptability inherent in effective prompt engineering[14].

As we delve into the intricacies of prompt engineering, it becomes apparent that prompts serve as a means to program LLMs by providing specific rules and guidelines for orchestrating conversations and shaping outputs[11]. The example prompt presented illustrates the programming potential, steering ChatGPT to inquire and generate a Python script for AWS deployment systematically. Prompt engineering extends beyond conventional instructions for text or code generation; it has the power

to reshape interactions fundamentally. For instance, prompts can be engineered to create new interaction paradigms, simulate diverse scenarios, or even self-adapt, suggesting additional prompts for gathering information or generating related artifacts[12].

The introduction of prompt patterns as documented in this paper signifies a crucial advancement. Analogous to software patterns, prompt patterns offer a codified approach to systematically engineer diverse outputs and interactions with conversational LLMs. The subsequent sections will delve into specific prompt patterns applied in the context of this research project, showcasing their adaptability and effectiveness in enhancing the capabilities of ChatGPT for automated verification and updating of End-of-Life databases[15].

3.5 API Wrapper Technology In MDM Integration

API wrapper technology in Master Data Management (MDM) integration marks a significant step towards automating End-of-Life (EOL) data updates, aligning seamlessly with organizational goals. By leveraging API wrapper technology, the project aims to streamline system efficiency, mitigating manual efforts associated with EOL updates. This innovative methodology combines the capabilities of the OpenAI API with ChatGPT and Python, facilitating the development of intelligent chatbots tailored for MDM integration[1]. Through API integration methods, the proposed system offers a practical and efficient approach to creating intelligent ChatGPT bots, promising transformative impacts across industries. The materials and methods section outlines a systematic approach, detailing stages of API integration and rationale behind GPT-3 variant selection. Rigorous testing procedures validate the system's efficiency and intelligence, demonstrating its ability to engage in meaningful conversations and provide insightful responses during chat sessions. Study emphasizes the simplicity and effectiveness of the proposed ChatGPT API system, positioning it as a valuable asset for developers seeking to enhance user experiences across diverse applications.

CHAPTER 04

DESIGN

4. DESIGN

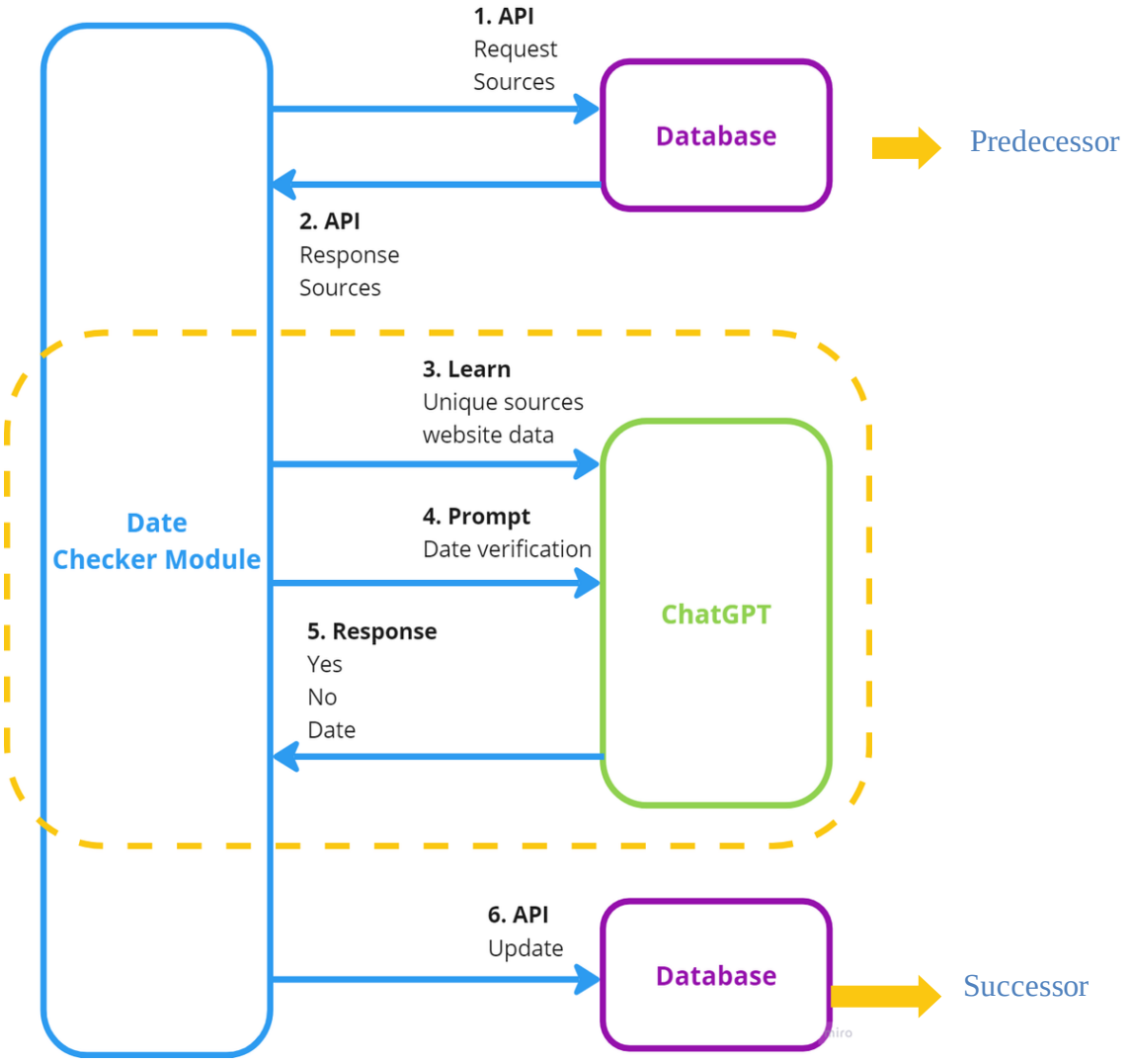

Fig 4.1 Working Architecture

Fig 4.1 shows the working architecture of a data processing system that retrieves information, checks dates, potentially uses it for ChatGPT responses, and updates a database.

CHAPTER 05

IMPLEMENTATION

5. IMPLEMENTATION

In our ambitious undertaking to redefine embedded device management, our project unfolds through a meticulously orchestrated workflow that integrates advanced technologies, language models, and robust data management practices.

1. **Data Retrieval**

The journey commences with Data Retrieval, utilizing APIs to aggregate comprehensive data from the company's asset database and external data providers. The focus here is on extracting crucial End-of-Life (EOL) dates, laying the foundation for subsequent stages. This initial step sets the groundwork for the entire workflow, ensuring that the subsequent processes are built upon accurate and reliable data.[11]

2. **Data Processing**

The workflow transitions into Data Processing, involving a meticulous dance of cleaning and pre-processing. This critical juncture ensures the data attains the highest levels of consistency and accuracy. Addressing any missing or incomplete data elements becomes paramount, fortifying the dataset for the intricate stages yet to unfold. Through rigorous processing, the data is refined and prepared for further analysis and validation[10].

3. **EOL Date Verification**

The third stage, EOL Date Verification, assumes prominence, particularly if enabled. Language models like ChatGPT take center stage, validating retrieved EOL dates. ChatGPT's unique capability to access and process information from diverse sources, including the vast realms of the internet, is harnessed to corroborate the validity of EOL dates. This stage ensures that the EOL dates are accurate and reliable, providing confidence in the subsequent decision-making processes.[8]

4. **Data Validation**

With validated information in hand, the workflow advances to Data Validation, a phase characterized by robust business rules and data validation checks. The objective is to ensure not only the accuracy but also the consistency of the updated EOL dates. A meticulous validation process unfolds, involving a judicious cross-referencing of the

updated dates with internal records, external sources, and industry standards. This validation step adds an extra layer of assurance, confirming the integrity of the data before proceeding further.[10]

5. Data Update

The subsequent stage, Data Update, marks the seamless integration of the verified or validated EOL dates into the company's asset database. This integration seamlessly dovetails with the existing IT asset management system, creating a unified repository that encapsulates the latest and most accurate information. By updating the database with validated EOL dates, the organization ensures that all stakeholders have access to consistent and up-to-date information, facilitating informed decision-making.[3]

6. Reporting and Monitoring

As the project strides forward, the focus shifts to Reporting and Monitoring. Comprehensive reports are generated, offering a detailed snapshot of the updated EOL dates and shedding light on any identified discrepancies. The vigilant monitoring of the system becomes imperative, with an unwavering eye on potential errors, exceptions, and performance-related intricacies. This stage ensures transparency and accountability, allowing stakeholders to track the progress of the workflow and address any issues promptly. Benefits-The benefits derived from this intricate workflow are manifold. It not only streamlines manual tasks, ushering in significant time and resource savings, but also elevates the precision and consistency of data, effectively mitigating the risk of errors and omissions. Furthermore, the project promises to provide timely insights into the lifecycles of assets, thereby empowering informed decision-making. By leveraging advanced technologies and robust data management practices, organizations can optimize their operations and stay ahead in today's competitive landscape.[12]

Nevertheless, as we embark on this transformative journey, several considerations come to the forefront. The pivotal role of data quality and availability in ensuring the accuracy of results cannot be overstated. Understanding the nuances and limitations of language models, especially the performance intricacies of ChatGPT, becomes paramount. Additionally, addressing security and privacy concerns with meticulous diligence is non-negotiable, upholding data integrity and user confidentiality at every juncture.

By addressing these considerations proactively, organizations can mitigate risks and ensure the success of their projects. Conclusion As we navigate through this intricate and transformative workflow, our project doesn't merely seek to enhance the efficiency of embedded device management; rather, it aspires to set new standards for accuracy, automation, and security within this dynamic landscape. The fusion of advanced technologies and robust data management practices propels us towards a future where embedded devices seamlessly align with evolving industry demands, ensuring a connected ecosystem that is not only intelligent but also secure and resilient.

By embracing innovation and collaboration, organizations can unlock new possibilities and drive sustainable growth in the ever-evolving digital era.

Integration of ChatGPT with EOL Data Management Using API Wrapper:

Techniques:

In the realm of Master Data Management (MDM), the convergence of ChatGPT with API Wrapper technology introduces an innovative approach to automate the verification and updating processes of End-of-Life (EOL) device data. This integration not only aligns with the company's objective to streamline EOL data management but also underscores the potential for transformative impacts on decision-making and asset management.

Stage 1: API Key Generation for EOL Data Management

The initial step involves the creation of a dedicated API pass to facilitate seamless communication between ChatGPT and the EOL data management system. Developers would acquire a unique API key, serving as the authentication mechanism for accessing the OpenAI API library and orchestrating interactions with ChatGPT.

Stage 2: Importing the OpenAI Module into MDM Systems

Following API key generation, the OpenAI module is imported into the MDM systems, establishing a crucial link between ChatGPT and the EOL database. This integration empowers developers to leverage ChatGPT's language processing capabilities to interpret and respond to natural language queries regarding EOL dates and device information.

Stage 3: Selection of GPT-3 Variant for Enhanced Performance

The integration process extends to selecting the most suitable GPT-3 variant for the specific requirements of EOL data management. Each variant, such as Da Vinci, Curie, Babbage, and Ada, offers distinct capabilities in terms of processing speed, cost efficiency, and overall performance. The choice of variant is tailored to optimize the system's responsiveness and effectiveness in handling EOL data.

Stage 4: Customizing ChatGPT Responses for EOL Queries

To ensure that ChatGPT provides accurate and contextually relevant responses, developers add a final touch by tailoring prompts to address EOL-specific queries. The completion mechanism, facilitated by the create () method, allows for the formulation of prompts that elicit precise information regarding EOL dates, firmware updates, and potential security vulnerabilities.

The proposed system architecture incorporates an API integration technique based on the OpenAI Python package, enabling seamless communication between ChatGPT and the EOL data management system. By following these systematic stages, developers can harness the power of ChatGPT to enhance decision-making processes and automate the validation and updating of EOL device information.

Testing: Ensuring Efficiency and Accuracy in EOL Data Management.

The efficiency of the integrated system is rigorously tested across various environments and scenarios. API calls are generated to specific endpoints, ensuring that the EOL queries reach the designated API endpoint accurately. The system undergoes thorough testing to validate its responsiveness, accuracy, and reliability in handling diverse EOL data management tasks.

Unlocking the Potential for Intelligent EOL Data Management-

The proposed integration of ChatGPT with EOL data management through API Wrapper techniques emerges as a promising solution for automating the validation.
updating processes. This approach not only simplifies the cross-checking of EOL updates but also introduces a dynamic and intelligent layer to decision-making in product lifecycle management. As the system proves its efficacy in various testing scenarios, it positions itself as a valuable tool for developers seeking to revolutionize

EOL data management and enhance the overall efficiency of Master Data Management systems. Future enhancements may explore additional functionalities to further enrich the capabilities of the system and its applications within the company's ecosystem.

The integration of ChatGPT with EOL data management using API wrapper techniques represents a significant step forward in the realm of Master Data Management (MDM). By seamlessly incorporating ChatGPT's language processing capabilities into the verification and updating processes of End-of-Life (EOL) device data, companies can achieve unprecedented levels of efficiency and accuracy in managing product lifecycle information.

As organizations continue to grapple with the complexities of managing vast amounts of EOL data, the integration of ChatGPT offers a transformative solution that streamlines processes, enhances decision-making, and ultimately drives operational excellence. Through rigorous testing and refinement, the integrated system ensures reliability, responsiveness, and accuracy across diverse environments and scenarios, empowering developers to confidently automate EOL data management tasks. By leveraging the power of ChatGPT and API wrapper techniques, companies can unlock valuable insights, identify trends, and proactively address challenges in product lifecycle management. As such, the integration of ChatGPT with EOL data management stands as a testament to the ongoing evolution of MDM practices and the relentless pursuit of excellence in data-driven decision-making.

CHAPTER 06

RESULT AND DISCUSSION

6. RESULT AND DISCUSSION

The proposed methodology demonstrates benefits such as streamlining verification and updating of EOL data, leading to time and resource savings, and improved data accuracy. This enables timely insights into asset lifecycles, fostering informed decision-making. The integrated system efficiently manages EOL data, enhancing database maintenance practices. Embracing ChatGPT and API Wrapper techniques unlocks new possibilities for sustainable growth in the digital landscape. Highlighting the importance of advanced technologies in addressing data management challenges, the integration of ChatGPT with API Wrapper techniques offers transformative solutions for Master Data Management (MDM), driving operational excellence. Real-time interactions with ChatGPT for EOL data verification and updates are showcased in the results, evidencing the system's functionality. In conclusion, the collaboration between human and artificial intelligence, exemplified by ChatGPT intesgration, enables efficient EOL data management, fostering innovation in organizational practices. Furthermore, the program's real-time interactions with ChatGPT for EOL data verification and updates are demonstrated in the Fig 6.1 and Fig 6.2, showcasing the system's functionality.

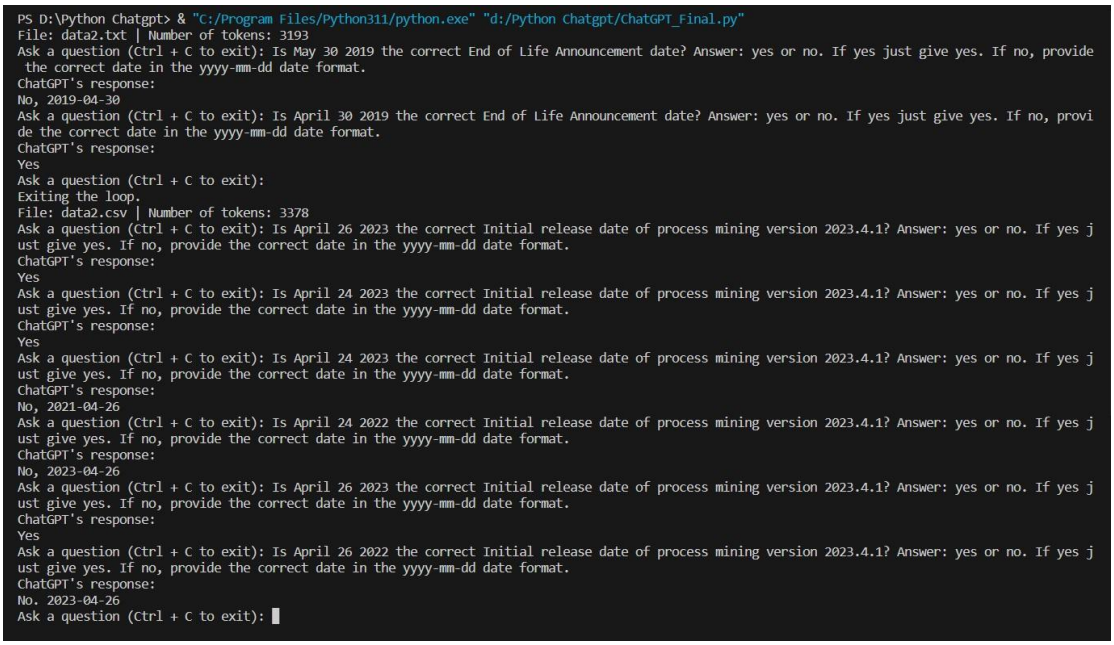

Fig 6.1 The program's real-time interactions with ChatGPT

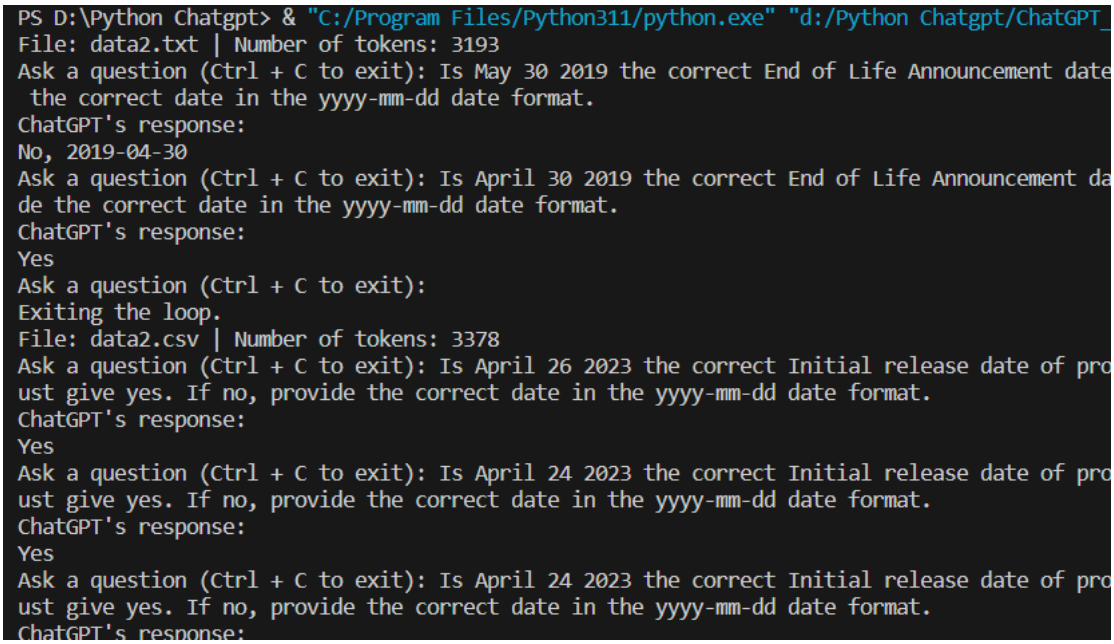

Fig 6.2 Response in the form of 'Yes' or 'No'

CHAPTER 07

CONCLUSIONS, CONTRIBUTIONS, SCOPE FOR FUTURE WORK

7. CONCLUSIONS, CONTRIBUTIONS, SCOPE FOR FUTURE WORK

Shaping a Secure, Intelligent, and efficient future in Embedded Device Management. In the rapidly evolving landscape of embedded devices, this research paper has delved into critical dimensions that significantly influence the security, functionality, and overall efficiency of device management. By addressing the nuances of End-of-Life (EOL) devices, understanding the capabilities of Large Language Models (LLMs) like ChatGPT, and harnessing the potential of API Wrapper technology, our exploration seeks to pave the way for a more secure, intelligent, and efficient future in embedded device management.

The comprehensive analysis of EOL devices reveals a concerning reality—devices left unattended post-EOL are vulnerable, exposing networks to potential threats. With over 2 million active EOL devices and more than half of their vulnerabilities discovered post-EOL date, a clarion call is sounded for heightened attention to the security issues surrounding these devices. Our research emphasizes the urgency for standardized security protocols, even for devices considered obsolete, to mitigate potential risks and fortify the cyberspace ecosystem. Large Language Models, exemplified by ChatGPT, emerge as powerful tools in shaping the interaction paradigms within the embedded device ecosystem. Beyond conventional applications, such as generating code snippets or answering questions, we highlight the transformative potential of prompt engineering. The catalog of prompt engineering techniques presented in this paper serves as a valuable resource for developers, enabling them to tailor interactions with ChatGPT to address diverse challenges in software development, thereby unlocking new dimensions of productivity and creativity.

Integration with Master Data Management (MDM) using API Wrapper techniques introduces a paradigm shift in EOL device data management. Automating the cross-checking of EOL updates through the OpenAI API not only streamlines processes but also represents a significant leap towards intelligent decision-making. The proposed system, combining ChatGPT, Python, and API Wrapper technology, enhances the development of smart chatbots, showcasing the versatility of these technologies in diverse domains.

7.1 CONCLUSIONS

In conclusion, our research underscores the imperative for a holistic approach to embedded device management—one that considers the entire lifecycle, incorporates advanced language models, and leverages cutting-edge technologies. As we navigate the complex interplay of security, language understanding, and automation, we envision a future where embedded devices seamlessly adapt to evolving challenges, contributing to a connected ecosystem that is both resilient and dynamic. Through the amalgamation of security protocols, language models, and innovative integration techniques, we chart a course towards an era where embedded devices not only meet functional expectations but also set new standards for intelligence, adaptability, and security.

7.2 CONTRIBUTIONS

Moving forward, future research endeavors could prioritize enhancing the scalability and performance optimization of embedded device management systems. As the proliferation of embedded devices continues to escalate, managing large-scale deployments, especially of End-of-Life (EOL) devices, poses significant challenges. Innovative approaches are needed to address these challenges by optimizing resource utilization, reducing latency, and enhancing system responsiveness. This may involve exploring novel algorithms, distributed computing techniques, and efficient data processing methodologies tailored to the unique requirements of embedded device environments. By focusing on scalability and performance optimization, researchers can develop robust solutions capable of supporting the growing complexity and scale of modern embedded device networks.

7.3 SCOPE FOR FUTURE WORK

Moreover, further exploration into standardization and interoperability efforts within the embedded device management domain is essential for fostering seamless integration and collaboration among different stakeholders. Establishing industry-wide standards and protocols can facilitate interoperability among diverse device manufacturers, management platforms, and communication protocols. This can

streamline device management processes, enhance data sharing capabilities, and promote greater efficiency and security across interconnected device networks.
Additionally, collaborative initiatives aimed at defining common frameworks and best practices for managing EOL devices can contribute to improved consistency, reliability, and compatibility within the embedded device ecosystem.

In addition to scalability, performance optimization, standardization, and interoperability, future research could also delve into the development of innovative security mechanisms specifically tailored for EOL devices. As highlighted in the preceding analysis, EOL devices represent a significant security concern due to their vulnerability to emerging threats. Exploring advanced encryption techniques, anomaly detection algorithms, and intrusion prevention systems designed specifically for EOL devices can help mitigate these risks and enhance overall security posture. By focusing on these key areas of research, scholars and practitioners can contribute to the ongoing evolution of embedded device management, paving the way for a more secure, efficient, and interconnected future.

CHAPTER 08

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8. REFERENCES

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LIST OF DELIVERABLES ON PRESENT WORK

PROJECT SPONSORSHIP LETTER

APEXAIQ
Inventory | Security | Productivity | Finance

Date: 04th March 2024

TO WHOM SO IT MAY CONCERN

Subject: Sponsorship Letter

Dear Riya Dangra,

We are pleased to inform you that ApexaiQ Technologies Pvt Ltd has chosen you to receive the sponsorship for your academic pursuits.

Below are the details:

- **Project Name:** Integration of ChatGPT to Verify and Update EOL Database
- **Duration:** This internship will cover the student beginning on [August'2023 to September'2023] and [January'2024 to March'2024].
- **Stipend:** You will receive a stipend of INR 7000 per month.

We look forward to witnessing your continued success and are excited to play a part in your educational journey.

Sincerely,

For, ApexaiQ Technologies Pvt Ltd.

Pragti Aggarwal

Pragti Aggarwal

Director

PUBLISHED RESEARCH PAPER

"Enhancing Database Maintenance: Leveraging ChatGPT for Real-Time Verification and Updates of End-of-Life (EOL) Data"

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ABSTRACT

The integration of ChatGPT technology into industrial product lifecycle management aims to tackle the labor-intensive and error-prone tasks related to validating and updating End-of-Life (EOL) dates in databases. Leveraging OpenAI's GPT-3 model through Python and the OpenAI API, the aim is to automate verification processes, reduce manual efforts, and enhance data reliability. By refining the AI model's capabilities through strategic prompts and real-time feedback mechanisms, the system can effectively manage fluctuating EOL dates, broken URLs, and secure authentication processes. The integration of ChatGPT's language processing capabilities offers a comprehensive solution for efficient decision-making and asset management within the product lifecycle management framework, ultimately revolutionizing EOL database management practices by optimizing accuracy, efficiency, and reliability while mitigating drawbacks associated with manual intervention.

Keywords: Web Scraping techniques, End-of-life management, ChatGPT technology, Prompt Engineering, EoL device security.

INTRODUCTION

In today's fast-paced technological landscape, maintaining accurate End-of-Life (EOL) databases poses challenges in industrial product lifecycle management. Integrating advanced technologies like ChatGPT offers transformative solutions by automating validation processes and reducing manual errors. This research explores the integration of ChatGPT into EOL database management, addressing vulnerabilities in EOL devices, methodologies for managing EOL information, and the role of prompt engineering. By leveraging ChatGPT's capabilities, organizations can streamline verification processes, enhance data reliability, and improve decision-making in asset management. Through meticulous exploration, this paper illuminates an innovative approach to EOL management driven by data and intelligence.

1.1 WEB SCRAPING- Web scraping efficiently gathers EOL data from various sources, but challenges like data integrity persist. Integrating ChatGPT automates verification processes, reducing manual efforts and enhancing operational efficiency.

1.2 EOL Dates- EOL devices pose cybersecurity risks, with many remaining active post-EOL. Integrating ChatGPT automates verification and updating, addressing challenges like changing EOL dates and broken URLs.

1.3 LLM Models- ChatGPT excels in conversational interactions, offering personalized recommendations and insights. Models like Davinci and Turbo showcase its versatility in various applications, promising a more intuitive AI experience.

1.4 PROMPT ENGINEERING- Prompt engineering plays a critical role in maximizing LLM efficacy. This paper presents a catalog of prompt patterns, offering reusable solutions to common conversational challenges with LLMs.

1.5 API WRAPPER TECHNOLOGY IN MDM INTEGRATION- API wrapper technology streamlines EOL data updates by combining OpenAI API with ChatGPT and Python. Rigorous testing validates the system's efficiency, positioning it as a valuable asset for enhancing user experiences.

LITERATURE SURVEY

The literature survey provided encompasses a diverse range of topics within the realm of technology and information management. These topics include voice-based authentication systems, web scraping techniques, industrial asset management, electronic parts obsolescence, ChatGPT technology, prompt engineering, API wrapper technology, and end-of-life (EoL) device security. Each abstract presents a unique perspective on the challenges, advancements, and applications within its respective domain.[1] Voice-based authentication systems represent a significant breakthrough, particularly beneficial for visually impaired individuals. Leveraging machine learning, these systems analyze vocal patterns to create unique voice prints for user authentication. Challenges such as security concerns and environmental factors impacting accuracy are acknowledged, with future directions focusing on multi-modal authentication for enhanced security [3].

Web scraping emerges as a crucial tool for collecting and organizing unstructured data from the internet, facilitating various applications across different fields.[5] The literature emphasizes the importance of web scraping methodologies, tools, and applications, ranging from business intelligence to open government data utilization. Opportunities for data exploitation in areas such as Big Data, Business Intelligence, and development of new applications are highlighted [2]. In the realm of industrial asset management, strategies for end-of-life (EoL) management are deemed paramount. Papers discuss challenges faced by industries dealing with assets reaching the end of their lifecycle and propose systematic frameworks for evaluating readiness levels and commercial indexes of EoL management strategies.[4] Collaboration between academia and industry experts is highlighted for developing comprehensive frameworks to address uncertainties and risks associated with EoL management [13]. Addressing electronic parts obsolescence, studies underscore the importance of considering both hardware and software lifecycle management in complex systems.[6] Methodologies, databases, and tools are discussed for addressing obsolescence issues, emphasizing proactive management to mitigate risks and ensure system sustainability [14]. ChatGPT technology and prompt engineering techniques emerge as promising areas of research, with several papers exploring their applications.[7] From generating feedback in higher education to improving generative AI content and developing smart chatbots, the potential of ChatGPT in various domains is evident. Prompt engineering techniques are identified as essential for optimizing interactions with large language models like ChatGPT, enabling more effective communication and task completion [5]. Lastly, the security of end-of-life (EoL) devices is addressed, highlighting vulnerabilities associated with devices no longer receiving firmware/software maintenance post-EoL. Measurement studies reveal the scale of active EoL devices and the prevalence of vulnerabilities, underscoring the need for attention to security issues in EoL device management to mitigate risks and ensure system integrity [14]. These areas represent critical fronts in advancing technology and addressing challenges in diverse domains, highlighting the need for continued research and innovation.[15]

METHODOLOGY

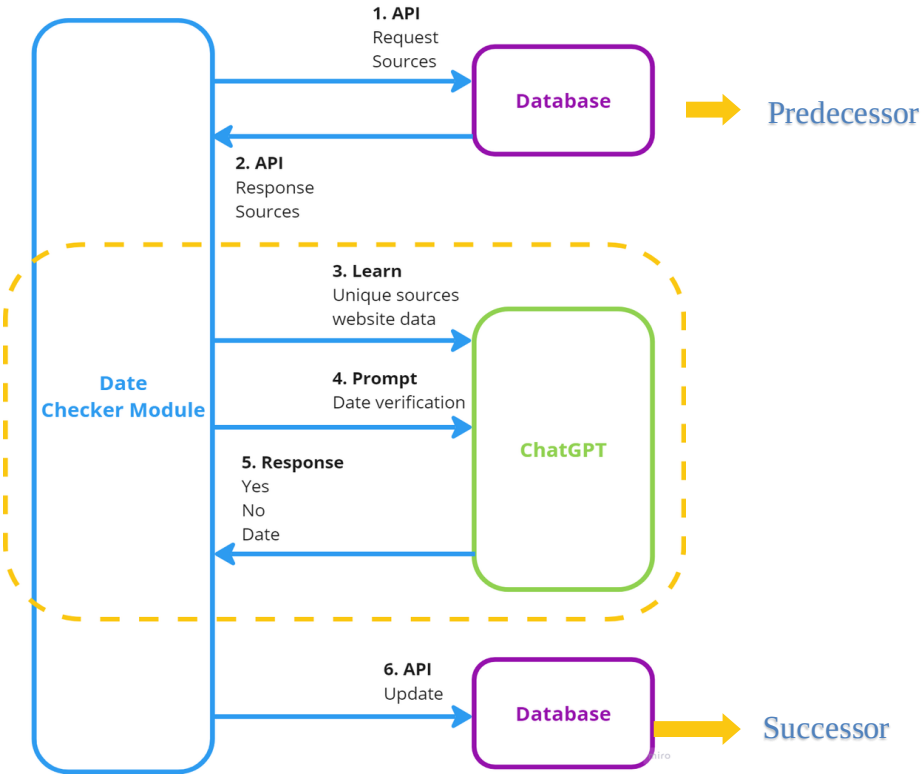

Fig1.1 Working Architecture

In our ambitious undertaking to redefine embedded device management, our project unfolds through a meticulously orchestrated workflow that integrates advanced technologies, language models, and robust data management practices.

Data Retrieval: We start by aggregating comprehensive data from the company's asset database and external providers using APIs. This initial step focuses on extracting crucial End-of-Life (EOL) dates, laying the foundation for subsequent stages.

Data Processing: The workflow then moves to data cleaning and pre-processing, ensuring the highest levels of consistency and accuracy. Addressing missing or incomplete data elements becomes crucial, fortifying the dataset for further analysis.

EOL Date Verification: Language models like ChatGPT play a pivotal role in validating retrieved EOL dates. ChatGPT's ability to access and process information from diverse sources ensures the accuracy and reliability of EOL dates, enhancing confidence in decision-making.

Data Validation: Validated information leads to a meticulous validation process involving robust business rules and checks to ensure accuracy and consistency. Cross-referencing updated dates with internal records and industry standards adds an extra layer of assurance.

Data Update: Verified or validated EOL dates are seamlessly integrated into the company's asset database, creating a unified repository. Updating the database ensures stakeholders have access to consistent and up-to-date information, facilitating informed decision-making.

Reporting and Monitoring: Comprehensive reports provide insights into updated EOL dates, while vigilant monitoring ensures prompt identification and resolution of any issues. Transparency and accountability are maintained throughout this stage.

Benefits: The workflow streamlines manual tasks, saving time and resources, while improving data precision and consistency. It also provides timely insights into asset lifecycles, empowering informed decision-making.

Considerations: Data quality and availability are crucial, as is understanding the nuances of language models like ChatGPT. Security and privacy concerns must be addressed diligently to uphold data integrity and user confidentiality.

Integration of ChatGPT with EOL Data Management Using API Wrapper Techniques: This integration automates EOL data verification and updating, streamlining processes and introducing intelligence into decision-making. Rigorous testing ensures efficiency and reliability, positioning the system as a valuable tool for revolutionizing EOL data management within Master Data Management systems.

RESULT

The proposed methodology demonstrates benefits such as streamlining verification and updating of EOL data, leading to time and resource savings, and improved data accuracy. This enables timely insights into asset lifecycles, fostering informed decision-making. The integrated system efficiently manages EOL data, enhancing database maintenance practices. Embracing ChatGPT and API Wrapper techniques unlocks new possibilities for sustainable growth in the digital landscape. Highlighting the importance of advanced technologies in addressing data management challenges, the integration of ChatGPT with API Wrapper techniques offers transformative solutions for Master Data Management (MDM), driving operational excellence. Real-time interactions with ChatGPT for EOL data verification and updates are showcased in the results, evidencing the system's functionality. In conclusion, the collaboration between human and artificial intelligence, exemplified by ChatGPT integration, enables efficient EOL data management, fostering innovation in organizational practices. Furthermore, the program's real-time interactions with ChatGPT for EOL data verification and updates are demonstrated in the results, showcasing the system's functionality.

CONCLUSION:

Shaping a Secure, Intelligent, and efficient future in Embedded Device Management. In the rapidly evolving landscape of embedded devices, this research paper has delved into critical dimensions that significantly influence the security, functionality, and overall efficiency of device management. By addressing the nuances of End-of-Life (EOL) devices, understanding the capabilities of Large Language Models (LLMs) like ChatGPT, and harnessing the potential of API Wrapper technology, our exploration seeks to pave the way for a more secure, intelligent, and efficient future in embedded device management. The comprehensive analysis of EOL devices reveals a concerning reality—devices left unattended post-EOL are vulnerable, exposing networks to potential threats. With over 2 million active EOL devices and more than half of their vulnerabilities discovered post-EOL date, a clarion call is sounded for heightened attention to the security issues surrounding these devices. Our research emphasizes the urgency for standardized security protocols, even for devices considered obsolete, to mitigate potential risks and fortify the cyberspace ecosystem. Large Language Models, exemplified by ChatGPT, emerge as powerful tools in shaping the interaction paradigms within the embedded device ecosystem. Beyond conventional applications, such as generating code snippets or answering questions, we highlight the transformative potential of prompt engineering. The catalog of prompt engineering techniques presented in this paper serves as a valuable resource for developers, enabling them to tailor interactions with ChatGPT to address diverse challenges in software development, thereby unlocking new dimensions of productivity and creativity. Integration with Master Data Management (MDM) using API Wrapper techniques introduces a paradigm shift in EOL device data management. Automating the cross-checking of EOL updates through the OpenAI API not only streamlines processes but also represents a significant leap towards intelligent decision-making. The proposed system,

combining ChatGPT, Python, and API Wrapper technology, enhances the development of smart chatbots, showcasing the versatility of these technologies in diverse domains. In conclusion, our research underscores the imperative for a holistic approach to embedded device management—one that considers the entire lifecycle, incorporates advanced language models, and leverages cutting-edge technologies. As we navigate the complex interplay of security, language understanding, and automation, we envision a future where embedded devices seamlessly adapt to evolving challenges, contributing to a connected ecosystem that is both resilient and dynamic. Through the amalgamation of security protocols, language models, and innovative integration techniques, we chart a course towards an era where embedded devices not only meet functional expectations but also set new standards for intelligence, adaptability, and security.

FUTURE WORK:

In the domain of embedded device management, the future presents promising avenues for innovation. One focal area is augmenting ChatGPT's integration with API Wrapper technology, broadening its communication scope to encompass diverse data management systems beyond End-of-Life (EOL) data. This expansion unlocks potential for streamlining processes and augmenting decision-making capabilities. Furthermore, there's a rising interest in leveraging artificial intelligence (AI) for predictive analytics in this field. Future endeavors could harness ChatGPT's language processing prowess to forecast EOL dates based on historical data and market trends, empowering proactive decision-making and resource optimization. Real-time monitoring and alerts offer another avenue for advancement, enabling timely responses to EOL data changes and anomalies. Refining ChatGPT's semantic understanding of EOL queries remains crucial, potentially through further exploration of natural language processing techniques. Integration with Internet of Things (IoT) devices also holds promise, facilitating direct querying and interaction for enhanced device lifecycle management. As data management landscapes evolve, ensuring robust security measures and scalability becomes imperative. Additionally, optimizing user interfaces enhances system accessibility and usability, while customizing solutions to industry-specific needs boosts efficiency. Finally, implementing mechanisms for continuous learning and adaptation ensures the long-term relevance and effectiveness of integrated systems. By incorporating user feedback and adapting to evolving requirements, these systems stay abreast of industry dynamics and maintain their efficacy in a dynamic environment.

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