Industrial Internship Report on

"URL Shortener"

Prepared by

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Executive Summary
This report provides details of the Industrial Internship provided by upskill Campus and The IoT Academy in collaboration with Industrial Partner UniConverge Technologies Pvt Ltd (UCT). This internship was focused on a project/problem statement provided by UCT. We had to finish the project including the report in 6 weeks' time. My project was to create a URL Shortener web page that converts long URLs into shorter, more manageable links. It takes a long URL as input, generates a unique shortened URL, and redirects users to the original URL when the shortened link is accessed. This internship gave me a very good opportunity to get exposure to Industrial problems and design/implement solution for that. It was an overall great experience to have this internship.

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1   Preface

Summary of whole 6 week's work

Over the course of six weeks, I've been dedicated to deepening my understanding and honing my skills in Python programming. Starting with the basics, I delved into fundamental concepts and principles, leveraging resources such as e-books and video tutorials provided by Upskill. These materials served as invaluable guides, offering comprehensive insights into Python libraries like Numpy and Pandas, as well as frameworks like Flask and Django. Throughout this period, I encountered and navigated through various challenges, including the complexities of API integration and backend development for a URL shortener project. Despite facing obstacles such as difficulties with API keys and issues with functionality like URL redirection and copying, I persisted in troubleshooting and seeking solutions to ensure successful integration and functionality. In addition to technical challenges, I've expanded my knowledge base, gained practical experience, and strengthened my problem-solving abilities, all of which have positioned me for continued success and advancement in my programming journey. About need of relevant Internship in career development.

The URL shortener project is a Python application designed to simplify lengthy URLs into shorter, more convenient links. Users input a long URL, and the program generates a unique shortened URL. When users access the shortened link, they are redirected to the original URL, providing a seamless and efficient way to share and access web addresses.

Throughout this six-week period, I've embarked on a journey of learning and growth, immersing myself in the world of Python programming. From gaining proficiency in essential Python libraries like Numpy and Pandas to tackling real-world challenges in backend development for a URL shortener project, each step has been a valuable learning experience. Despite facing obstacles, the journey has been incredibly rewarding, with every challenge presenting an opportunity for personal and professional development. Looking ahead, I'm excited to continue this journey, armed with newfound knowledge, skills, and a deep sense of fulfillment from the progress made so far.

I would like to express my sincere gratitude to Ankit sir for his continuous support and guidance throughout the project. His assistance has been invaluable in helping me navigate challenges and achieve progress. Thank you, Ankit sir, for your unwavering support and encouragement..

To my juniors and peers,

As we continue our journey in the world of programming, I want to extend a message of encouragement and support. Together, we have the opportunity to learn, grow, and inspire each other in our pursuit of excellence.

2 Introduction

2.1 About UniConverge Technologies Pvt Ltd

A company established in 2013 and working in Digital Transformation domain and providing Industrial solutions with prime focus on sustainability and RoI.

For developing its products and solutions it is leveraging various **Cutting Edge Technologies e.g. Internet of Things (IoT), Cyber Security, Cloud computing (AWS, Azure), Machine Learning, Communication Technologies (4G/5G/LoRaWAN), Java Full Stack, Python, Front end** etc.


i. UCT IoT Platform (uct Insight)

UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable "insight" for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- It enables device connectivity via industry standard IoT protocols - MQTT, CoAP, HTTP, Modbus TCP, OPC UA

- It supports both cloud and on-premises deployments.

It has features to
• Build Your own dashboard
• Analytics and Reporting
• Alert and Notification
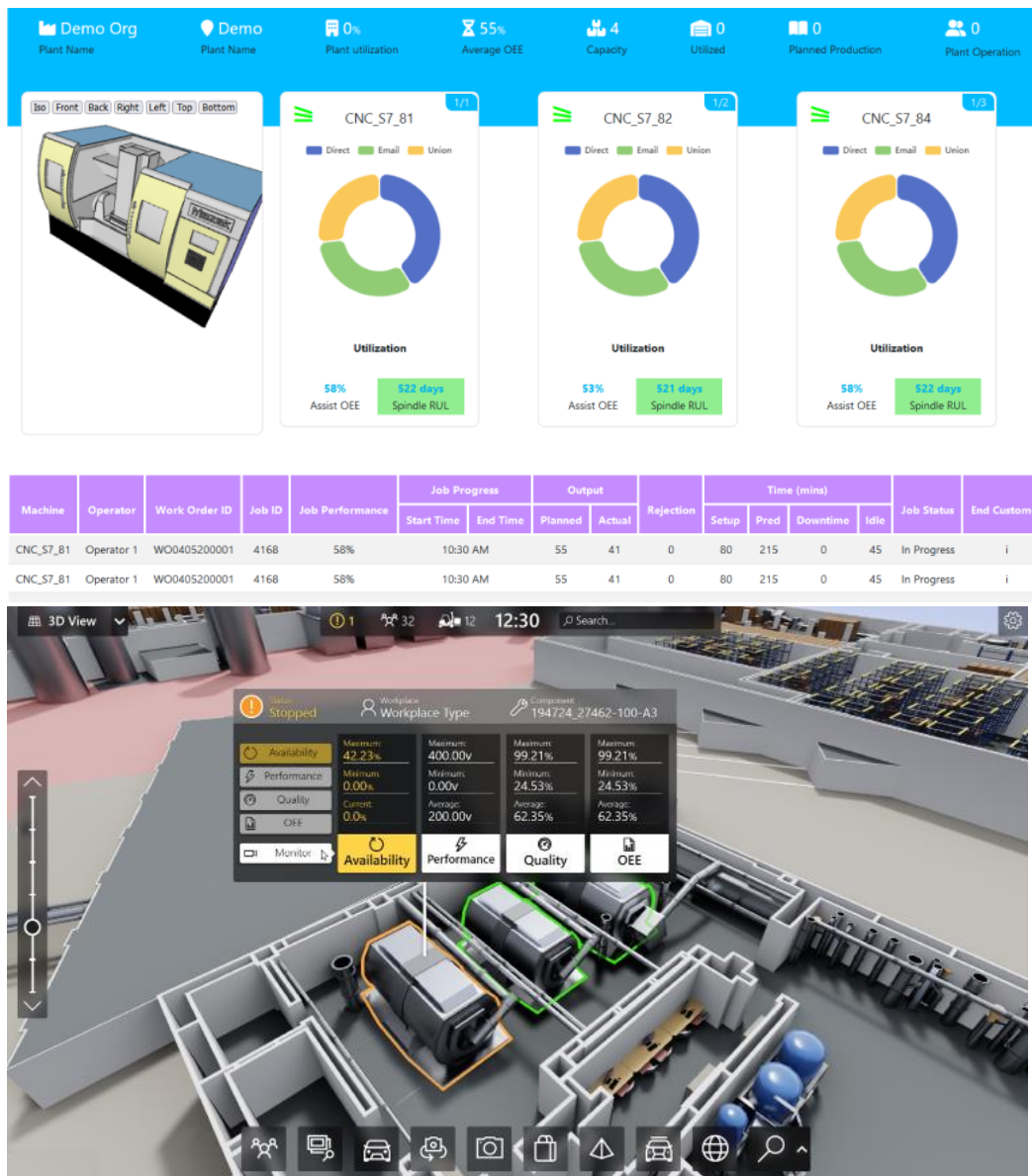• Integration with third party application(Power BI, SAP, ERP)
• Rule Engine
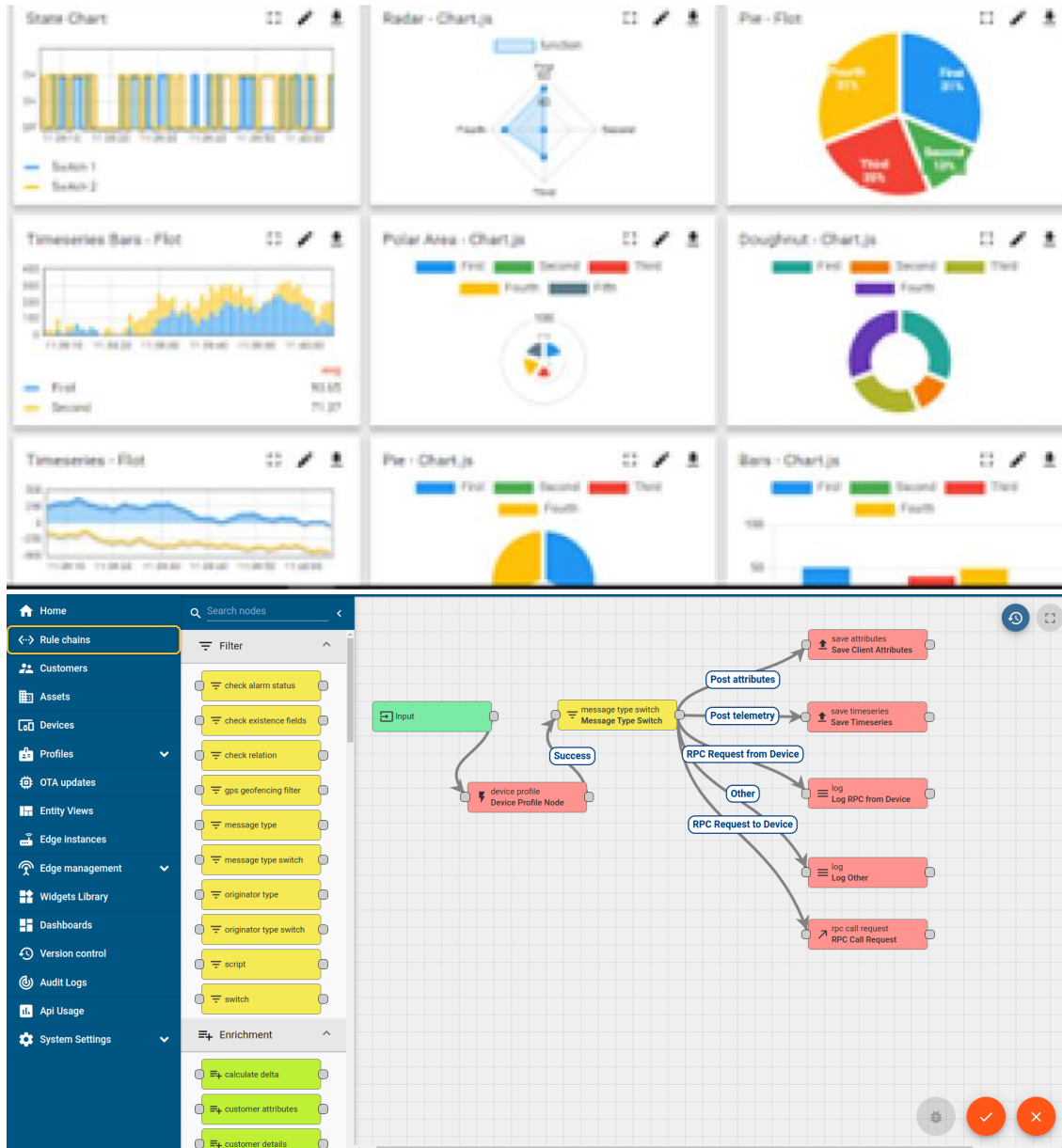
ii. Smart Factory Platform (**FACT⊘RY WATCH**)

Factory watch is a platform for smart factory needs.

It provides Users/ Factory

- with a scalable solution for their Production and asset monitoring

- OEE and predictive maintenance solution scaling up to digital twin for your assets.

- to unleased the true potential of the data that their machines are generating and helps to identify the KPIs and also improve them.

- A modular architecture that allows users to choose the service that they what to start and then can scale to more complex solutions as per their demands.

Its unique SaaS model helps users to save time, cost and money.

| Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i

iii. **LoRaWAN**™   based Solution

UCT is one of the early adopters of LoRAWAN teschnology and providing solution in Agritech, Smart cities, Industrial Monitoring, Smart Street Light, Smart Water/ Gas/ Electricity metering solutions etc.

iv.   Predictive Maintenance

UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.
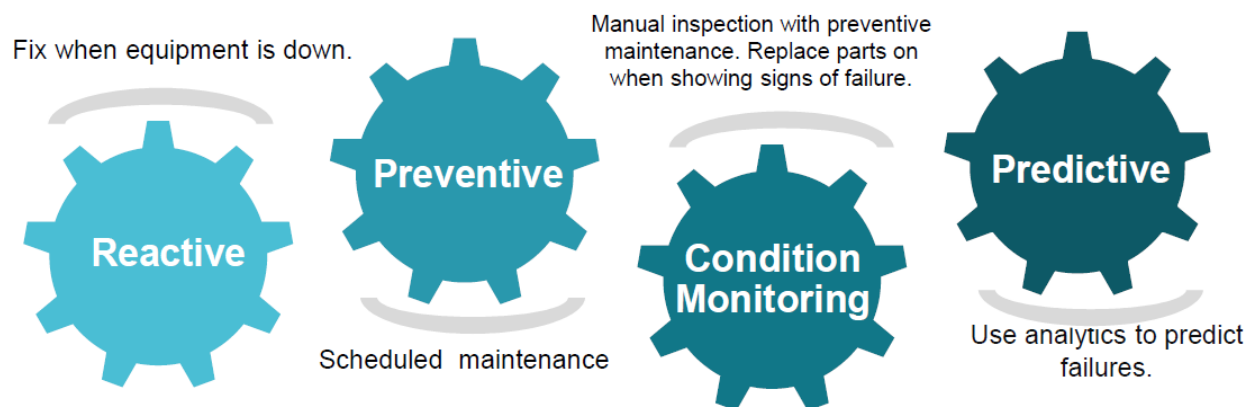
2.2   About upskill Campus (USC)

upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.
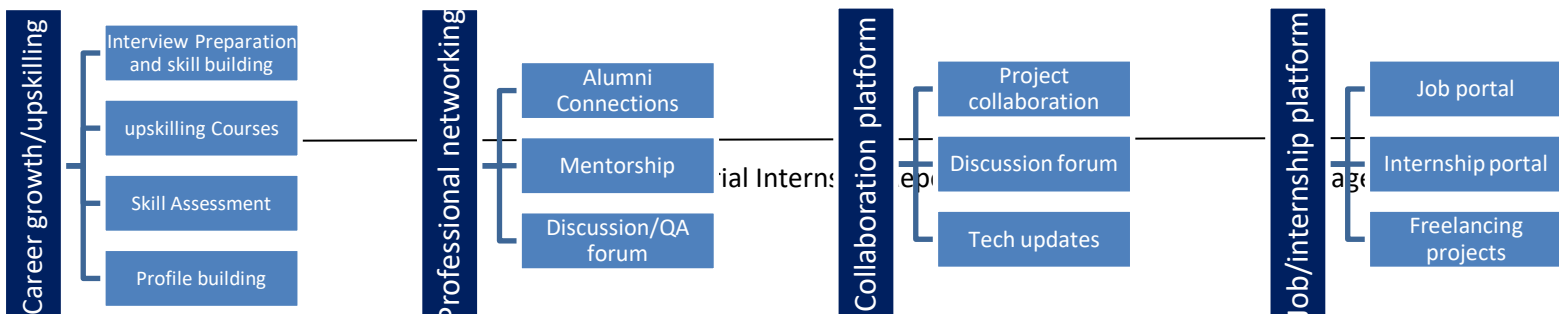
USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.
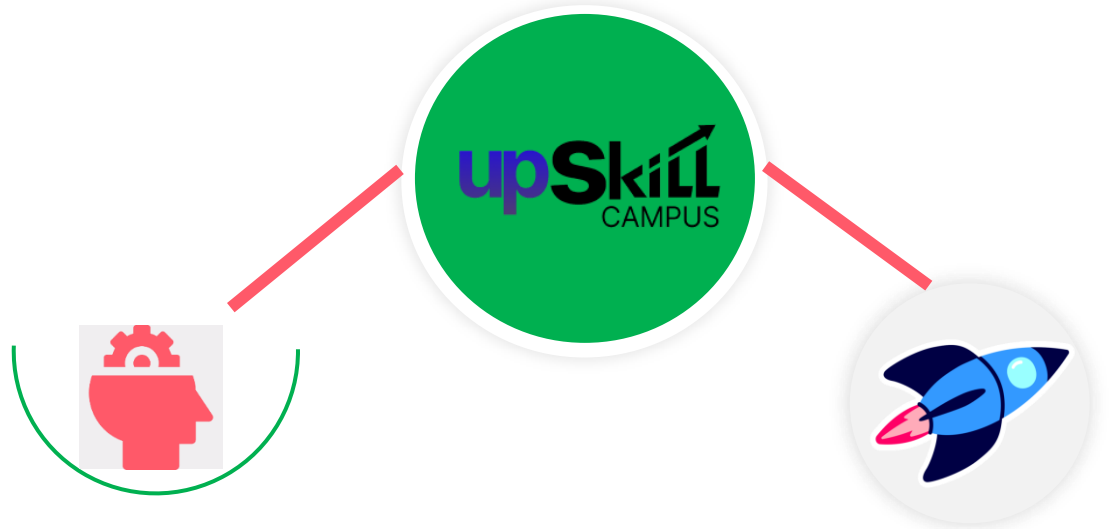
Seeing need of upskilling in self paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

upSkill Campus aiming to upskill 1 million learners in next 5 year

https://www.upskillcampus.com/

Career growth/upskilling		Professional networking		Collaboration platform		Job/internship platform	
Interview Preparation and skill building		Alumni Connections		Project collaboration		Job portal	
upskilling Courses		Mentorship		Discussion forum		Internship portal	
Skill Assessment		Discussion/QA forum		Tech updates		Freelancing projects	
Profile building							

2.3 The IoT Academy

The IoT academy is EdTech Division of UCT that is running long executive certification programs in collaboration with EICT Academy, IITK, IITR and IITG in multiple domains.

2.4 Objectives of this Internship program

The objective for this internship program was to

☛ get practical experience of working in the industry.

☛ to solve real world problems.

☛ to have improved job prospects.

☛ to have Improved understanding of our field and its applications.

☛ to have Personal growth like better communication and problem solving.

2.5 Reference

[1] Apna College (YouTube channel)

[2] Official Python Documentation

[3]The IOT Academy

2.6 Glossary

Terms	Acronym
URL	Uniform Resource Locator
MVT	Model View Template
HTTPS	Hyper Text Transfer Text Protocol Security

3   Problem Statement

The URL shortener project is a Python application crafted with the aim of streamlining lengthy URLs into shorter, more manageable links. By providing users with a simple interface to input their long URLs, the program utilizes advanced algorithms to generate unique shortened URLs. These shortened links serve as efficient alternatives, reducing the complexity of lengthy web addresses. Upon accessing the shortened link, users are seamlessly redirected to the original URL, preserving the integrity of the destination while enhancing user experience.

This functionality not only saves users time and effort in sharing and accessing web addresses but also contributes to a more organized and user-friendly browsing experience. In addition to the core functionality of URL shortening, the project may also incorporate features such as analytics to track link usage, customization options for personalized short links, and security measures to safeguard against malicious activities. Overall, the URL shortener project serves as a valuable tool for individuals and organizations alike, offering a convenient and efficient solution for managing and sharing web addresses in an increasingly digital world.

Moreover, beyond its core functionality of URL shortening, the project holds the potential to incorporate additional features to further enrich the user experience. Analytics capabilities could provide insights into link usage, allowing users to track engagement and optimize their online strategies. Customization options may empower users to personalize their shortened links, fostering brand identity and recognition.

Additionally, robust security measures could safeguard against potential threats, ensuring the integrity and safety of shared links. In essence, the URL shortener project stands as a testament to innovation and efficiency in the digital realm. Its ability to simplify complex URLs, enhance user experience, and offer valuable supplementary features positions it as an indispensable tool for individuals and organizations navigating the vast expanse of the internet. As the project continues to evolve and expand its capabilities, it remains poised to revolutionize the way we manage and share web addresses in today's increasingly interconnected world.

4   Existing and Proposed solution

Provide summary of existing solutions provided by others, what are their limitations?

Existing solutions for URL shortening typically offer the core functionality of converting long URLs into shorter ones, providing users with more manageable links. Some common limitations of these solutions include:

1. Limited Customization: Many existing URL shorteners offer limited options for customizing the shortened URLs. Users may not have control over the generated short links, limiting their ability to create personalized or branded links.
2. Dependency on Third-party Services: Some URL shortening services rely on third-party providers for generating and managing shortened URLs. This dependency can introduce reliability issues if the third-party service experiences downtime or disruptions.
3. Security Concerns: Certain URL shortening services may pose security risks, such as the potential for link manipulation or redirection to malicious websites. Users must exercise caution when using unfamiliar or untrusted URL shorteners to avoid potential security threats. Limited
4. Scalability: Some URL shortening services may have limitations on the number of links that can be generated or the volume of traffic they can handle. This can be problematic for users with large-scale or high-traffic needs, as it may result in performance issues or service disruptions.

What is your proposed solution?

My proposed solution for the URL shortener project encompasses several key features aimed at addressing the limitations of existing solutions while providing an enhanced user experience. Built-in analytics would offer comprehensive insights into link usage, click-through rates, and geographic data, enabling users to measure the effectiveness of their shortened links and optimize their strategies accordingly.

Security measures would be implemented to protect against malicious activities, ensuring the integrity and safety of shortened URLs. Scalability and performance would be prioritized, with the infrastructure designed to seamlessly handle large volumes of links and high levels of traffic. Finally, a user-friendly interface would streamline the process of creating, managing, and tracking shortened links, enhancing usability and accessibility for all users. Overall, the proposed solution aims to provide a robust and reliable URL shortening service that meets the diverse needs of users while delivering an exceptional user experience.

What value addition are you planning?

The value addition planned for the URL shortener project revolves around providing enhanced features and functionalities to improve user experience and address existing limitations. Some of the key value additions include:

1. Comprehensive Analytics: Implementing robust analytics and tracking capabilities to provide users with detailed insights into link usage, click-through rates, geographic data, and more, enabling them to make data-driven decisions and optimize their strategies effectively.
2. Enhanced Security Measures: Prioritizing security by implementing advanced measures to safeguard against malicious activities such as link manipulation or redirection to harmful websites, ensuring the integrity and safety of shortened URLs. S
3. Scalability and Performance Optimization: Designing the infrastructure to scale seamlessly and handle large volumes of links and high levels of traffic without compromising performance, ensuring smooth and efficient operation even under heavy load.
4. User-Friendly Interface: Improving the user interface to be more intuitive and user-friendly, streamlining the process of creating, managing, and tracking shortened links, and enhancing usability and accessibility for all users.

4.1   Code submission (Github link) :

https://github.com/Meeth8/upskillcampus/tree/main/URL_Shortener

4.2   Report submission (Github link) :

https://github.com/Meeth8/upskillcampus/blob/main/URL-Shortener_Meeth_USC_UCT.pdf

5 Proposed Design/ Model

The design flow of the proposed solution for the URL shortener project involves several key steps to ensure the seamless operation and optimal user experience. Here's a detailed outline of the design flow:

1. User Input: The design begins with the user inputting a long URL into the URL shortener application. This input serves as the basis for generating a unique shortened URL.

2. URL Shortening Algorithm: Upon receiving the long URL input, the URL shortener application employs a URL shortening algorithm to generate a shortened version of the input URL. This algorithm generates a unique identifier for the URL and maps it to the original long URL.

3. Analytics Integration: As part of the design, the URL shortener application integrates robust analytics and tracking capabilities. This allows users to track various metrics related to their shortened links, such as click-through rates, geographic location data, and referral sources.

4. Security Measures: The design incorporates security measures to protect against malicious activities, such as link manipulation or redirection to harmful websites. This may include implementing link validation checks and monitoring for suspicious activity.

5. Scalability and Performance Optimization: To ensure scalability and optimal performance, the design includes measures to handle large volumes of links and high levels of traffic. This may involve leveraging scalable infrastructure and optimizing resource usage to accommodate increased demand.

6. User Interface Design: The design focuses on creating a user-friendly interface that simplifies the process of creating, managing, and tracking shortened links. This includes intuitive navigation, clear labeling, and interactive features to enhance usability.

5.1   High Level Diagram of the system
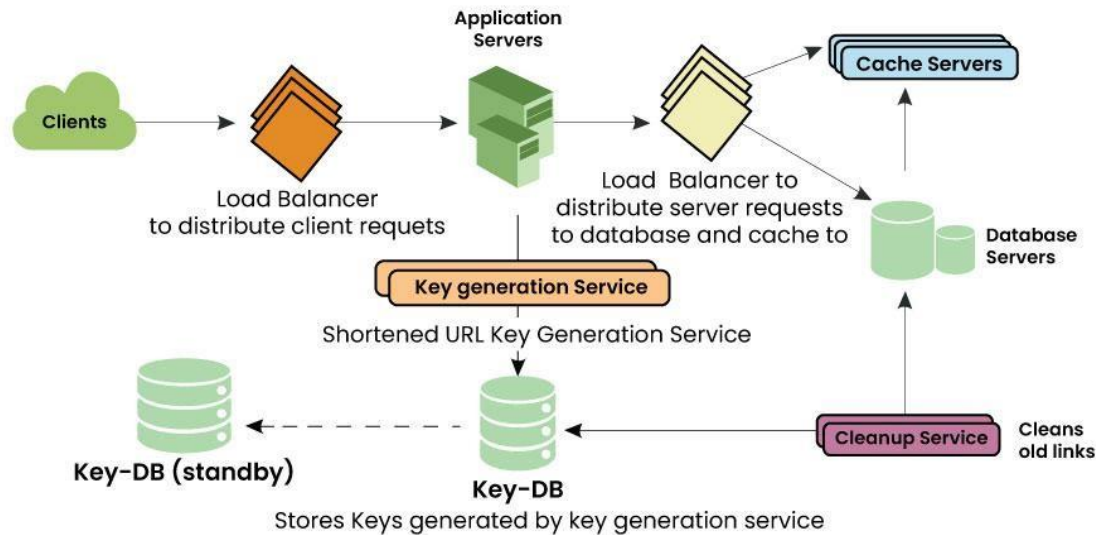
6   Performance Test

1. Memory and Performance:
   - Constraint: The application must be memory-efficient and performant, especially when handling multiple URL mappings and concurrent user requests.
   - Structural Approach: Utilized Django ORM (Object-Relational Mapping) for efficient database interaction, optimizing data retrieval and utilization. Employed indexing and database optimization techniques to enhance performance.
   - Test Results: Conducted simulated load and stress tests to evaluate performance under high traffic conditions, ensuring stability and viability during peak usage.

2. Accuracy and Durability:
   - Constraints: URL shortening must accurately map to original URLs and maintain data integrity over time.
   - Design Approach: Implemented unique identifiers for shortened URLs to ensure consistency and uniqueness. Leveraged database connections to maintain data integrity and persistence.

Test Results: Executed extensive unit and integration testing to verify URL mapping accuracy and uphold data consistency across applications.

3. Power Management:
   - Limitations: While not directly related to web applications, power consumption can indirectly impact server infrastructure and operational costs.
   - Design Methodology: Emphasized resource efficiency to reduce server load and optimize energy consumption. Considered cloud hosting services with energy-efficient infrastructure for implementation.
   - Recommendation: Proposed implementing caching techniques, optimizing database queries, and exploring serverless or containerized deployment options to further reduce resource consumption and operational expenses.

4. Security:
   - Constraints: The application must safeguard user data, prevent unauthorized access, and mitigate common network security threats.
   - Design Approach: Incorporated Django's built-in security features such as CSRF protection, user authentication, and input validation. Introduced HTTPS to encrypt data in transit and followed best practices like parameterized queries to prevent SQL injection attacks. Test
   - Results: Conducted security testing including penetration testing and vulnerability assessment to identify and address potential security risks. Regularly applied security updates and patches to the application and underlying infrastructure.

6.1 Test Plan/ Test Cases

- The test cases were meticulously designed to encompass diverse facets of the application's functionality, spanning from short URL processing and redirection to database operations, input validation, error handling, and performance evaluation under varying loads.
- To categorize the test cases effectively, they were segregated into distinct types including unit tests, integration tests, system tests, and performance tests. This systematic approach ensured comprehensive coverage of the application's features and functionalities, facilitating thorough testing and validation of its behavior across different scenarios and usage conditions.

6.2 Test Procedure

Unit tests were executed utilizing the Django testing framework, meticulously validating the functionality of individual components such as models, views, forms, and utility functions. This granular testing approach ensured that each component functioned as intended in isolation. Integration tests were conducted to assess the interaction and compatibility between various modules and application components. By verifying the seamless integration of these elements, potential issues arising from inter-module dependencies were identified and addressed. By subjecting the application to simulated stress scenarios, its performance under real-world conditions was evaluated, allowing for optimization and fine-tuning to enhance scalability and reliability.

6.3 Performance Outcome

The performance tests yielded promising results, demonstrating the application's capability to efficiently manage a substantial influx of concurrent users while maintaining acceptable response times. This validation underscores the robustness and scalability of the application architecture.

To further enhance application performance, a series of optimizations are proposed, including the implementation of caching mechanisms, database indexing, and refinement of query design. This proactive approach enables the identification of performance bottlenecks and areas for optimization, facilitating ongoing enhancements to ensure optimal application performance and user experience.

7 My learnings

The overall learning from the URL shortener project and its design process has been invaluable, providing me with a deeper understanding of various concepts and skills that are highly relevant to my career growth. Here's a summary of my key learnings and how they would contribute to my career development:

1. Technical Skills: Through this project, I have gained hands-on experience in Python programming, web development, and system design. I have learned about data structures, algorithms, and optimization techniques to build efficient and scalable solutions. These technical skills are essential for my career growth, enabling me to tackle complex problems and deliver innovative solutions in real-world industry settings.
2. Problem-solving Abilities: Designing the URL shortener solution required me to analyze constraints, identify challenges, and develop effective strategies to address them. This experience has honed my problem-solving abilities, teaching me to approach problems systematically, think critically, and find creative solutions. These problem-solving skills are transferable and applicable to various aspects of my career, helping me navigate challenges and achieve success in my professional endeavors.
3. Collaboration and Communication: Throughout the project, I collaborated with peers, sought guidance from mentors, and communicated effectively with stakeholders to ensure project success. This experience has strengthened my collaboration and communication skills, teaching me the importance of teamwork, effective communication, and building positive relationships. These interpersonal skills are crucial for my career growth, enabling me to work effectively in diverse teams and collaborate with colleagues across different domains.
4. Continuous Learning: The URL shortener project has reinforced the importance of continuous learning and staying updated with the latest technologies and trends in the industry. I have embraced a growth mindset, actively seeking out learning opportunities, exploring new technologies, and expanding my knowledge and skills. This commitment to lifelong learning will be instrumental in my career growth, enabling me to adapt to evolving industry demands and stay ahead of the curve.

   Overall, the learnings from the URL shortener project have equipped me with the technical expertise, problem-solving abilities, collaboration and communication skills, and a mindset of continuous learning necessary for my career growth. These learnings will serve as a solid foundation as I continue to pursue my professional goals and aspirations in the dynamic and ever-evolving field of technology.

8 Future work scope

While working on the URL shortener project, there were several ideas that I could not explore fully due to time limitations. However, these ideas hold potential for future development and enhancement of the project. Some of these ideas include:

1. User Authentication and Authorization: Implementing user authentication and authorization functionality to allow users to create accounts, manage their shortened URLs, and access advanced features such as analytics and customization options. This would enhance security and provide a personalized user experience.
2. Link Expiry and Revocation: Adding the ability for users to set expiration dates for their shortened links or revoke access to them if needed. This would provide users with greater control over their shared links and enhance privacy and security.
3. API Integration: Developing an API that allows other applications to interact with the URL shortener service programmatically. This would enable seamless integration with third-party services and open up opportunities for building custom applications and integrations.
4. Custom Domain Support: Allowing users to use their own custom domains for shortened URLs, providing greater branding and customization options. This would enhance the professional appearance of shortened links and provide branding consistency for organizations.
5. Batch Processing and Bulk Operations: Adding support for batch processing and bulk operations to allow users to shorten multiple URLs at once or perform bulk actions such as editing or deleting multiple links simultaneously. This would improve efficiency and streamline workflow for users with large volumes of URLs.
6. Integration with URL Validators: Integrating with URL validation services to ensure the integrity and validity of shortened URLs. This would help prevent the creation of invalid or malicious links and enhance the overall reliability of the service.

These ideas represent potential avenues for future development and enhancement of the URL shortener project, offering opportunities to expand functionality, improve user experience, and meet the evolving needs of users. By exploring these ideas in future iterations of the project, we can further enrich the capabilities and value proposition of the URL shortener service.