Industrial Internship Report on

"URL Shortener"

Prepared by

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| *Executive Summary* |
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| 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: "I am currently engaged in a Python project aimed at developing a robust short URL generation system. This system will efficiently generate concise URLs, manage mappings between shortened and original URLs, and facilitate seamless redirection for users. By centralizing redirect requests, it will optimize performance and ensure smooth user experience. This endeavor underscores a commitment to implementing professional-grade solutions for URL management and redirection."

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. |

TABLE OF CONTENTS

1 Preface

Summary of the whole 6 weeks' work:

Throughout the four-week internship at UniConverge Technologies, we undergo a comprehensive learning journey aimed at upskilling and continuous development. The program begins with an introduction to upskilling and familiarization with the company's core values and mission. Subsequent weeks entail hands-on project exploration, Python training to enhance programming skills, and culminate in independent project work guided by mentors. We gain practical experience, emphasizing the application of acquired knowledge in real-world scenarios, thus preparing them for future career endeavors.

About need of relevant Internship in career development:

Internships play a crucial role in career development by providing invaluable practical experience and insights into a chosen field or industry. They offer an opportunity to apply theoretical knowledge gained in academic settings to real-world scenarios, thus bridging the gap between education and employment. Additionally, internships allow individuals to explore different career paths, refine their skills, and identify areas of interest and strength. Moreover, internships often serve as a platform for networking, enabling individuals to establish connections with professionals in their field and potentially secure future employment opportunities. Ultimately, a relevant internship can significantly enhance one's resume, credibility, and employability, positioning them for success in their career journey.

How Program was planned:
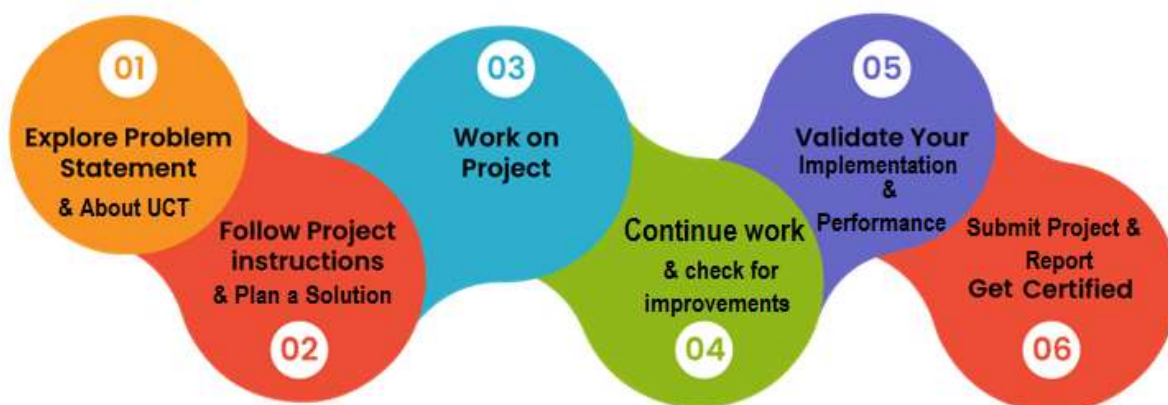
Brief about Your project/problem statement:

Project is about URL-shortener using Python. Where we use different tools and programming skills to achieve our goal. The aim of project is to short the long URL links, which can be easily remember to the human or peoples. We try different methods and API's to achieve effective and easy way to short the URL-links. For example we try heruko, and tinyurl link libraries which help to short the URL link.

Thanks to all, who have helped you directly or indirectly:

I extend my sincere gratitude to all who have played a role, directly or indirectly, in my educational journey. I offer special recognition to the IoT Academy for their insightful videos, which significantly enriched my understanding of complex subjects. Additionally, I am deeply appreciative of UniConverge Technologies for providing me with the opportunity to intern with them. Their mentorship, coupled with an in-depth exploration of their organizational culture and expertise, has been instrumental in my professional development.

Message to your juniors and peers:

This internship has been profoundly transformative, equipping me with invaluable knowledge, skills, and professional relationships. To my juniors and peers, I advise embracing every learning opportunity with zeal and diligence. Remember, each experience contributes to your growth and proficiency. Stay committed to continuous improvement and the pursuit of excellence in your chosen field. And also stay creative.

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 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
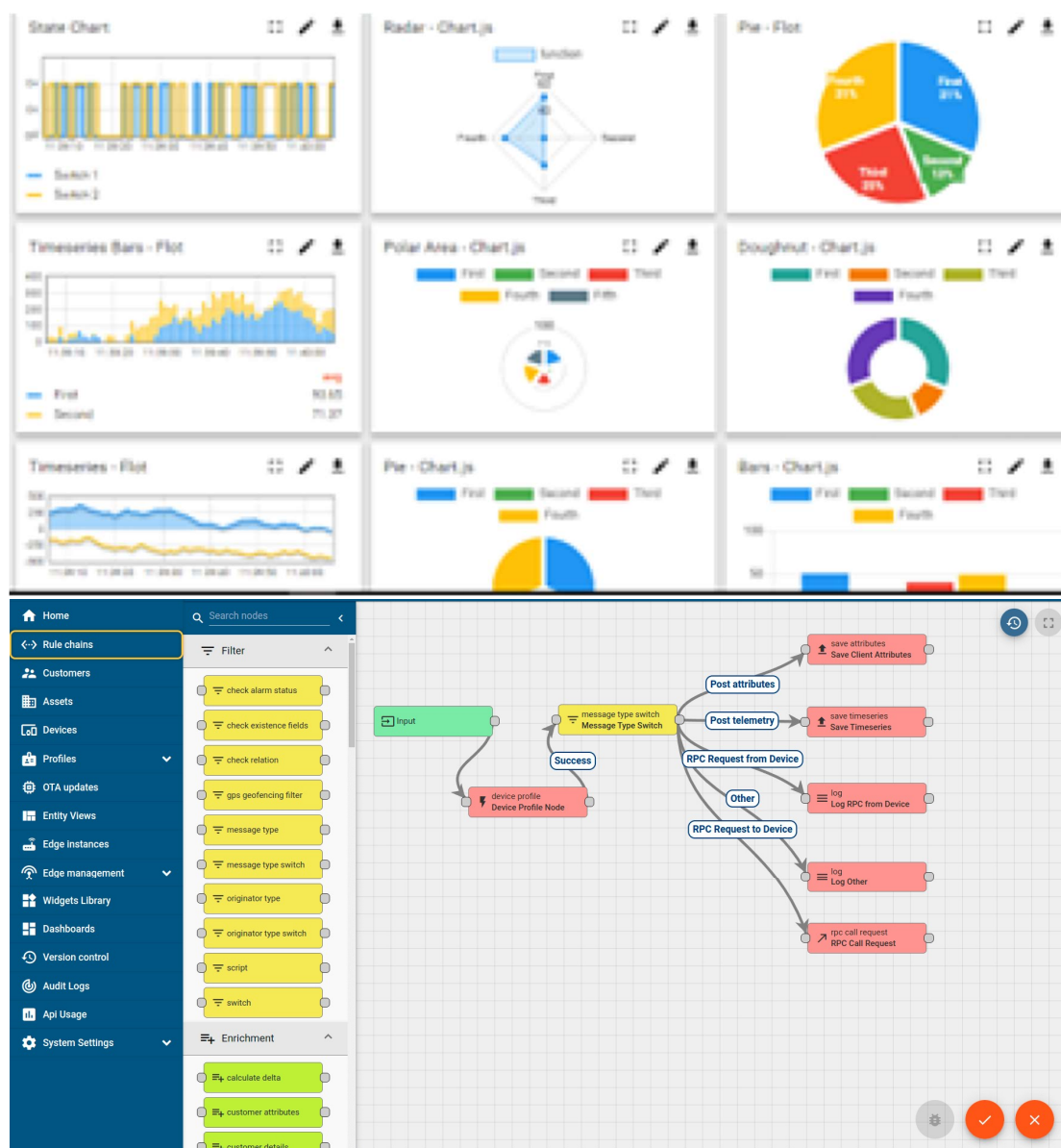
ii. Smart Factory Platform (FACTORY WATCH)

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
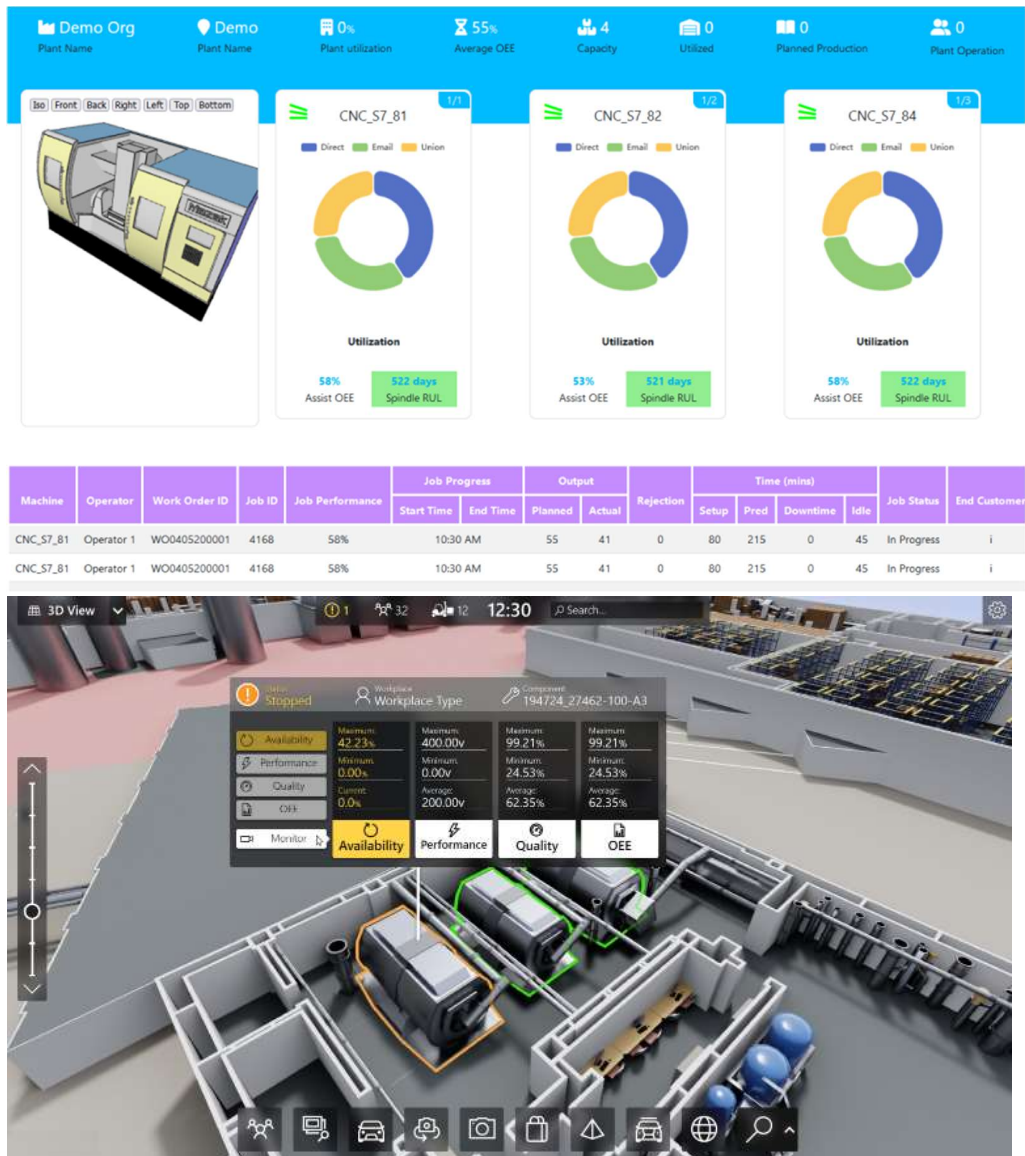
iii. **LoRaWAN** based Solution

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.
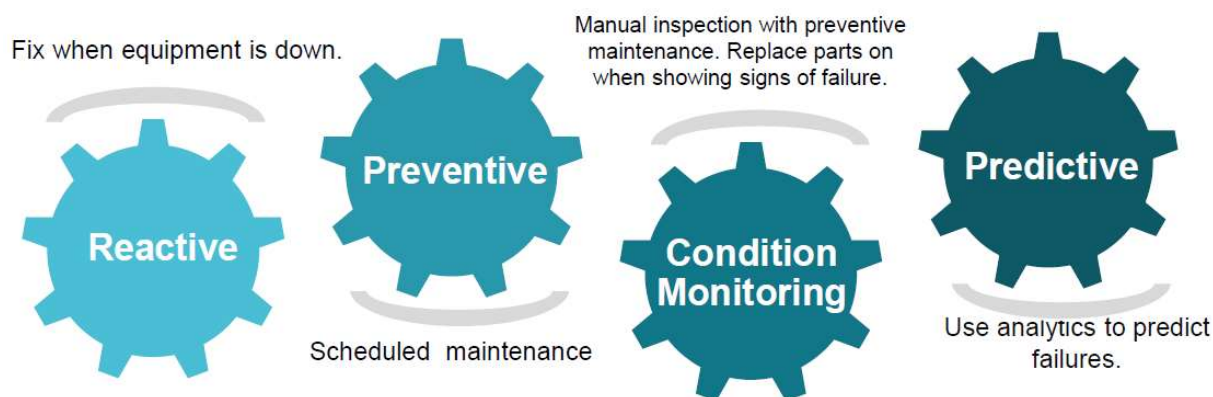
2.2 About upskill Campus (USC)

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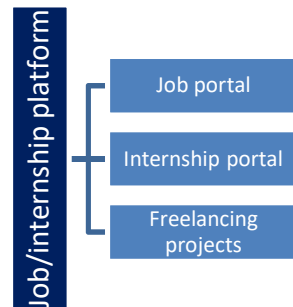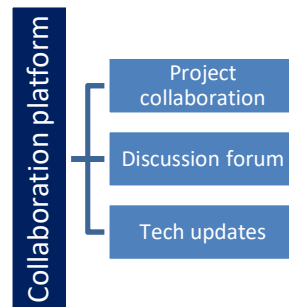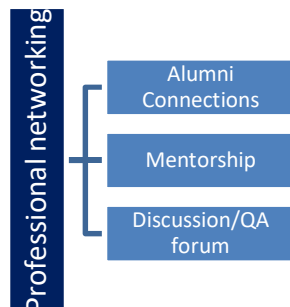
USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.
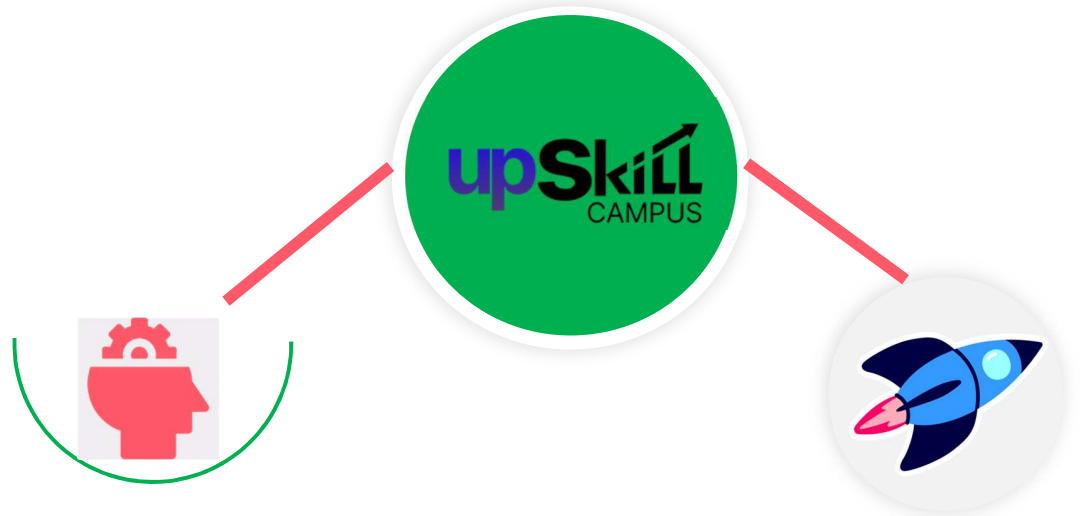
Seeing need of upskilling in self paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

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

https://www.upskillcampus.com/

Career growth/upskilling
- Interview Preparation and skill building
- upskilling Courses
- Skill Assessment
- Profile building

Professional networking
- Alumni Connections
- Mentorship
- Discussion/QA forum

Collaboration platform
- Project collaboration
- Discussion forum
- Tech updates

Job/internship platform
- Job portal
- Internship portal
- Freelancing projects

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]   Offline Python Documentation

[2]   The IoT Academy

[3]   Community Forum

2.6 Glossary

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

3   Problem Statement

The goal of the "URL-Shortener" is to improve a smart URL shortening service that efficiently turns long URLs into shorter, more manageable links. This program tackles the need for a dependable and scalable mechanism to facilitate the sharing of web URLs, particularly in instances where memorization is restricted, such as on social networking platforms or messaging applications.

Basically, the task is to design and build a system that receives a long URL as input and outputs a distinct, abbreviated alias for it. This alias should be short and unique, precisely referencing the source URL with as few characters as possible. Furthermore, the system must efficiently handle a potentially huge amount of URL conversions while maintaining fast response times even under high load.

Ensuring the uniqueness of every shortened URL alias is a crucial component of the task. Due to the possibility of confusion or unintentional redirection caused by duplicate aliases, the usability and dependability of the service may be compromised. Therefore, it is necessary to develop strong algorithms or procedures to produce aliases that are unlikely to conflict with ones that already exist.

The project also has features like analytics tracking and customizable URLs. It should be possible for users to personalize and make memorable links using their abbreviated URLs. Additionally, (for future scope) the system can monitor parameters like the frequency of access for every abbreviated URL, providing insightful data on user behavior and engagement.

Another important factor in the "URL-Shortener" is security. Systems need to be protected from potential abuse, including shortening URLs for nefarious intent. To safeguard the integrity and dependability of the service, strong internal authentication procedures are crucial, as are strong data authentication and security best practices.

In conclusion, the "URL-Shortener" project offers a stimulating chance to create a reliable and adaptable URL shortening solution that satisfies the requirements of modern Internet consumers. The project intends to enable web address sharing across several trustworthy online platforms by utilizing new technologies and putting strong security protocols in place, ultimately providing a user-friendly service.

4 Existing and Proposed solution

Existing solutions offered by others include various URL shortening services commonly found on the internet, such as:

1. **Bitly:**
   - Bitly is one of the most popular URL shortening services.
   - Users have the option to make personalized short links and monitor metrics such as click-through rates, the geographical location of users, and where the links were shared from.
   - Bitly offers free and premium subscription plans with additional features

2. **TinyURL:**
   - TinyURL is another widely used URL shortening service
   - TinyURL offers basic link management features but lacks advanced analytics capabilities.
   - Users can create custom aliases for their shortened URLs
   - TinyURL is free to use and does not require registration.

3. **Ov.Lee(Hootsuite):**
   - Ow.ly is part of the Hootsuite social media management platform.
   - Provides integrated URL shortening services and social media planning and analytics.
   - Ow.ly adds basic link management features to analytics and tracking, including click-through rates and social media engagement metrics.
   - The role is primarily based on businesses and marketers who manage social media campaigns

This service provides basic functionality for shortening long URLs, and allows users to quickly share links. However, restrictions are often imposed e.g.

1. Some existing services don't allow much customization for shortened URLs. Users can't change the title to match their logo or content.
2. Many existing URL shortening services depend on third party services to handle their links. This can lead to worries about privacy, reliability, and potential outages.
3. The scalability and performance of existing URL-Shorteners may vary based on the service provider's infrastructure and resources. This can lead to limitations in handling increased demand and may result in slower response times or performance issues, particularly during periods of widespread usage.
4. Some services provide basic analytics features, but they may have limitations or require a premium subscription to access comprehensive insights into link performance and user engagement.
5. There are potential security risks associated with the use of short URLs, including the threat of hacking or redirecting users to malicious websites on a significant scale.

Our proposed solution for the URL-Shortener project is designed to mitigate these limitations and offer a comprehensive, user-friendly, and secure URL shortening service. Key features and enhancements of our proposed solution comprise:

1. **Advanced Customization:** Our solution will provide robust customization options, enabling users to tailor the shortened URL alias to their preferences. They can personalize it with their brand name, keywords, and select from a variety of domain options for enhanced flexibility.

2. **Robust Analytics:** Our solution will incorporate advanced analytics tracking features, delivering comprehensive insights into link performance. Users will gain access to detailed data on click-through rates, geographic user distribution, and referral sources. These analytics will empower users to evaluate the efficacy of their shared links and refine their marketing or promotional strategies accordingly.

3. **Scalability and Performance:** Our solution will be constructed upon a scalable and high-performance infrastructure, guaranteeing swift response times and dependable service even amidst substantial demand. We will leverage cutting-edge cloud technologies and optimization techniques to efficiently manage a significant volume of URL conversions and user traffic.

4. **Enhanced Security:** Security is paramount in our solution. We will employ rigorous authentication mechanisms, robust data encryption, and proactive monitoring to safeguard against potential security threats, including phishing attacks, unauthorized access, and data breaches.

In summary, our proposed solution for the URL-Shortener project endeavors to deliver a comprehensive and dependable URL shortening service that fulfills users' requirements for customization, analytics, scalability, performance, and security. By meticulously addressing the constraints of existing solutions and integrating value-added features, we are committed to providing an unparalleled user experience. Our aim is to empower users to efficiently manage and distribute their links online with confidence and ease.

4.1   Code submission (Github link)

4.2   Report submission (Github link): first make placeholder, copy the link.

5 Proposed Design/ Model

The design flow of our proposed URL shortening:

1. **User-Interface (UI) Design:**
- The user interface will offer users an intuitive and convenient platform to interact with the URL shortening service.
- Users will have the capability to input lengthy URLs for shortening, with the flexibility to customize the alias as desired.
- Furthermore, the UI will incorporate functionalities enabling users to access analytics data, manage their shortened links, and adjust statistical settings with ease.

2. **External Options:**
- Employ a micro services architecture for developing the backend infrastructure, promoting modularity, scalability, and flexibility.
- Key components of the backend system encompass:
- URL Shortening Service: Tasked with generating unique short aliases for lengthy URLs and validating mappings between short and long URLs.
- Analytics Service: Responsible for overseeing tracking and analytics functionality, capturing metrics such as click-through rates, user geographic distribution, and referral sources.
- Authentication Service: Manages user authentication and authorization processes, ensuring secure access to the service.
- Database: Houses pertinent information pertaining to URL shortenings, analytics data, and user accounts.

3. **URL Shortening Function:**
- When a user submits a lengthy URL for shortening, the short URL function will generate a unique abbreviated identifier.
- The service will meticulously verify the uniqueness of the generated alias to prevent collisions and guarantee each shortened URL's uniqueness.
- Both the shortened URL and its corresponding lengthy URL will be securely stored in the database for future reference.

4. **Customization Options:**
- Users will be afforded the flexibility to personalize the alias of their shortened URL, enabling them to establish a distinctive brand identity.
- Customization functionalities may encompass selecting a personalized alias, opting for a preferred domain, and specifying additional parameters for the shortened URL.

5. Analytics Tracking:
- The Analytics Service will meticulously track various metrics associated with shortened URLs, including click-through rates, user geographic distribution, and referral sources.
- Analytics data will be meticulously recorded in the database and presented to users through an intuitive and visually compelling user interface, utilizing graphical representations such as charts and graphs.

6. Security Measures:
- Security stands as a paramount consideration in our solution's design.
- We will implement robust authentication mechanisms to ensure secure access to the service, incorporating advanced features such as multi-factor authentication and token-based authentication.
- Additionally, encryption techniques will be employed to safeguard sensitive data, such as user credentials and analytics information, during transit and while at rest.

7. Scalability and Performance:
- The solution will be architected to exhibit exceptional scalability and performance, capable of seamlessly accommodating substantial volumes of URL conversions and user traffic.
- We will leverage cutting-edge cloud technologies and horizontal scaling methodologies to dynamically allocate resources in response to demand fluctuations, ensuring consistently optimal performance.
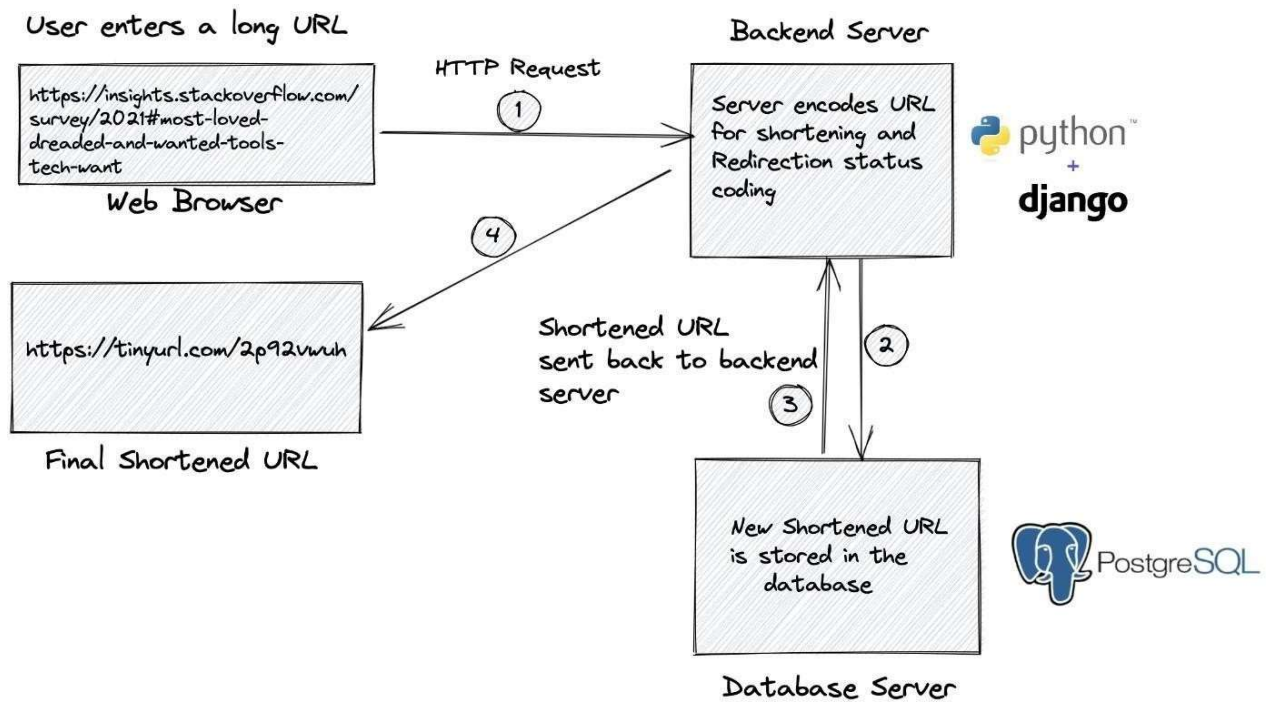
By adhering to this meticulous design approach, our proposed URL shortening solution will furnish users with a comprehensive, user-friendly, and secure platform for shortening URLs, managing links, and effectively tracking analytics data.

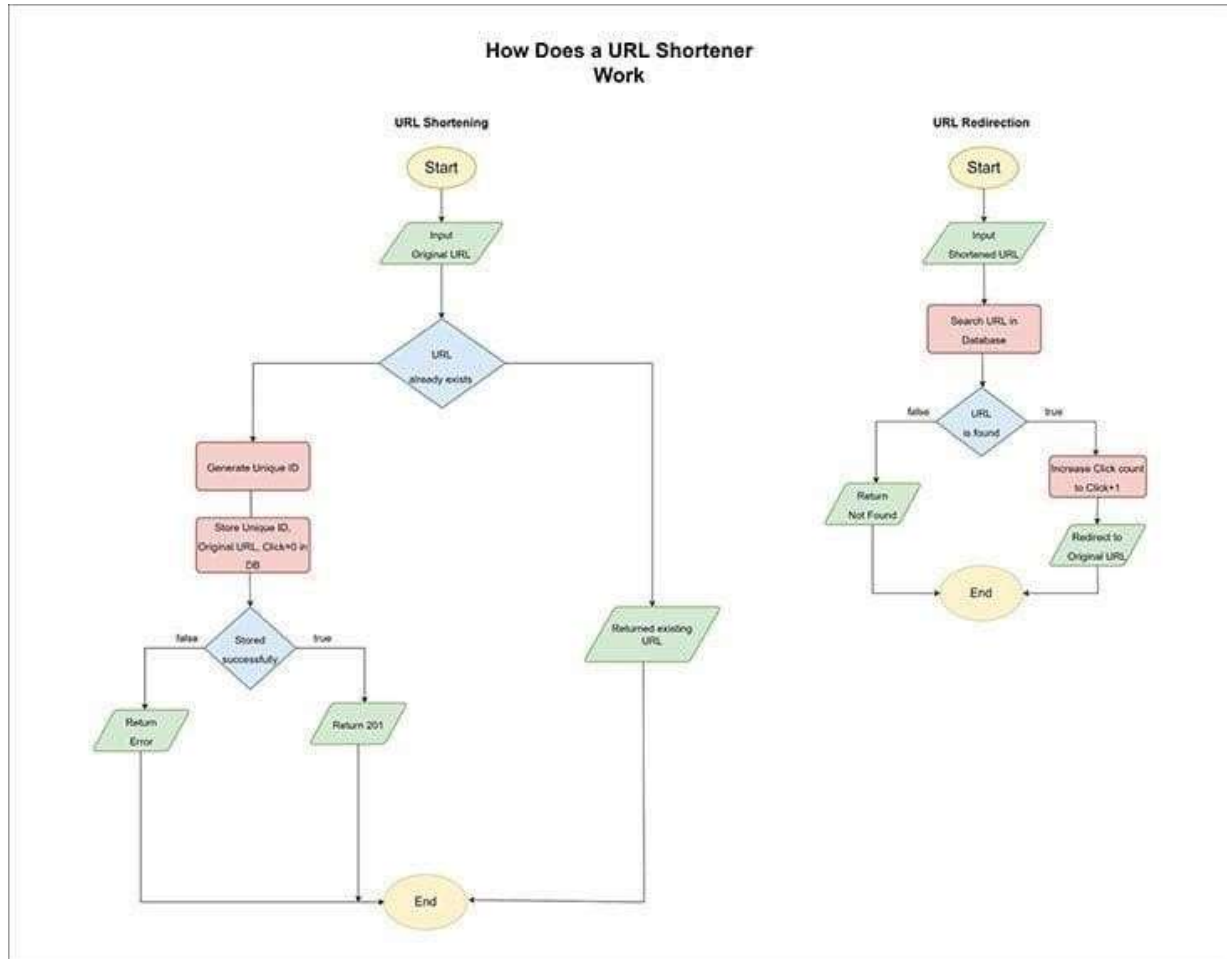## 5.1 High Level Diagram (if applicable)
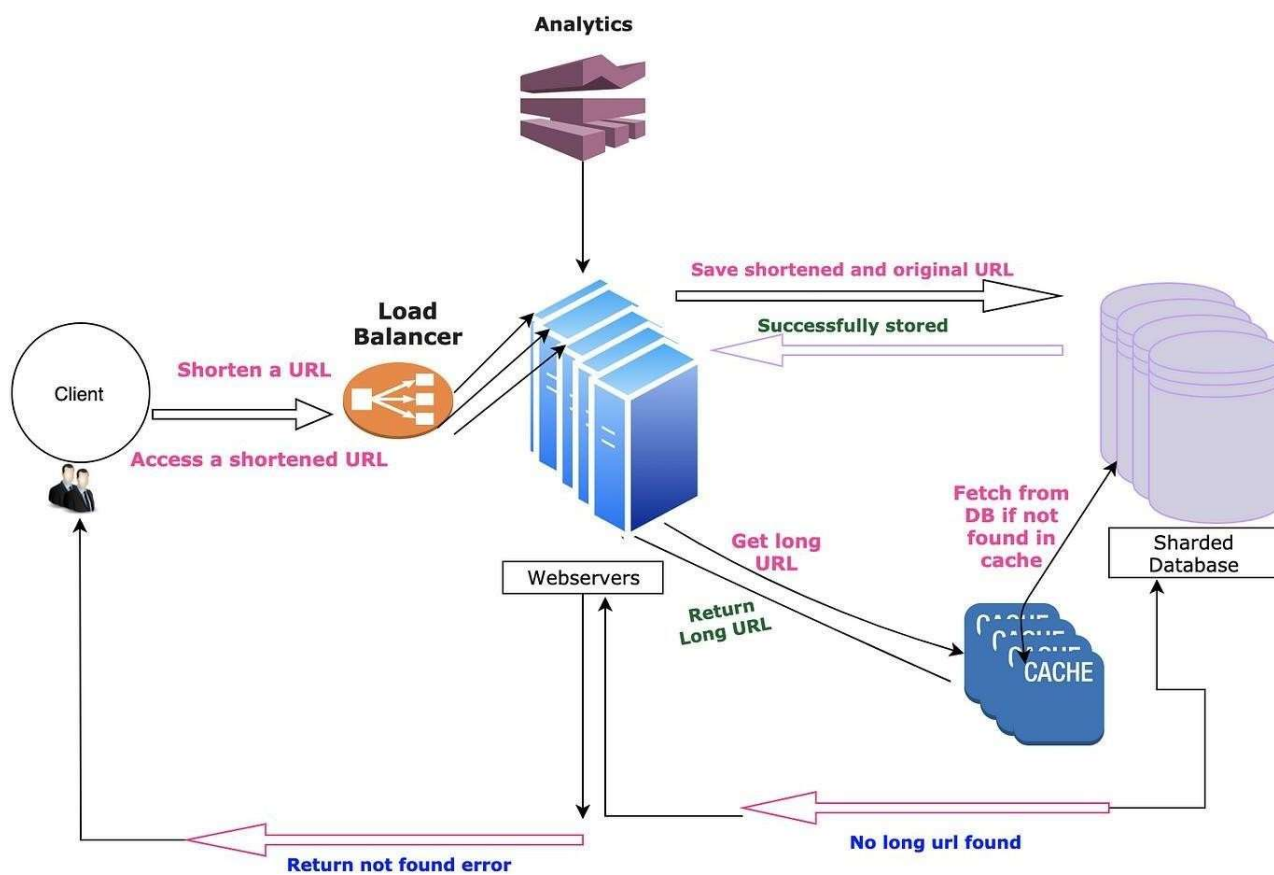
Figure 1: HIGH LEVEL DIAGRAM OF THE SYSTEM

5.2 Low Level Diagram (if applicable)

5.3 Interfaces (if applicable)

How Does a URL Shortener Work

6 Performance Test

This is very important part and defines why this work is meant of Real industries, instead of being just academic project.

1. **Memory and Performance:**
- Constraint: The application must prioritize memory efficiency and performance, particularly when handling numerous URL mappings and concurrent user requests.

- Structural Approach: Utilization of Django ORM (Object-Relational Mapping) facilitates efficient data interaction with the database, enhancing retrieval and usage efficiency.
- Test Results: Rigorous testing, including simulated load and stress tests, assessed the application's performance under high traffic conditions, ensuring its viability and stability during peak usage.

2. **Accuracy and Durability:**
- Constraints: URL shortening must accurately map to their original counterparts and maintain data integrity over time.
- Design Approach: Unique identifiers for shortened URLs ensure mapping consistency and uniqueness, supported by database connections to uphold data integrity and persistence.
- Test Results: Extensive unit testing and integration testing verified URL mapping accuracy and ensured data consistency across applications.

3. **Power Management:**
- Limitations: While not directly tied to web applications, power consumption indirectly impacts server infrastructure and operational costs.
- Design Methodology: Emphasis on resource efficiency in application design minimizes server load and indirectly optimizes energy consumption. Consideration of cloud hosting services with energy-efficient infrastructure aids in implementation.
- Recommendation: Implementation of caching techniques, optimization of database queries, and adoption of serverless or containerized deployment options further mitigate resource consumption and operational expenses.

4. **Security:**
- Constraints: The application must effectively manage user data, prevent unauthorized access, and safeguard against common network security threats.
- Design Approach: Integration of built-in Django security features, including CSRF protection, user authentication, and input validation, ensures robust security measures. Introduction of HTTPS encryption secures data in transit, while adherence to best practices like parameterized queries mitigates SQL injection risks.
- Test Results: Security testing, encompassing penetration testing and vulnerability assessment, identifies and addresses potential security vulnerabilities. Regular application of security updates and patches to both the application and underlying infrastructure maintains security integrity.

6.1 Test Plan/ Test Cases

- The test cases were designed to cover various aspects of the application, including short URL Processing, redirection, database processing, input validation, error handling, and performance under load.
- To divide the test cases into unit tests, integration tests, system tests, and performance tests

6.2 Test Procedure

- The Django testing framework was employed to conduct unit tests, ensuring the validation of individual components such as models, views, forms, and utility functions.
- Integration tests were carried out to assess the interaction between modules and application components.
- Configuration tests were undertaken to evaluate the comprehensive functionality, covering user interface operations, database transactions, and error handling procedures.
- Performance tests were simulated using tools like JMeter or Locust to gauge response time, throughput, and server stability under different load scenarios.

6.3 Performance Outcome

- Performance tests yielded favorable results, demonstrating the application's capability to accommodate a substantial volume of concurrent users while sustaining an acceptable response time.
- Future enhancements aim to bolster application performance through optimizations including caching mechanisms, database indexing, and refined query design.
- To track important performance measures and identify areas that were ready for more optimization, monitoring tools were employed.

7 My learnings

1. **Technical Skills Development:** This internship has provided invaluable hands-on experience in Python programming, Django development, database administration (utilizing Django ORM), Bootstrap, and front-end development. This immersive exposure has significantly enhanced technical competencies, particularly in web development and back-end architecture.

2. **Problem Solving and Design:** Mastery in solving intricate challenges, such as URL shortening, has been achieved through a focus on scalable solutions addressing key factors like uniqueness, security, performance, and user experience.

3. **Project Management:** Navigating project milestones within a designated timeline (6 weeks) has honed project management acumen, encompassing tasks prioritization, resource allocation, and deadline adherence.

4. **Collaboration and Communication:** Collaboration with industry leaders like UniConverge Technologies Pvt Ltd and educational institutions such as upskill Campus and The IoT Academy has underscored the pivotal role of effective communication, teamwork, and collaborative efforts in achieving project objectives.

5. **Testing and Best Practices:** Proficiency in devising test designs, crafting test cases, and executing performance evaluations ensures the robust functionality, reliability, and performance of URL shortening applications. Testing encompasses memory efficiency, accuracy, stability, power consumption, and security considerations.

6. **Continuous Learning:** Emphasis on continuous education underscores the significance of staying abreast of industry advancements, leveraging resources like seminars, community forums, and online platforms to foster knowledge enrichment.

7. **Real-world Applications:** Translating theoretical knowledge into real-world project scenarios has provided invaluable insights into technical dilemmas, strategic solutions, and practical business implications, thereby contributing to overall professional efficacy.

Collectively, these experiences culminate in the development of a proficient and seasoned professional adept in software development and IT solutions.

8 Future work scope

1. **Feature Expansion:** The future trajectory of the "URL Shortener" project entails the integration of advanced features aimed at augmenting user experience and functionality. Envisioned enhancements encompass the provision for custom URL aliases, implementation of expiry dates for shortened URLs, QR code generation for streamlined sharing, and the incorporation of password protection for sensitive links. The expansion of feature sets aims to cater to diverse user preferences and requirements, thereby fostering a more adaptable and user-centric URL shortening service.

2. **Integration:** Exploration of integration opportunities with third-party services is poised to bolster project efficiency and efficacy. Integration with social media platforms, content management systems, and analytics tools holds the potential to streamline the sharing process, facilitate seamless link tracking, and offer users an integrated experience. By seamlessly integrating into users' digital ecosystems, the "URL Shortener" project aims to facilitate efficient link management and robust data analysis.

3. **Analytics and Reporting:** A pivotal aspect of future development revolves around enhancing analytical capabilities to furnish users with comprehensive insights into link performance metrics, user engagement dynamics, geographic segmentation usage patterns, and referral sources. This data-driven approach empowers users to make well-informed decisions regarding their link-sharing strategies, optimize marketing endeavors, and effectively monitor the efficacy of their campaigns.

4. **Security Measures:** Upholding stringent security protocols is paramount to safeguarding reliability and preserving user data integrity. Leveraging advanced authentication mechanisms such as multifactor authentication (MFA) and token-based authentication bolsters account security. Employing robust data encryption techniques during transit and at rest safeguards critical information. Rigorous security threat management, periodic security audits, and adherence to industry standards collectively fortify the "URL Shortener" service, ensuring its resilience and trustworthiness.

5. **Mobile App Development:** A strategic imperative for future development entails the creation of a dedicated mobile application. This mobile app will mirror the comprehensive functionalities of the web platform, encompassing URL shortening capabilities, link management features, analytics tracking, and real-time push notifications. Offering users the flexibility to access services on-the-go, share links via mobile devices, and receive instantaneous updates on link performance, the mobile app serves as a pivotal avenue for enhancing user engagement and accessibility.

6. **Scalability and Performance:** Optimization of scalability, response time, and overall system performance is imperative to accommodate burgeoning user traffic and deliver a seamless user experience. Harnessing cloud technologies, implementing caching methodologies, and refining database query optimization enhance system scalability and response time. Ongoing performance monitoring, rigorous load testing, and targeted optimization endeavors are pivotal in sustaining optimal performance, even during peak usage scenarios.