URL Shortener using Python

Murshed SK

Aligarh Muslim University

Author Note

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Address: 56/11 First Floor, near STELLAR IT PARK, C Block, Phase 2, Industrial Area, Sector 62, Noida, Uttar Pradesh 201309

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URL shorteners are web applications that take a long URL as input and generate a shorter version that redirects to the original link.URL shorteners are essential tools for transforming long and cumbersome URLs into shorter and more user-friendly versions. The primary purpose of URL shortening is to make links more manageable and easier to share, particularly in contexts where character count is limited or when dealing with dynamically generated URLs. They are widely used in social media platforms, web services, and online marketing to enhance link sharing and improve user experience. In this report, we discuss the implementation of a URL shortener using Python and several libraries, including pyshorteners, which simplifies the process of shortening URLs by leveraging different URL shortener services.

1. System requirements of the project

Recommended System Requirements

Processors: Intel® Core™ i3 processor 4300M at 2.60 GHz.

Disk space: 2 to 4 GB.

Operating systems: Windows® 10, MACOS, and UBUNTU.

Python Versions: 3.9. or Higher.

Minimum System Requirements

Processors: Intel Atom® processor or Intel® Core™ i3 processor.

Disk space: 1 GB.

Operating systems: Windows 7 or later, MACOS, and UBUNTU.

Python Versions: 3.6 or above

2. URL Shortener Algorithm

The URL shortener algorithm is the heart of this project, enabling the transformation of long URLs into shorter, more manageable links. In a nutshell, the algorithm follows these steps:

1. **Input:** Take the user's input of the long URL that needs to be shortened.
2. **Hashing:** Generate a unique hash or code from the long URL. This can be done using various hash functions, ensuring that each URL maps to a distinct hash.
3. **Generating Short URL:** Append the unique hash to the base URL of the shortening service. This forms the short URL.
4. **Storing:** Store the mapping of the unique hash and the long URL in a database. This allows quick retrieval of the original URL when the short URL is accessed.
5. **Output:** Provide the user with the generated short URL.

It's important to ensure the uniqueness of the generated hash to prevent collisions and guarantee that different long URLs map to different short URLs. Additionally, robust error handling should be implemented to handle cases where the input URL is invalid or the shortening process encounters issues.

This algorithm combines hashing, database management, and URL manipulation to create a functional URL shortener application that converts long URLs into concise and shareable links.

3. Implementation in Python

In this section, we will discuss the main concepts and codes for implementing a URL shortener using Python and the '**pyshorteners**' library. We will cover the installation of required libraries and provide example code to demonstrate the URL shortening functionality.

3.1 Installation of Required Libraries:

Before we begin implementing the URL shortener, we need to install the necessary libraries. Follow these steps to install the required libraries:

1. ***Install Python:*** Make sure Python is installed on the system. Python can be downloaded from the official website: https://www.python.org/downloads/
2. ***Install 'pyshorteners' Library:*** Open terminal or command prompt and use the following command to install the '**pyshorteners**' library:

   ```
   pip install pyshorteners
   ```
3. ***Install 'pyperclip' Library:*** Open terminal or command prompt and use the following command to install the '**pyperclip**' library:

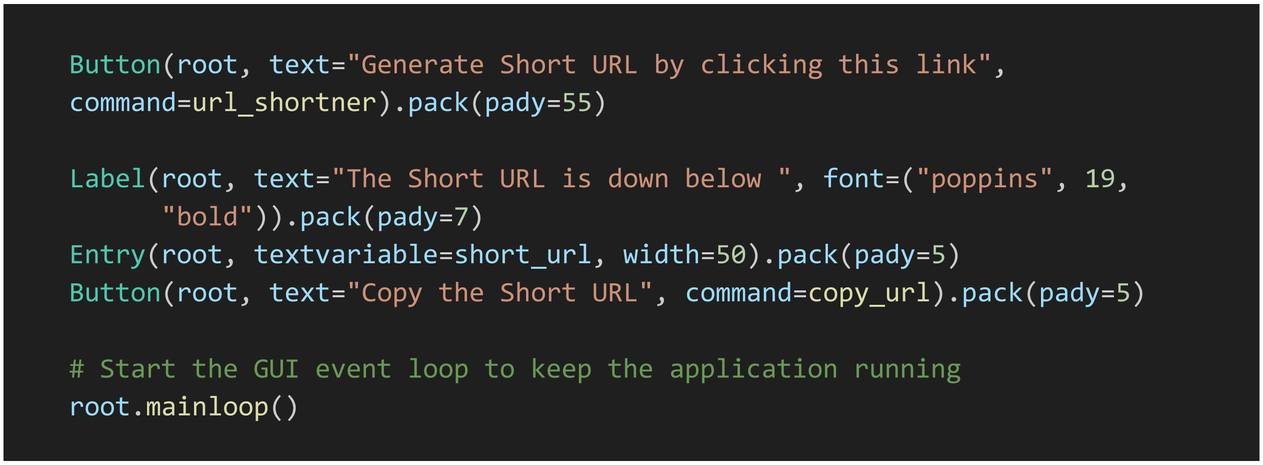
   ```
   pip install pyperclip
   ```
4. ***Install 'paperclip' Library:*** Open terminal or command prompt and use the following command to install the '**paperclip**' library:

   ```
   pip install paperclip
   ```
5. ***Install 'tkinter' Library:*** Open terminal or command prompt and use the following command to install the '**tkinter**' library:

   ```
   pip install tkinter
   ```

3.2 URL Shortener Code:

```
# Import necessary libraries
from tkinter import *
import paperclip
import pyperclip
import pyshorteners

# Function to generate and display the shortened URL
def url_shortner():
    # Create an instance of the Shortener class
    shortener = pyshorteners.Shortener()

    # Get the URL from the input field and generate the shortened URL
    url_short = shortener.tinyurl.short(main_url.get())

    # Set the shortened URL to the StringVar, updating the GUI
    short_url.set(url_short)

# Function to copy the shortened URL to the clipboard
def copy_url():
    # Copy the content of the short_url variable to the clipboard
    pyperclip.copy(short_url.get())

# Main program entry point
if __name__=="__main__":
    # Create the main application window
    root = Tk()

    # Set window properties
    root.geometry("800x500")        # Initial window size
    root.maxsize(1920,1080)         # Maximum window size
    root.minsize(650,300)           # Minimum window size
    root.title("My URL Shortener Application")   # Window title
    root.configure(bg="#39f")       # Background color

    # Create StringVar variables to store input and output URLs
    main_url = StringVar()          # For the main URL
    short_url = StringVar()         # For the shortened URL

    # Create and place GUI elements using Tkinter
    Label(root, text="Enter The Main URL Below", font="poppins", bg =
          "#936c7d").pack(pady=15)
    Entry(root, textvariable=main_url, width=100).pack(pady=5)
```



```
Button(root, text="Generate Short URL by clicking this link",
command=url_shortner).pack(pady=55)

Label(root, text="The Short URL is down below ", font=("poppins", 19,
      "bold")).pack(pady=7)
Entry(root, textvariable=short_url, width=50).pack(pady=5)
Button(root, text="Copy the Short URL", command=copy_url).pack(pady=5)

# Start the GUI event loop to keep the application running
root.mainloop()
```

3.3 Code Explanation:

The provided code is a Python script that demonstrates the implementation of a URL Shortener application with a graphical user interface (GUI) using the Tkinter library. A URL shortener is a tool used to convert long URLs into shorter, more manageable links. This script utilizes the Pyshorteners library to generate shortened URLs, Paperclip for clipboard operations, and Pyperclip to copy URLs to the clipboard. The Tkinter library is employed to create the GUI interface for the application.

Below the explanation of every line of code is explained.

1. `from tkinter import *`: Imports the entire Tkinter module, which provides tools for GUI development.

2. `import paperclip`: Imports the Paperclip library for clipboard operations.

3. `import pyperclip`: Imports the Pyperclip library for copying text to the clipboard.

4. `import pyshorteners`: Imports the Pyshorteners library, which will be used for URL shortening.

5. `def url_shortner():`: Defines a function named `url_shortner` that will generate the shortened URL.

6. `shortener = pyshorteners.Shortener()`: Creates an instance of the `Shortener` class from the Pyshorteners library.
7. `url_short = shortener.tinyurl.short(main_url.get())`: Uses the `tinyurl` method to generate a shortened URL from the URL provided in the `main_url` variable.
8. `short_url.set(url_short)`: Sets the value of the `short_url` variable to the generated shortened URL.
9. `def copy_url():`: Defines a function named `copy_url` that will copy the shortened URL to the clipboard.
10. `pyperclip.copy(short_url.get())`: Copies the value of the `short_url` variable to the clipboard using the Pyperclip library.
11. `if __name__=="__main__":`: This block of code ensures that the following code is only executed when the script is run directly (not when imported as a module).
12. `root = Tk()`: Creates the main application window using the Tkinter `Tk` class.
13. `root.geometry("800x500")`: Sets the initial dimensions of the window to 800 pixels in width and 500 pixels in height.
14. `root.maxsize(1920,1080)`: Sets the maximum dimensions of the window to 1920x1080 pixels.
15. `root.minsize(650,300)`: Sets the minimum dimensions of the window to 650x300 pixels.
16. `root.title("My URL Shortener Application")`: Sets the title of the application window.
17. `root.configure(bg="#39f")`: Configures the background color of the application window.

18. `main_url = StringVar()`: Creates a `StringVar` variable to store the main URL entered by the user.

19. `short_url= StringVar()`: Creates a `StringVar` variable to store the generated shortened URL.

20. `Label(root, text="Enter The Main URL Below", font="poppins", bg = "#936c7d").pack(pady=15)`: Creates a label widget with the specified text and font, and adds it to the window with some padding.

21. `Entry(root,textvariable=main_url, width =100).pack(pady=5)`: Creates an entry widget for the user to input the main URL, binds it to the `main_url` variable, and adds it to the window with some padding.

22. `Button(root, text="Generate Short URL by clicking this link", command =url_shortner).pack(pady=55)`: Creates a button widget that, when clicked, triggers the `url_shortner` function to generate the shortened URL. Adds the button to the window with padding.

23. `Label(root, text="The Short URL is down below ", font=("poppins", 19, "bold")).pack(pady=7)`: Creates a label widget to display text indicating the presence of the shortened URL below. Adds the label to the window with padding.

24. `Entry(root, textvariable= short_url, width=50).pack(pady=5)`: Creates an entry widget to display the generated shortened URL, binds it to the `short_url` variable, and adds it to the window with padding.

25. `Button(root, text="Copy the Short URL", command= copy_url).pack(pady=5)`: Creates a button widget that, when clicked, triggers the `copy_url` function to copy the shortened URL to the clipboard. Adds the button to the window with padding.

26. `root.mainloop()`: Initiates the Tkinter event loop, which keeps the GUI window running and responsive to user interactions.

In summary, this code showcases a simple URL Shortener application with a user-friendly GUI, allowing users to input a URL, generate a shortened version, and copy it to the clipboard. The Tkinter library is employed for the graphical interface, while Pyshorteners, Paperclip, and Pyperclip are used for the URL shortening and clipboard functionality.

4. Advantages of Using URL shorteners

URL shorteners offer several advantages that make them valuable in various scenarios. Here are some of the key advantages of using URL shorteners:

I. ***Shorter, Cleaner URLs****:* URL shorteners convert long and complex URLs into shorter, more manageable links. This makes the URLs more user-friendly, easier to share.

II. ***Social Media Sharing***: On platforms like Twitter, where character limits are imposed, URL shorteners allow users to convey their message concisely without exceeding character limits.

III. ***Link Management***: URL shorteners often provide link management features, allowing users to edit, delete, or redirect the destination URL without changing the shortened link.

IV. ***Prevent Link Breakage***: Long URLs are more prone to breakage, especially when sent through email or in printed materials. URL shorteners ensure that the link remains intact and clickable.

V. ***Security and Privacy***: Some URL shorteners offer security features, such as link expiration or password protection, to restrict access to the shortened URLs.

VI. ***Cross-Platform Compatibility***: Shortened URLs work across different platforms and devices. They are not limited to specific operating systems or browsers, ensuring universal accessibility.

VII. ***Enhanced User Experience***: Shortened URLs create a seamless user experience, reducing the barrier to access content and encouraging users to click on the link.

Overall, URL shorteners are valuable tools that offer convenience, tracking capabilities, and improved user experience in various online contexts.

5. Conclusion

The journey through this internship has been an enlightening and transformative experience. Over the course of the weeks, I delved into the world of programming, tackled challenges head-on, and gained invaluable skills that will undoubtedly shape my future. As I wrap up this project, I reflect on the significant strides I've made and the profound impact this opportunity has had on my growth.

At the outset, I embraced the challenge of creating a URL Shortener application. Despite my background in physics, I navigated the intricacies of programming languages with determination. Week after week, I witnessed my proficiency in Python expand, as I understood algorithms, libraries, and concepts that were once foreign to me. This project encapsulates my journey from being a novice to confidently coding functional applications.

Throughout the internship, the guidance provided by Upskill Campus (USC), The IoT Academy, and UniConverge Technologies Pvt Ltd (UCT) was instrumental. The structured curriculum, expert guidance, and hands-on projects guided my learning in a way that I could not have achieved independently. The collaborative environment fostered a strong foundation, enabling me to overcome challenges and explore new horizons.

As I worked on the URL Shortener project, I gained a deep understanding of web application development, algorithmic thinking, and practical implementation. The process of designing a user-friendly GUI, integrating libraries, and ensuring smooth functionality exposed me to real-world coding scenarios. The culmination of my efforts resulted in a functional application that can generate and manage shortened URLs seamlessly.

Moreover, this internship has been a bridge that facilitated my transition from a physics-focused background to mastering programming skills. I've expanded my career prospects and now possess a versatile skill set that can be applied across industries. The exposure to libraries such as Numpy and Pandas, understanding the significance of Git and GitHub, and familiarizing myself with GUI development using Tkinter, has opened doors to new opportunities.

As I move forward, I carry with me a profound sense of accomplishment and a heightened enthusiasm for continuous learning. The experience gained during this internship has equipped me with problem-solving techniques, a knack for programming, and a newfound confidence in my abilities. I extend my heartfelt gratitude to Upskill Campus (USC), The IoT Academy, and UniConverge Technologies Pvt Ltd (UCT) for providing this platform for growth. The invaluable skills, knowledge, and confidence gained will undoubtedly serve as my stepping stones toward contributing effectively in today's technology-driven industries.

References

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Lutz, M. (2013). *Learning python: Powerful object-oriented programming*. " O'Reilly Media, Inc.".

Guttag, J. V. (2016). *Introduction to computation and programming using Python: With application to understanding data*. MIT press.

Severance, C. (2016). *Python for Everybody: Exploring Data Using Python 3*.

https://docs.python.org/3/library/tkinter.html

Week 1 progress:

Content: In week 1, I tried to understand the essence of the internship program, the week content and revise my python knowledge using the course content. Thereafter, I choose "URL Shortener" as my project. I choose this topic because I feel convenient and comfort about the content of this topic. I have learnt many aspects of it. I have completed the table of contents (TOC) part, introduction of the project. I also have completed some topics of this project like the algorithm for the URL shortening, make the specific contents(section) space. I will fill those sections with the flow of this internship. I am learning the python coding part of this project and I believe it will be finished within week 3.

Challenges and Hurdles: I am an undergraduate student in physics. Therefore, it was a little hard for me to understand the programming languages. Now I am comfortable with it. I learnt a lot from the course content and external resources like Youtube and other platforms. I will mention those resources in the reference section. The main challenge was where to start. So, I started from the beginning. It takes times but I have more clearer understanding in python now. I am now trying to learn the main Component of this project i.e. "URL Shortening". There may come many difficulties during the learning but I will tackle them and will finish this internship program with a great enthusiasm.

Lessons Learned: In first week, I have learned the core of Python. I started from the beginning. I watched course contents. I have learnt the algorithm for URL shortening. It was a great experience while learning topics related to this project. Therefore, I have gained the knowledge and skills. Many times, I encountered difficulties (code error), but with constant efforts I overcome them and solve those difficulties. In this way I learnt how to solve programming problems and I am constantly learning more. These skills, problem-solving techniques, will benefit me in my future endeavors.

Week 2 progress:

Content: In week 2, I read few books of python and watched the weekly contents. I have learnt many aspects and benefits of this topic. I have updated the table of contents (TOC) part. I remove the section numbering of "reference" as in Microsoft word the references tools do not allow external numbering (bullets) for references I also have completed writing some topics of this project like "Advantages of Using URL shorteners" sections, make the specific section in the beginning of every page (it is mentioned in the format). I attached some reference in the reference section which I have read this week. I have finished writing the section "System requirements of the project" I will fill others sections with the flow of this internship. I am learning the python coding part of this project and I believe it will be finished by the end of week 4.

Challenges and Hurdles: As a non-CS student I struggled with the concepts when I read those from books. I mentioned some resources in the reference section. I started reading the book from the beginning. It takes times but I have more clearer understanding in python now. I am now trying to learn the main Component of this project i.e. "URL Shortening". I have learnt the advantages of "URL Shortening" and wrote down in the specific section. There may come many difficulties during the learning but I will tackle them and will finish this internship program with a great enthusiasm.

Lessons Learned: In second week, I have learned the core and applications of Python. I started from the beginning. I watched course contents. I have read books (mentioned in references section). I have learnt the algorithm for URL shortening. It was a great experience while learning topics related to this project. I have gained the knowledge of the advantages of URL shortener. Many times, I encountered difficulties (code error), but with constant efforts I overcome them and solve those difficulties. In this way I learnt how to solve programming problems and I am constantly learning more. These skills, problem-solving techniques, will benefit me in my future endeavors.

Week 3 progress:

Content: In week 3, I read few books of python and watched the weekly contents. I have learnt many aspects and benefits of this topic. I have completed writing some topics of this project like "Implementation in Python" sections, make the specific section in the beginning of every page (it is mentioned in the format). I attached some reference in the reference section which I have read this week. I will fill others sections with the flow of this internship. I am learning the python coding part of this project and I believe it will be finished by the end of week 4.

Challenges and Hurdles: As a non-CS student I struggled with the concepts when I read those from books. I mentioned some resources in the reference section. I started reading the book '*Python for Everybody: Exploring Data Using Python 3*' from the beginning. This book is suggested in the internship content and I find this book very interesting. It takes times but I have more clearer understanding in python now. I am now trying to learn the main Component of this project i.e. "URL Shortening". I have learnt the advantages of "URL Shortening". There may come many difficulties during the learning but I will tackle them and will finish this internship program with a great enthusiasm.

Lessons Learned: In third week, I have learned the core and applications of Python. I watched course contents. I have read books (mentioned in references section). I have learnt the algorithm for URL shortening. It was a great experience while learning topics related to this project. I have gained the knowledge of the advantages of URL shortener.

I am known to some libraries used for data science. I also learnt how SEO is being done with the help of Python. I come to know about the SEO and data science using well documented course content. I come to know about Python Data Analysis Packages, several libraries like Pandas, Numpy, Scipy, Matplotlib, Scikit-learn and their specific uses in data science, machine learning etc.

Many times, I encountered difficulties (code error), but with constant efforts I overcome them and solve those difficulties. In this way I learnt how to solve programming problems and I am constantly learning more. These skills, problem-solving techniques, will benefit me in my future endeavors.

Week 4 progress:

Content: In week 4, I have watched the weekly contents and try to understand two essential python libraries Numpy and Pandas. I have learnt many aspects and benefits of these libraries. I planned to write the codes for the URL shortener. But I have not completed writing because I think I need some more knowledge of **Tkinter** library for the user interface system and **Pyperclip** library. Once I well able to understand these libraries, I can finish writing the remaining of the report. I also started to learn about Git and GitHub. Within week 5, I can able to put my codes, necessary data in my repository. I will fill others sections with the flow of this internship. I am learning the python coding part (mentioned libraries) of this project and I believe it will be finished by the end of week 5.

Challenges and Hurdles: As a non-CS student I struggled with the concepts when I read those from books. Therefore I started reading about blogs and articles from internet. It helps a lot because with specific key search, I can learn the specific topic. Also if some doubt arises, I can ask the huge community over the internet. This prefers more benefit and practical knowledge rather than books.

It takes times but I have more clearer understanding in python now. I am now trying to learn the necessary libraries for the main Component of this project i.e. "URL Shortening". I have learnt two important python libraries used computation i.e. Numpy and Pandas. I also have learnt the advantages of "URL Shortening". There may come many difficulties during the learning but I will tackle them and will finish this internship program with a great enthusiasm.

Lessons Learned: In fourth week, I have learned and revised the core and applications of Python. I watched course contents. I have read books (mentioned in references section). I have learnt the algorithm for URL shortening. It was a great experience while learning topics related to this project. I have gained the knowledge of the advantages of "URL shortener". I have learnt two important python libraries used computation i.e. Numpy and Pandas. I have known about the key features and main difference between Numpy and Pandas. I come to know about Data type supported in NumPy and Pandas, their uses in machine learning and deep learning, their indexing methods etc.

Many times, I encountered difficulties (code error), but with constant efforts I overcome them and solve those difficulties. In this way I learnt how to solve programming problems and I am constantly learning more. These skills, problem-solving techniques, will benefit me in my future endeavors.

Week 5 progress:

Content: In week 5, I have watched the weekly contents and try to understand two essential python libraries Numpy and Pandas. I have learnt many aspects and benefits of these libraries. I practiced those in local jupyter notebook. I have written the code for the URL Shortening. The code is in its early stage. Many interfaces updated are required to make it more interactive. I'm working in that part. For that I am trying to understand the more functionalities of of tkinter.

Once I well able to understand these libraries, their functionalities, I can finish writing the remaining of the report. I also started to learn about Git and GitHub. I gained basic knowledge of distributed version control systems and basic of Git and GitHub. Within week 6, I can able to put my codes, necessary data in my repository. I will fill others sections with the flow of this internship.

Challenges and Hurdles: As a non-CS student I struggled with the concepts when I read those from books. Therefore I started reading about blogs and articles from internet. It helps a lot because with specific key search, I can learn the specific topic. Also if some doubt arises, I can ask the huge community over the internet. This prefers more benefit and practical knowledge rather than books. Also YouTube helps me a lot to understand tkinter and other libraries.

It takes times but I have more clearer understanding in python now. I am now trying to learn the necessary libraries for the main Component of this project i.e. "URL Shortening". I have learnt two important python libraries used computation i.e. Numpy and Pandas. I also have learnt the advantages of "URL Shortening". There may come many difficulties during the learning but I will tackle them and will finish this internship program with a great enthusiasm.

Lessons Learned: In fifth week, I have learned and revised the core and applications of Python. I watched course contents. I have read books (mentioned in references section). I have learnt the algorithm for URL shortening. It was a great experience while learning topics related to this project. I have gained the knowledge of the advantages of "URL shortener". I have learnt two important python libraries used computation i.e. Numpy and Pandas. I have known about the key features and main difference between Numpy and Pandas. I come to know about Data type supported in NumPy and Pandas, their uses in machine learning and deep learning, their indexing methods etc.

I have learnt about tkinter, pyperclip, pyshortners and paperclip libraries for this project. I have gained knowledge about Git and GitHub.

Many times, I encountered difficulties (code error), but with constant efforts I overcome them and solve those difficulties. In this way I learnt how to solve programming problems and I am constantly learning more. These skills, problem-solving techniques, will benefit me in my future endeavors.

Week 6 Progress

Content: Week 6 marked the culmination of my internship journey, where I integrated all the knowledge and skills gained over the past weeks. I continued refining the URL Shortener coding and delved deeper into creating an interactive user interface using Tkinter. Additionally, I expanded my understanding of Git and GitHub, allowing me to effectively manage my project repository.

Challenges and Hurdles: Throughout the internship, the challenge of grasping complex concepts persisted. However, my proactive approach of seeking online resources and YouTube tutorials helped bridge the knowledge gap. As I polished the user interface, I encountered design intricacies that demanded creative problem-solving.

Lessons Learned: The final week encapsulated the entire internship experience. I solidified my grasp of Python and crucial libraries, transforming theoretical knowledge into practical applications. Navigating Git and GitHub enriched my understanding of version control and collaborative development. By persevering through challenges and actively seeking solutions, I not only acquired technical skills but also honed my ability to adapt to evolving technological landscapes.

This internship has been a transformative journey, propelling me from a physics-focused background to a confident programmer. The structured curriculum, expert guidance, and hands-on projects provided by Upskill Campus, The IoT Academy, and UniConverge Technologies Pvt Ltd (UCT) have been invaluable. This experience has equipped me with skills that extend beyond the realm of coding, enabling me to contribute effectively to the tech-driven industries of today and tomorrow. My sincere gratitude goes out to USC, The IoT Academy, and UCT for this enriching opportunity.