Industrial Placement Final Report

Total word count: 1500-2000 words

1. Executive Summary (100 words)

- Brief overview of placement and Tour Guide App project

I am currently interning at the Bird Heritage Foundation. The foundation primarily restores and refurbishes old heritage monuments in New Delhi. They also have created an audio tour guide app called Audio Odigos for the famous monuments within India. My role as a design engineering intern was to develop a fully functional mobile application for an AI tour guide. The app would allow users to ask any question and get real time text and audio responses from the AI guide. It also would utilize GeoTagging to make navigation and exploration easier.

- Key achievements and skills developed

In addition to using my design engineering skills in the real world, I successfully developed my skills as a software engineer and learnt the Swift language along with how I can use various APIs to implement them into the app.

2. Introduction (150 words)

- Company background (50 words)

Bird Heritage Foundation has been established since 2019 and takes part in the “Adopt a Heritage” program initiated by the Archeological Survey of India. Through this program the ASI urged all entities to come forward and help in better upkeep and rejuvenation of India's rich cultural heritage and there are over 3600 monuments under their protection.

- Your role as a product developer/design engineer (50 words)

My role as a design engineer was manage an entirely new project by myself. I was responsible for developing and coming up with a project roadmap to launch an AI based Tour Guide application for the foundation. I had to conduct secondary and primary market research, observe user behaviour, analyse the gap in the market, ideate a solution, develop a mock user interface, learn the Swift programming language, and finally develop the functional mobile app. In addition to this, I had to also briefly come up with a future roadmap and how the project could be taken forward once my placement is over.

- Initial expectations vs. reality (50 words)

Initially I had expected that this entire project was extremely ambitious, and I was afraid that I would not be able to successfully complete what I had envisioned for it. However, in reality, I took on each task bit by bit and broke down the absolutely essential components of the app. Then I combined those components into one and iteratively improved on the app. This along with feedback from the team allowed me to almost finish the project to the level of finally presenting it to the ASI.

3. Summary of the Placement (400 words) - 20% of total

3.1 Role Description (150 words)

- Detailed explanation of your position and responsibilities

- Engagement with relevant stakeholders

For my role I sit with Mrs Geetanjali Nanda's team. Her team consists of 3 employees: Mr Prabhmeet, Mr Deep and Ms Anu. They specialise in market research and outreach, website development and product testing respectively. I primarily communicate with them on a daily basis and get feedback and mentorship from them as well. Apart from them, I also engage with the Board of Directors and other departments at the parent company, Resbird Technologies Private Limited. The other departments include design, sales and finance/accounting. I usually sit in some of their meetings and mostly observe the discussions and operation. This enables me to learn a lot more to expand my understanding of real-world businesses. Whenever asked, I always try to give an idea or an insight from the meetings which makes me feel like a part of their teams as well. I have even gotten the opportunity to be a part of some of the board meetings of the foundation and learn how they are conducted. Sitting in the board meetings has given me a top-down understanding of all the factors that are involved in the day to day running of the organisation and the challenges that are faced every day.

3.2 Contributions and Achievements (250 words)

- Development of Tour Guide App for Humayun's Tomb Complex

I was able to successfully identify a gap in the tourism market in India. There was no accessible way to learn about the monuments and their history at the location. All the guides that were present were with foreign tourist and not only were they prebooked but were also too expensive for the average Indian to hire. This prevented the local travellers from learning about the history of the monument and of their own heritage.

- Impact on company's tourism offerings and visitor experience

- Link to larger departmental short and long-term objectives and strategies

I had only noticed this at the extremely well known Humayun's Tomb monument in New Delhi. However, there are more than 170 heritage monuments recognised by the ASI in New Delhi alone. If the popular ones also do not have any access to guides, then the lesser known ones are currently completely overlooked. Creating an AI app that can easily be scaled to accommodate majority of the monuments present would encourage widespread education and knowledge about India's history and would not only promote tourism but also would motivate further exploration from locals as well.

- Reflection on how achievements relate to initial personal expectations

Initially I had not imagined that I would really be able to produce a fully functional stand-alone application by myself. However, I was able to full fill the goal well. It would need some changes before it can be launched as an actual product. This would include making the product more robust, translating it to android devices and accounting for the variety of different smartphones that are available in the market. In the middle when planning the user interface I became quite ambitious with what all I wanted to include in the app. This included a 3d map of the entire monument along with an Augmented Reality tour guide projected through the phone's camera. However, once consulted with the team, I realised this would require a lot of resources and would be a very capital intensive process in addition to the countless approvals the team would need to do. Therefore, to manage the

timelines I focused on just developing the essential features of the app with these advanced features that can be released later in the future.

4. Professional Development Reflection (1000 words) - 60% of total

4.1 Design Engineering Knowledge and Understanding (200 words)

- Application of user-centred design principles

By utilising the user-centred design principles of *[insert user centred design principles]* I started with designing an intuitive UI for the app. The audience for the app is extremely widespread with a variety of demographics visiting the monument every day. To narrow down the audience further, I primarily decided to focus on young adults who are more comfortable with navigating apps. They would likely prefer to have an app-based tour guide vs a physical guide that would constantly be walking with them. After talking to some university students exploring the monument, on average, it would be unlikely for them to organise a tour guide for their exploration. They enjoy the curious exploration much more and prefer to be just with their own friend group. An additional guide, who would usually be a lot older than them, would feel more of a burden than an aid.

- Integration of historical information with modern technology

Initially I had recorded a tour done by one of the ASI's hired guide. He also worked as a guide along with a security officer for the monument. Analysing his way of explanation and observing the nuances in his gestures and related knowledge, I transcribed the entire experience. Once transcribed, I was able to train a custom GPT based on this information to try to recreate the tour guide experience through the AI chatbot. Further, I also used the previous information collected by the Bird Heritage Foundation for their Audio Odigos app to refine the AI guide. This lead to the integration of historical information with modern technology.

- Learning and applying coding skills from scratch

To develop the app, I had to learn about mobile app development. I narrowed down the development stack to using swiftUI and Xcode as the IDE. To start development, the first month I did a basic free online course which taught me the basic syntax of the language. This knowledge paired with my learnings of html, css and JavaScript from the computing 2 module and python in the electronics modules as part of my MEng, course jump started my app development journey. In the 2nd month I was able to put together the 2 aspects of my app, the map navigation and AI chat as 2 separate applications. In the following months I iterated on the app, building it bit by bit. Finally now I have a working functional application that has all the essential features for it to be usable in the field. Based, on the app I have conducted a field test and have made some overactions on the changes that would be required. Once these changes are complete I plan on presenting the app to the ASI committee responsible for the heritage monuments and then release the app in beta.

4.2 Analysis and Problem-Solving (200 words)

- Methods for problem identification (field observations, user interaction studies)

To effectively identify a problem, I visited the Humayun Tomb multiple times by myself and with the Bird Heritage Team. We were first guided by one of the security guards working there, he was commissioned by the ASI and also had worked as a Tour guide for this monument as well as other monuments in Delhi such as the Red Fort. He showed us around the main tomb. This is where we realised that the only other guides around, were expensive

ones prebooked by foreigners and there was almost no readily available information about the tomb for walk in visitors. The ASI had setup other area in the complex such as the walkways and the West Gate where they had put up posters about the restoration of the tomb and a brief history of it. This was at least a 10 min walk from the actual tomb and the visitors barely learnt from it. We noticed that there were many locals who were gathering around us, and our tour guide to learn more from him and ask him questions. Initially, I thought there would be tour guides available for hire at the ticketing desk but this was far from the case.

The realisation had set in that there is a major gap in the market, especially for locals to find and source tour guide or just learn more about the history. There was no written information about the tomb or any labels inside the tomb either. I wanted to figure out a way to make information more accessible and use upcoming technology to fulfil that goal.

To recreate the tour guide experience through and AI app, I recorded and transcribed the entire experience we had at the tomb done by the security guard cum guide. I took note of the locations where he gestured and spoke about different aspects related to the tomb. This information was later translated into the app through geofencing and tracking the user's location using the onboard GPS on their phones.

I also noticed that the surrounding monuments such as the Barber's tomb and Neela Gumbad had very little attention given to them and the access to them was really confusing for the visitors as well. Furthermore, information about where to find the toilets or drinking water was challenging, which is why I realised the need for an interactive map on the app as well.

- Iterative prototyping process and overcoming technical challenges

The first prototype of the app was in 2 separate apps – an AI chat tour guide and an interactive GPS map with annotations about the monuments present within the Humayun's Tomb Complex.

The first was just an ai chat bot LLM trained on the custom instructions and information of the guide along with other sources such as the data of the Audio Odigos app. This worked well by itself, but further testing made us realise that it does not have any guardrails to prevent answering questions that are un related to the monument tour. Implementing guard rails within the chat made us realise that it would be difficult to read the information in the hard sunlight on the phones and would need to be spoken out aloud by the app. This lead to me figuring out how the app can speak out the content while allowing the user to easily control when the app should speak or not.

The second was an interactive GPS map with annotations. It worked well by itself and allowed the users to tap on the monuments to read a short description of them.

The biggest challenge I found initially was how to combine the 2 apps into one such that the user can easily use both. I started with using a simple scroll view and stacking the map at the top followed by the chat. This looked good but as the chat got larger, it became difficult for the user to keep scrolling back to the top for the map. This was not ideal. After a lot of ideas discussing with the team at my organisation, we decided to take inspiration from existing apps such as google maps or the uber app. They solved this problem using a "bottom sheet". The bottom

sheet allowed the chat's size to be adjustable and the user can then always expand or hide the chat based on their use.

Then another problem I faced was, I needed the app to automatically scroll to the bottom of the chat as soon as the user touched the text field to input a text. This was extremely challenging, and I tried to solve problem by setting a flag to whenever the user would tap on the text field. When the user tapped on the text field, I wanted to scroll to the most recent message. Finding the most recent message was difficult, and to solve that problem I created a placeholder value for keeping the ID of the most recent message as they got displayed on the screen. This ID placeholder system allowed me to easily scroll to the newest message allowing intuitive use by the user.

- Case study: Significant challenge and solution

A big challenge for me was figuring out how to handle an interrupted spoken chat message. If the user were to click on a new message while the app was speaking an older message, the required functionally would need the app to stop the spoken message, clear the speech queue, start speaking the new message. All of this while correctly updating the speaker icons on each respective message. I was able to get the voice functionality to work but was not able to align the icons to update in time. After a lot of brainstorming and discussions, I had to connect with an experienced app developer through the contacts in our organisation. He guided me to set up a speech synthesizer delegate and set up flags within that to allow the icons to update according to when the respective speech was playing.

4.3 Technical and Commercial Leadership (200 words)

- Initiative in learning new skills (e.g., coding)

At my organisation they used to have a development team pre-covid but because of the pandemic they needed to downsize the team and because the apps were already up and running, the developers were let go. As a result, I needed to learn the entire app development process by myself. My initiative to do so was greatly sped up by my knowledge through the courses at Imperial, especially the computing and electronics modules. Using my knowledge of Object Oriented Programming, I was able to quickly adapt my coding skills to the new language of Swift and was able to build basic apps using the native iOS frameworks of SwiftUI.

- Leading the app development process

Initially, I needed to make the choice of deciding what language to learn to build the app in. After a lot of consideration, even though android devices are far more popular in India, I decided to use Swift because of its clear and straightforward documentation along with reliable device API's that would allow me to more accurately utilise the device's hardware as inputs to my app. Swift has very robust frameworks especially for apple devices and it would be the one language that would've allowed me to build my prototype the quickest. Further, I saved on the organisation's resources and took permission by them to test the app on my own existing phone.

I had to learn to pace myself and plan based on the timelines. This made me do the "Hacking with SwiftUI" course till I started to get the hang of it, made 10-15 basic apps myself, and it explained the important modules that I would need in my app such as MapKit and Core Location.

- Understanding the business context of enhancing tourist experiences

The business context of enhancing tourist experiences involved in analysing the needs and the user journey map that a tourist would go through when visiting the monument. Through this, I deeply understood the entire business of heritage monuments and tour guides. The tour guides not only provide the history of the monument but they also help tourists navigate, translate and learn about the Indian culture at the same time. Furthermore, they give

context aware suggestions based on a variety of factors such as the engagement of their client or their current surroundings. Tour guides also benefit from being present within the monument complex where there are not many options left for the foreigners but to take their service to make sure their visit is worth their time. The tour guides pitch themselves, to the foreigners by giving attractive deals. I observed this at the monument visit where I witnessed a local tour guide approach a foreign tourist couple and say “600 rupees for both of you, if you like my service you pay after if you don’t like you don’t pay.” This becomes a very attractive deal for the tourists and more often than not after the tour, they would 100% pay for the guide.

4.4 Interpersonal Skills (200 words)

- Collaboration with team members, historians, and IT department

I communicated well with all the team members, mostly with the web development team at Bird Heritage Foundation. The previously researched information through historians were collaged by the foundation during the building of the Audio Odigos app along with the most frequently asked questions. This was handed to me as a document that I could use to train my chat bot. In addition to this project, I had many meetings and discussions with the employees at the organisation and provided my input as a design engineer whenever required.

- Communication with stakeholders (presenting prototypes, gathering feedback)

Every week on Fridays I was presenting to the team and Ms Geetanjali about the changes I have made to the app. Additionally there were other employees in the parent organisation that we got feedback from and I even showed my app to potential visitors at the tomb. Based on their feedback, I noted their expectations from the app and implemented the features they had suggested.

4.5 Professional Standards and Ethics (200 words)

- Adherence to company policies and heritage site regulations

I stuck by the company policies and heritage site regulations. I did not take any professional equipment to capture data from the heritage site. I only used my phone to record the experience, make notes and try navigating through the complex. I was mindful to not take equipment such as an elaborate microphone setup or a tripod setup at the monument. When visiting the Mosques, I made sure I did not enter it with my shoes on or without my phone on silent mode.

- Consideration of accessibility and inclusivity in app design

I made sure the app can be used just vocally utilising the built in dictation feature on iOS. I used colours that were contrasting such that the app can be intuitively used by visually impaired users as well. In the code, I made sure to correctly label each button or navigation element accordingly to allow users to use the voiceover control feature as well. The GPT has been trained on multiple languages, as a result it can me simultaneously communicated to with any language.

- Ethical considerations in digitizing cultural heritage

In my app, I am only using information that has been widely digitized for many years. I am trying to make that information more accessible and engaging using the AI chat. One thing to consider right now is to prevent the GPT from hallucinating. In most of the cases the AI is able to give a reliable and accurate response to the user’s queries however there had been a handful of instances where the bot hallucinated and got confused with the information

it is providing. This problem can be mitigated by further fine-tuning the model instructions and will only get better with time as the technology progresses.

5. Future Career Reflection (300 words) - 20% of total

- Key skills learned and personal growth (100 words)

I learned how to develop a mobile app from scratch. I learned to conduct real world user and market research, analysis the business model. I learned to work as part of an organisation, become part of a team and come up with solutions to real world problems. I learned to communicate with professionals, how board meetings are conducted. I learned to manage my time, make myself some roadmaps and timelines to meet my goals. I learned to gather feedback and iterate on a product. I learned to use means of problem solving such as online research, professional guidance and even using AI in some instances.

- Reflection on professional profile and values (100 words)

Professionally, I learned a lot in this placement. I was able to understand almost all areas of the organisation, from accounts, sales, product development and even other administrative tasks. For me, through this experience I have realised that I would want to work towards being an entrepreneur and lead a business. I really enjoyed attending board meetings and thinking about overall strategy and business plans, along with problem solving and figuring out how to make business processes more efficient using technology. I love to ideate on new business ideas, analysing their growth potential and would want that to be a large part of my professional career in the future.

- Potential future opportunities and transferable skills (100 words)

In the future, the skills I have managed to learn at this placement would be easily transferrable to almost all areas of any business. I learnt to develop apps, which can be created for every business. I learnt business processes and decision making which can not only be applied to other businesses but also in day to day life.

6. Conclusion (50 words)

- Overall impact of the placement on professional development

- Final thoughts on the experience