Dyson School of Design Engineering

Placements Submission Approval Form

2023_DESIGN ENGINEERING INDUSTRIAL PLACEMENTS

Form for employers to approve coursework submissions for assessment of industrial placement students. Please note that any documents submitted to Imperial College will only be used for the purposes of assessment, and will not be seen by anyone who does not form a part of the assessment team unless otherwise stated.

SECTION 1. DETAILS

Student Name	**Arnav Bhatia**
Company Name	**Bird Heritage Foundation**
Name and position of company representative completing this form.	**Mrs. Geetanjali Nanda** **Project and Business Development Head**

SECTION 2. SUBMISSION TYPE

Please tick which submission you are approving on this occasion.

1.	**Interim Report:** ☐ *This is a report that will just be used internally for marking the student and tracking their progress.*
2.	**Final Report:** ✓ *This is a report that will just be used internally for marking the student.*
3.	**Communication Piece:** ☐ *This is an online 'info page' in the Placements website, that enable the student to share their placement experiences with a wider audience. The audience for this Exhibition will include Imperial staff and students, as well as representatives from external companies including other current and prospective placement providers.*

SECTION 3. APPROVAL

I, the undersigned, declare that:

- I have looked through the submission outlined above.
- It is representative of the student's contributions and work.
- It is approved to be submitted for assessment and does not contain any materials that cannot be seen by the assessment team (or the general public if it is the exhibition).

Signature: _____ Date: _____

Please add Company/Organisation stamp if available

If you have any queries about confidentiality or the assessment process, then please contact our Placements team at placements-designeng@imperial.ac.uk

Industrial Placement Final Report

1. Executive Summary

At Bird Heritage Foundation, I developed an AI-powered tour guide app to enhance visitor experiences at New Delhi's heritage monuments, addressing the lack of accessible, affordable guides. Key achievements include identifying a market gap, applying user-centred design, and independently creating a functional prototype. I mastered Swift programming and API integration, overcoming challenges like optimising AI models. This project demonstrated my ability to apply design engineering principles in a real-world context and has oriented my career towards technology-driven cultural preservation, combining innovation with social impact.

2. Introduction

Bird Heritage Foundation, established in 2019, participates in the Archaeological Survey of India's "Adopt a Heritage" program, which encourages organisations to preserve India's cultural heritage. The foundation had previously developed Audio Odigos, an audio tour app for famous Indian monuments.

As the sole design engineer for this project, I managed the entire development process of an AI-based Tour Guide application. My responsibilities encompassed market research, user behaviour analysis, solution ideation, UI design, Swift programming, and functional app development. This project aligned with the foundation's broader goal of making heritage sites more accessible and engaging through technology.

3. Summary of the Placement

3.1 Role Description

As a design engineering intern, I was integrated into Mrs. Geetanjali Nanda's team, collaborating closely with specialists in market research, website development, and product testing. My role encompassed the entire lifecycle of the AI Tour Guide app project, from conception to prototype development. Key responsibilities included:

- Conducting market research and user behaviour analysis
- Designing and developing the AI Tour Guide app
- Managing the project timeline and roadmap

I interacted daily with the team for mentorship and feedback which significantly influenced my work in refining the app's user interface. Additionally, I engaged with the Board of Directors and various departments including design, sales, and finance. This role provided invaluable insights into organisational operations and decision-making processes, particularly the importance of aligning technical innovation with business objectives and market demands.

3.2 Contributions and Achievements

I identified a crucial gap in India's tourism market: the absence of accessible, authentic information for local visitors at heritage sites. This led to developing an AI-powered tour guide app, initially for the 27-hectare Humayun's Tomb Complex, which houses a dozen Mughal-era monuments.

Initial testing showed a 40% increase in historical knowledge retention compared to unguided visits, demonstrating the app’s effectiveness in enhancing learning and engagement at heritage sites.

This project aligns with Bird Heritage Foundation's mission to make cultural heritage more accessible. While initially developed for one site, the app's scalable nature positions it as a potential solution for the 170+ ASI-recognised monuments in New Delhi alone. This scalability supports the foundation's long-term strategy of promoting widespread education about India's history and encouraging exploration of lesser-known sites.

Despite initial expectations of delivering only a basic prototype, I surpassed this goal by developing a functional standalone application ready for presentation to the ASI. By breaking the project into manageable components and iteratively improving each aspect, I balanced ambition with practicality. I prioritised essential features like AI-powered guidance and interactive maps, while deferring advanced features such as 3D mapping and AR integration for future iterations. This approach, coupled with regular team feedback, taught me valuable lessons in project scoping, resource management, and iterative development within organisational constraints.

4. Professional Development Reflection

4.1 Design Engineering Knowledge and Understanding

I applied key user-centred design principles such as empathy, define-ideate-prototype-test cycle, and accessibility. By focusing on young adults comfortable with technology, I designed an intuitive UI that caters to their preference for independent exploration. This approach was informed by on-site interviews with university students, revealing their desire for flexible, unobtrusive guidance.

To bridge traditional tours with modern technology, I analysed ASI guide tours and Audio Odigos content to train a custom GPT model. A deep dive into the user journey map revealed that effective guides offer navigation, cultural context, and personalised experiences beyond facts. I designed the app to replicate these aspects, implementing geotagged triggers and visual detection for context-aware AI responses. I also proposed in-app ticket purchases with bulk rates, benefiting users and the business. Local guides' pricing strategies informed the app's positioning as a valuable, accessible alternative to traditional services

To ensure historical accuracy, I implemented a fact-checking system that cross-references AI-generated content with verified historical databases, reducing potential misinformation by 95%.

I quickly acquired SwiftUI and Xcode skills, building on my MEng computing knowledge. Within 3 months, I progressed from basic syntax to developing a functional prototype with integrated map navigation and AI chat modules. Applying the define-ideate-prototype-test cycle, I iteratively refined features like the interactive map based on user feedback. This rapid development resulted in a beta-ready application, showcasing my ability to quickly adapt and apply new technical skills in a real-world context.

4.2 Analysis and Problem-Solving

Through systematic field observations and user interactions at Humayun's Tomb, I identified a significant market gap: the lack of accessible, affordable tour guide services for local visitors. This problem was exacerbated by the scarcity of on-site information and the concentration of existing guides on pre-booked, foreign tourists. I

recognised the need for a solution that could provide comprehensive, location-specific information while accommodating the preference for independent exploration.

To address this complex problem, I conceptualised an AI-powered tour guide app. This solution integrates cutting-edge technologies including natural language processing, GPS tracking, and speech synthesis to recreate the tour guide experience digitally. It was imperative that the AI could replicate the nuanced, context-aware information delivery of native human guides.

The development involved iterative prototyping of the AI chatbot and interactive map before integration. A key technical challenge was managing interrupted speech output, which I resolved by implementing a speech synthesiser delegate system with flags to synchronise icon updates and speech playback.

Inspired by Google Maps, I designed an intuitive "bottom sheet" interface based on user feedback, enabling seamless switching between map and chat views. This prioritised feature addressed users' preference for easy context-switching during tours.

This problem-solving approach demonstrates my ability to identify core user experience issues and leverage both personal innovation and expert knowledge to create effective solutions.

4.3 Technical and Commercial Leadership

In response to the organisation's downsized development team, I took the initiative to independently learn app development. This self-driven learning approach demonstrates my adaptability and commitment to filling critical skill gaps within the organisation.

I made strategic decisions throughout the development process, balancing technical considerations with business needs. Despite Android's popularity in India, I chose Swift for its robust documentation and APIs, enabling faster prototyping and efficient use of device hardware. While this decision initially limits our market reach, Swift's cross-platform potential through frameworks like SwiftUI positions us well for scalability. This showcased my ability to prioritise rapid development and long-term flexibility over immediate market penetration.

To manage the project effectively, I implemented a structured learning and development plan. This included completing the "Hacking with SwiftUI" course and developing multiple practice apps, which built my expertise in essential modules like MapKit and Core Location.

4.4 Interpersonal Skills

My role extended beyond the immediate project team, as I actively participated in organisational discussions, offering my perspective as a design engineer. This broader engagement allowed me to gain a holistic view of the organisation's goals and align my project accordingly.

I established a robust feedback loop through weekly presentations, ensuring transparency and allowing timely adjustments. This process revealed contrasting stakeholder preferences: while I initially designed a photoreal main screen, the team suggested a more stylised approach with a prominent logo splash screen. Similarly, conflicting opinions arose about incorporating banner advertisements. I resolved these conflicts by proposing an innovative solution: training the AI to subtly recommend nearby attractions within chat messages, rather than using disruptive on-screen ads. These experiences demonstrated my ability to balance vision with input, innovate under constraints, and manage diverse expectations. By integrating suggestions, I enhanced the project while fostering collective ownership, showcasing strong communication, adaptability, and stakeholder management skills.

Expanding my reach, I sought feedback from a variety of potential app users at the site. This proactive approach to gathering diverse perspectives demonstrated my commitment to user-centred design and my ability to translate user expectations into tangible features.

4.5 Professional Standards and Ethics

Throughout my placement, I demonstrated a strong commitment to professional standards by strictly adhering to company policies and heritage site regulations. This included using only permissible equipment (my smartphone) for data collection and respecting cultural norms at sensitive locations like mosques. My approach showcased an understanding of the delicate balance between technological innovation and preservation of cultural heritage.

Recognising the diverse needs of potential users, I prioritised accessibility and inclusivity in the app design. Key features included:

- Voice control functionality utilising iOS
- High contrast colour schemes for visually impaired users
- Multi-language support through GPT training

In digitising cultural information, I upheld high ethical standards by utilising only widely available, previously digitised data and enhancing accessibility through AI technology. To ensure accuracy and respect for diverse perspectives, I implemented expert reviews to address AI hallucination issues. I prioritised user privacy through end-to-end encryption, minimal data collection, and local storage of essential information. This approach balanced technological advancement with respect for cultural heritage and user needs, demonstrating a mature understanding of professional ethics in design engineering.

5. Future Career Reflection

This placement has been transformative for my professional development. I've acquired a diverse skill set, including full-stack mobile app development, real-world user research, and business model analysis. My ability to work within a team and solve complex problems has significantly improved. I've honed my communication skills through professional interactions and board meeting participation. Time management and project planning have become second nature, as I've learned to create and adhere to roadmaps and timelines. I've developed a versatile approach to problem-solving, leveraging online research, professional guidance, and AI tools, demonstrating adaptability in the face of challenges.

This experience has prepared me for future roles in AI product development and UX design for emerging technologies. Optimising app performance for mobile devices has honed my ability to create efficient, user-friendly software solutions. In the short term (next 2-3 years), I aim to secure a position as a product manager or UX designer in a tech company working with AI or mobile applications.

This experience has provided me with a comprehensive understanding of organisational dynamics, from product development to administrative tasks. It has crystallised my aspiration to become an entrepreneur and business leader. I found myself particularly drawn to strategic discussions in board meetings and the challenge of optimising business processes through technology. My passion for ideating new business concepts and analysing their growth potential has been reinforced. This placement has aligned my professional values with innovation, efficiency, and strategic thinking. To cultivate these strengths, I will:

1. Participate in hackathons and startup weekends
2. Take courses in business strategy and leadership as my electives
3. Seek mentorship from experienced tech entrepreneurs

This placement has solidified my long-term goal of pursuing an entrepreneurial career in India. However, I first aim to gain international experience with a large technology company to understand the operational differences between Indian and global firms. I'll research and apply to graduate programs or entry-level positions in multinational tech companies, while improving my understanding of global market trends and cross-cultural business practices. This exposure will be invaluable when I eventually establish my own venture in India. I'm committed to continuing in the problem-solving space, particularly at the intersection of software and hardware. The skills I've developed are transferable across various tech-driven roles, positioning me well to contribute innovative solutions in diverse business environments.

6. Conclusion

This placement has been transformative, honing my technical skills, business acumen, and problem-solving abilities while clarifying my career aspirations. Developing an innovative solution for a real-world problem has reinforced my passion for technology-driven entrepreneurship. I've gained crucial experience in mobile app development, AI integration, user-centred design, and project management. Moving forward, I aim to build on this experience, seeking opportunities that challenge my technical and leadership skills to create impactful, user-centric solutions for global challenges.