Internship Report

BraInsight SmartCare

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Internship at:
Intellcap

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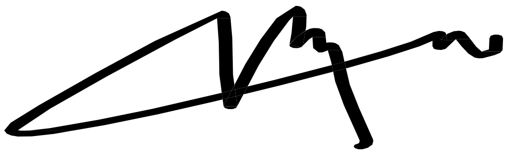


BraInsight Smartcare

Internship Report

Student Statement:

I, the undersigned, confirm that the work presented in this report reflects the progress made during my internship at **Intellcap**, carried out as part of the requirements of Al Akhawayn University's School of Science and Engineering.

This report represents my own learning experience, development efforts, and observations to date. I have respected the confidentiality agreements signed with the host organization and have not included any proprietary or sensitive information.

Ouail El Maadi

Approved by the Supervisor

Dr. Houda Chakiri

Content

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to **Intellcap** for the opportunity to carry out this internship and contribute to the development of the **SmartCare** medical application. This experience has been an excellent opportunity to grow both technically and professionally.

I am especially thankful to my internship supervisor at the company **Mrs. Rania Bakouch** for her guidance, feedback, and support throughout this first phase. Her insights and mentorship have been extremely valuable in shaping my approach to UI design, 3D interaction, and professional development practices.

I would also like to thank **Dr. Houda Chakiri**, my academic supervisor at **Al Akhawayn University**, for her continuous support since day 1.

Finally, I am grateful to the faculty and staff of the **School of Science and Engineering** for preparing me with the knowledge and mindset needed to make the most of this experience.

ABSTRACT (ENGLISH)

This report details the development of an interactive 3D anatomical application model for the SmartCare medical application at Intellcap. The project addresses the challenge of making medical information more accessible to patients by transforming static content into an immersive, educational experience. The final system enables users to explore the complete human body: **external regions** such as the head, arms, legs, and torso are fully interactive, while **internal organs** including the heart, liver, stomach, and intestines are displayed in 3D with accompanying educational descripti text. The implementation combined modern web technologies (Flask, Three.js, Blender) to achieve smooth performance, intuitive navigation, and cross-device compatibility. The results confirm that the application delivers a user-friendly interface that improves patient engagement and understanding.. the application also integrates a placeholder for AI-driven diagnosis visualization (e.g., brain tumor display), indicating future functionality under development by the AI team. My contribution focused specifically on delivering the interactive 3D model and educational interface, which together form the foundation of SmartCare as a patient-centered digital health platform.

Keywords: SmartCare, Intellcap, interactive 3D model, medical visualization, patient education.

ABSTRACT (FRENCH)

Ce rapport présente le développement d'un modèle anatomique interactif en 3D pour l'application médicale SmartCare chez Intellcap. Le projet répond au défi de rendre l'information médicale plus accessible aux patients en transformant un contenu statique en une expérience immersive et éducative. Le système final permet aux utilisateurs d'explorer l'ensemble du corps humain : les parties externes telles que la tête, les bras, les jambes et le torse sont entièrement interactives, tandis que les organes internes y compris le cœur, le foie, l'estomac et les intestins sont visualisés en 3D avec un texte explicatif associé. L'implémentation a combiné des technologies web modernes (Flask, Three.js, Blender) pour assurer des performances fluides, une navigation intuitive et une compatibilité multi-plateformes. Les résultats confirment que l'application offre une interface réactive et conviviale qui améliore l'engagement et la compréhension des patients. L'application intègre également un espace réservé pour la visualisation diagnostique basée sur l'IA (par exemple, l'affichage de tumeurs cérébrales), indiquant une fonctionnalité future en cours de développement par l'équipe IA. Ma contribution s'est concentrée spécifiquement sur la réalisation du modèle 3D interactif et de l'interface éducative, qui constituent ensemble la base de SmartCare en tant que plateforme de santé numérique centrée sur le patient.

Mots clés: SmartCare, Intellcap, modèle 3D interactif, visualisation médicale, éducation des patients

1 INTRODUCTION

The effective communication of medical information remains a major challenge in modern healthcare. Patients often struggle to understand complex medical terminology, diagnoses, or surgical plans, which can create uncertainty, anxiety, and barriers to informed decision-making. Digital health solutions have emerged as a powerful way to bridge this gap, offering tools that make medical knowledge more accessible, engaging, and personalized.

This internship project, carried out at Intellcap, contributes to this vision through the development of **SmartCare**, a patient-centered medical application designed to transform static medical data into an interactive and educational experience. The application integrates 3D anatomical models that allow patients to explore different parts of the human body, accompanied by simple explanatory text. By making the anatomy visually accessible and medically accurate, SmartCare empowers patients to better understand their health conditions and fosters clearer communication with healthcare professionals.

The specific objective of this internship was to design and implement the **interactive 3D anatomical model and user interface** of the SmartCare platform. The work involved combining modern web technologies (Flask, Three.js, Blender) to create a smooth, intuitive experience. While the integration of AI-driven diagnosis visualization (e.g., brain tumor detection) is still under development by the AI team, this project successfully delivered the interactive foundation of SmartCare. This achievement represents an important step toward building a modern, patient-focused digital health platform that strengthens trust and understanding between patients and healthcare providers.

2 COMPANY OVERVIEW

Intellcap is a deep-tech company committed to transforming bold ideas and projects into impactful technology innovations. It operates across the full innovation cycle: from research and development, prototyping, and labs, to industrialization and market-ready products.

The company is active in many advanced fields: aeronautics & space (UAVs, satellites, probes), robotics, AI/ML & deep learning, IoT & sensor systems, immersive 3D environments, and also technologies for smart materials and metaverse experiences. Intellcap also fosters spin-offs, joint ventures and its own product development, along with strong partnerships with universities and research centers to support R&D and technology transfer.

With a leadership team composed of experts in aerospace, robotics, embedded systems, material sciences, and innovation management, Intellcap places a strong emphasis on scientific and technical excellence. The company promotes an international reach (Europe, Morocco, USA, Japan, etc.), encourages entrepreneurship, and offers an environment that supports interns, researchers, and innovators tackling hard technical challenges.

3 INTERNSHIP BACKGROUND

This internship, conducted at Intellcap, was a project-based experience focused on applying interactive visualization technologies to a real-world challenge in the healthcare sector. The central objective was to contribute to the development of **SmartCare**, a patient-centered medical application designed to transform the way individuals interact with their health information.

The internship was structured around the design and implementation of an interactive **3D anatomical model** that enables patients to explore the human body in a clear and intuitive manner. Unlike traditional medical communication tools that rely on static images or complex reports, SmartCare provides immersive interaction: clicking on external regions (head, arms, legs, torso) or internal organs (heart, liver, stomach, intestines) reveals a 3D visualization along with explanatory text. This design directly addresses the gap in medical communication by making complex anatomy accessible to non-specialists.

The internship served as a practical application of knowledge in UI/UX design, 3D modeling, and web technologies. While advanced features such as AI-driven diagnosis visualization (e.g., brain tumor detection) remain under development by the AI team, the work carried out during this internship successfully delivered the interactive foundation of SmartCare, aligning with Intellcap's mission of building innovative and patient-focused digital health solutions.

4 PROBLEM STATEMENT

Effective communication between healthcare professionals and patients is a persistent challenge in modern medicine. Medical reports, diagnostic images, and technical explanations are often presented in formats that are difficult for non-specialists to interpret. This lack of clarity can create confusion, increase patient anxiety, and limit active participation in medical decision-making.

Traditional solutions to this problem have remained limited. Educational brochures, 2D illustrations, or verbal explanations given during consultations are often insufficient to capture the complexity of the human body or a medical condition. While these tools provide some guidance, they fail to offer an interactive and personalized experience that can adapt to the patient's needs and level of understanding. In this context, there is a growing demand for digital health applications that can simplify and visualize medical knowledge in a clear, interactive, and patient-friendly way.

SmartCare was developed in response to this need. The application introduces an **interactive 3D anatomical model** that transforms static medical content into an immersive and educational experience. Patients can click on body regions such as the head, arms, legs, or torso and explore internal organs like the heart, liver, stomach, and intestines. Each interaction triggers a 3D visualization and is paired with a simple explanatory paragraph that describes the organ's function. This combination of visual and textual information makes complex anatomy easier to understand and bridges the communication gap between medical professionals and patients.

While the integration of advanced features such as AI-driven diagnostic visualization (e.g., showing the precise location of a brain tumor) remains under development by the AI team, this project directly addresses the central problem of patient–doctor communication. By delivering a clearand educational interactive model, SmartCare provides a solid foundation for improving patient engagement, reducing uncertainty, and supporting more informed decision-making in healthcare.

5 PROJECT SPECIFICATIONS

The internship project was defined around the development of an interactive 3D anatomical model integrated into the SmartCare medical application. The main specifications were divided into functional and technical aspects, ensuring that the final system could provide a smooth, educational, and user-friendly experience for patients.

5.1 Functional Specifications

- Provide a **full-body interactive 3D avatar** that patients can explore by clicking on different regions of the body.
- Enable **external interactivity**: head, torso, arms (left and right), and legs.
- Enable **internal organ exploration** within the torso, including the heart, liver, stomach, and intestines.
- Display a **dynamic paragraph of medical information** for each selected body part or organ.
- Ensure that the **UI automatically updates** to reflect the currently selected anatomical element (title and description).
- Support with an **educational purpose**, helping patients better understand anatomy and their medical conditions.
- Integrate a **placeholder for AI-driven diagnostic visualization**, such as brain tumor display, to indicate future functionality under development by the AI team.

5.2 Technical Specifications

- Develop the front-end interface using **HTML, CSS, and JavaScript** for accessibility and responsiveness.
- Integrate **Three.js** for rendering and interacting with 3D anatomical models.
- Use **Flask (Python)** for backend routing, templating, and server-side logic.
- Employ **Blender** for model segmentation and export to GLB format.
- Implement **raycasting logic** in Three.js to detect and respond to user clicks on specific anatomical zones.

These specifications defined the scope of the internship project and guided the implementation process. By meeting these requirements, the application ensures that patients can interact with anatomical content in an intuitive and informative manner, while also laying the groundwork for future integration of AI-powered diagnostic features.

6 STEEPLE ANALYSIS

To evaluate the broader context of this project, a STEEPLE analysis was conducted. This framework examines the **Social, Technological, Economic, Environmental, Political/Legal, and Ethical** dimensions that influence the design and implementation of SmartCare. Since the application is intended for use in the sensitive domain of healthcare, it is important to consider not only the technical achievements of the project but also its wider social impact, regulatory requirements, and ethical implications. The following analysis outlines how each of these factors relates to the development and potential adoption of SmartCare.

6.1 Social

SmartCare directly addresses a social challenge in healthcare: the communication gap between patients and professionals. By making anatomy and medical conditions more understandable through interactive 3D models, the platform empowers patients, reduces anxiety, and promotes more active participation in their healthcare journey. This improves trust in medical processes and strengthens the doctor–patient relationship.

6.2 Technological

The project leverages cutting-edge web technologies such as Three.js for real-time 3D rendering, Flask for backend management, and Blender for anatomical model preparation. The integration of interactive 3D visualization reflects current trends in digital health applications, positioning SmartCare at the forefront of innovation. The system also anticipates future integration with AI, which will further enhance its technological impact.

6.3 Economic

By digitizing medical communication, SmartCare reduces the need for printed materials, educational brochures, or lengthy in-person explanations. This saves time for healthcare professionals and reduces costs associated with patient education. In the long term, an accessible digital platform may also reduce miscommunication errors, improving healthcare efficiency and potentially lowering treatment costs.

6.4 Environmental

Although not its primary objective, SmartCare contributes to environmental sustainability by promoting paperless communication. Educational brochures and printed reports can be replaced by digital, interactive tools, reducing paper consumption and waste in medical facilities.

6.5 Political / Legal

SmartCare must adhere to strict legal and regulatory requirements regarding medical data protection and patient privacy. While the current interactive 3D model does not use real patient data, future integration with diagnostic information will require compliance with international standards such as GDPR and HIPAA. Accessibility standards must also be respected to ensure inclusivity for all users.

6.6 Ethical

The project is built on principles of accuracy, neutrality, and accessibility. Medical visualizations are presented in a scientifically correct and unbiased manner, avoiding misrepresentation of anatomical information. By providing clear and accessible knowledge, SmartCare promotes transparency and supports ethical practices in digital healthcare communication.

7 INTERNSHIP PLAN

The internship was organized according to a structured weekly plan in order to ensure steady progress and achieve the objectives of the SmartCare project. Each week was dedicated to specific tasks, beginning with understanding the project requirements and gradually moving toward the implementation of advanced interactive features. This step-by-step approach allowed the project to evolve in a logical sequence, from initial design to a fully interactive 3D anatomical model. The plan also facilitated regular feedback and adjustments, ensuring that the final product met both technical expectations and the educational goals of the application.

Week 1: Orientation and Requirement Analysis

The first week was dedicated to understanding the SmartCare project, its goals, and its potential impact. I studied the existing version of the application, identified limitations in patient–doctor communication, and reviewed the specifications with my supervisor at Intellcap.

Week 2: UI Redesign and Navigation Setup

During the second week, I worked on redesigning the main user interface pages such as login, registration, and home. I implemented a modern, user-friendly navigation flow to ensure accessibility for non-technical users.

Week 3: Integration of the 3D Avatar (Initial Version)

The third week focused on embedding the 3D anatomical avatar into the application. I introduced basic interactivity, allowing users to rotate and zoom the avatar, and made initial regions such as the head, torso, and heart clickable.

Week 4: Expansion of Interactivity (External Body)

In the fourth week, I extended interactivity to external body parts including the arms (left and right) and legs. Each click triggered the display of a dynamic paragraph explaining the selected body part, enhancing the educational purpose of the application.

Week 5: Internal Organs and Educational Layer

This week was dedicated to implementing interactivity inside the torso. I added clickable organs such as the liver, stomach, intestines, and heart, each linked to both a 3D visualization and an explanatory text. The system also updated the title and description dynamically with each selection.

Week 6: Performance Testing and Refinements

The sixth week focused on validating the performance of the application. I tested loading times, and smoothness of transitions across browsers. Feedback from my supervisor was used to refine the UI and improve usability.

Week 7: Placeholder for AI-driven Features

Although the AI-driven medical diagnosis visualization (such as brain tumor display) was not part of my responsibilities, I implemented the placeholder framework in the application to indicate this upcoming functionality. This ensures that the app is ready for integration with the work of the AI team.

Week 8: Final Review and Documentation

In the last week, I completed the documentation of the interactive 3D model and finalized the internship report. The finished system delivered a fully interactive anatomical avatar with educational features.

8 LITERATURE REVIEW

In recent years, the role of digital technologies in healthcare has attracted significant academic and industrial attention. Researchers consistently highlight that patient engagement and health outcomes are closely tied to the quality of communication between doctors and patients [1]. However, traditional methods of conveying medical information often remain inadequate. Medical reports are written using highly technical vocabulary, while diagnostic images such as X-rays, MRIs, or CT scans require professional expertise to interpret. For non-specialists, this complexity creates confusion, stress, and, in some cases, mistrust toward the healthcare process.

To mitigate these challenges, several studies have emphasized the use of visual aids and educational materials to improve patient understanding. Research has shown that diagrams, illustrations, and simplified charts can support patients in grasping key medical concepts [2]. Nevertheless, such tools remain static and lack interactivity, limiting their effectiveness in situations where a more dynamic representation of anatomy or pathology would be beneficial.

The development of 3D visualization technologies has marked a turning point in medical education and communication. Advances in computer graphics and real-time rendering have enabled the creation of interactive models that allow users to manipulate and explore anatomical structures [3]. These innovations have been widely applied in medical schools and professional training environments, providing students and practitioners with immersive educational experiences. However, most of these solutions are primarily intended for academic or clinical use rather than for direct patient education.

Parallel to this, the rise of digital health applications and mobile health platforms has transformed how patients access and manage their medical information. Studies highlight that such applications contribute to reducing anxiety, improving adherence to treatment, and promoting shared decision-making [4]. Despite these benefits, many existing solutions either provide only general health information or remain too complex for non-specialists to use effectively. In other words, there is a lack of patient-oriented digital tools that combine scientific accuracy with simplicity and interactivity.

The SmartCare project positions itself within this emerging field by addressing precisely this gap. Unlike academic 3D anatomy software, SmartCare is specifically designed for patients, offering an interactive and educational experience that allows users to click on body regions or internal organs and access immediate, comprehensible explanations. By merging 3D interactivity with textual content, SmartCare creates an environment where patients can better understand their conditions and communicate more effectively with their doctors. Moreover, the integration of a placeholder for AI-driven diagnostic visualization reflects the current evolution of digital health toward personalized medicine, where technology not only informs but also adapts to individual medical cases.

In conclusion, the literature demonstrates the importance of innovative communication tools in healthcare and highlights both the strengths and limitations of existing approaches. The SmartCare project contributes to this field by developing a solution that is at once technologically advanced, medically accurate, and socially impactful, thereby responding to a need clearly identified in academic research and professional practice.

9 METHODOLOGY

The methodology adopted for this internship combined a structured development process with the use of modern tools and technologies, ensuring that the objectives of the SmartCare project were met efficiently. Since the aim was to design an interactive and educational 3D anatomical model, it was necessary to follow a systematic approach that balanced technical implementation with usability and performance requirements. The methodology was therefore divided into three main aspects: tools and technologies, workflow, and development phases.

9.1 Workflow

The development followed an **iterative workflow**, inspired by agile methods. Each stage of development was tested and refined before moving on to the next, allowing continuous improvement. Weekly progress was reviewed with supervisors to validate functionality, identify issues, and apply corrections.

The workflow included:

- Requirement gathering and clarification.
- Incremental design of UI and interactivity.

- Integration of 3D models and raycasting logic.
- Testing across browsers.
- Documentation and preparation of deliverables.

This iterative cycle ensured that the application remained aligned with the educational purpose of SmartCare while maintaining technical robustness.

9.2 Development Phases

The implementation was carried out in progressive phases:

- **Activity 1: Requirement Analysis** — understanding project objectives and defining specifications.
- **Activity 2: UI Design and Navigation** — building the base interface and clear navigation flow.
- **Activity 3: Initial 3D Integration** — embedding the anatomical avatar with basic interactivity.
- **Activity 4: Full Interactivity** — extending interactions to all external and internal body parts.
- **Activity 5: Educational Layer** — linking each part to descriptive paragraphs for patient understanding.
- **Activity 6: Performance Testing** — validating the speed, and usability.
- **Activity 7: AI Placeholder Integration** — preparing the structure for future AI-driven diagnostic features.

This structured methodology ensured that the internship achieved its primary goal: delivering a fully interactive, educational anatomical model that represents the foundation of SmartCare as a patient-centered digital health application.

9.3 Tools and Technologies

To implement the interactive 3D model, a set of specialized tools and frameworks were employed:

- **Three.js**: used for real-time rendering and interactivity of 3D anatomical models within the browser [5].

- **Blender**: applied for preparing and exporting anatomical models in GLB format, enabling segmentation of organs and body parts [6] [7].
- **Flask (Python)**: served as the backend framework for routing, templating, and server logic [8].
- **HTML, CSS, and JavaScript**: ensured a user-friendly design and accessibility of the interface across devices [9].

These technologies were selected to ensure cross-platform compatibility, smooth performance, and scalability for future integration with AI modules.

10 ARCHITECTURE, SIMULATIONS, RESULTS, AND INTERPRETATION

10.1 High-Level Architecture of the System

The SmartCare application is designed as a **three-layer system** that separates the front-end interface, the back-end logic, and the data layer. This modular design ensures maintainability, security, and readiness for future AI integration.

1. Presentation Layer (Front-End)

- **Technologies:** HTML, CSS, JavaScript, Three.js
- **Role:** Provides the user interface for patient interaction.
- **Functions:**
  - Loads and displays the 3D anatomical models.
  - Captures user interactions (click, rotate, zoom).
  - Dynamically updates the interface with the name and educational description of the selected anatomical element.

2. Application Layer (Back-End)

- **Technology:** Flask (Python)
- **Role:** Manages the application's business logic, routing, and communication between the UI and the database.
- **Functions:**

- **Authentication & Accounts:** Handles user **sign-up**, **log-in**, and **session management**. Passwords are securely hashed before being stored.
- **SmartCare Module:** Serves the correct 3D model and description when the user interacts with the body.
- **File Management:** Supports medical file uploads and retrieval via GridFS.
- **AI Placeholder:** Provides integration points for future diagnostic features (e.g., brain tumor visualization) being developed by the AI team.

3. Data & Assets Layer

- **MongoDB:**
  - Stores **user credentials** (accounts collection) and session information.
  - Manages patient-related data such as reports, appointments, billing, and uploaded medical images.
  - GridFS is used for storing large files (diagnostic images).
- **Static Assets:**
  - 3D anatomical models (GLB files) are stored locally in the static/3d_Models/ directory and served by Flask.
  - Educational text is bundled with the application as static content/templates, not stored in MongoDB.

10.2 System Workflow

1. A patient signs up or logs in → credentials checked against **MongoDB**.
2. Upon authentication, the patient accesses the **SmartCare 3D interface**.
3. When the user clicks on a body region, the **front-end (Three.js)** captures the event and sends a request to **Flask**.
4. Flask fetches the corresponding GLB file (static asset) and descriptive text, then returns it to the interface.
5. The front-end updates the 3D view and displays the explanatory paragraph in real time.
6. For uploads, files are stored via **GridFS** in MongoDB and linked to patient records.

10.3 Simulations

To validate the functionality of the interactive 3D anatomical model, several simulations were conducted on different platforms and devices. The simulations aimed to test three key aspects: interactivity, performance, and educational usability. Interactivity was assessed by clicking on body parts (head, torso, arms, legs) and internal organs (heart, liver, stomach, intestines) to verify whether the system correctly displayed 3D visualizations and updated explanatory text. Performance tests included checking loading speed and smooth transitions when rotating or zooming the model. Usability was simulated by evaluating whether a non-technical user could intuitively navigate the application and understand the information presented.

10.4 Results

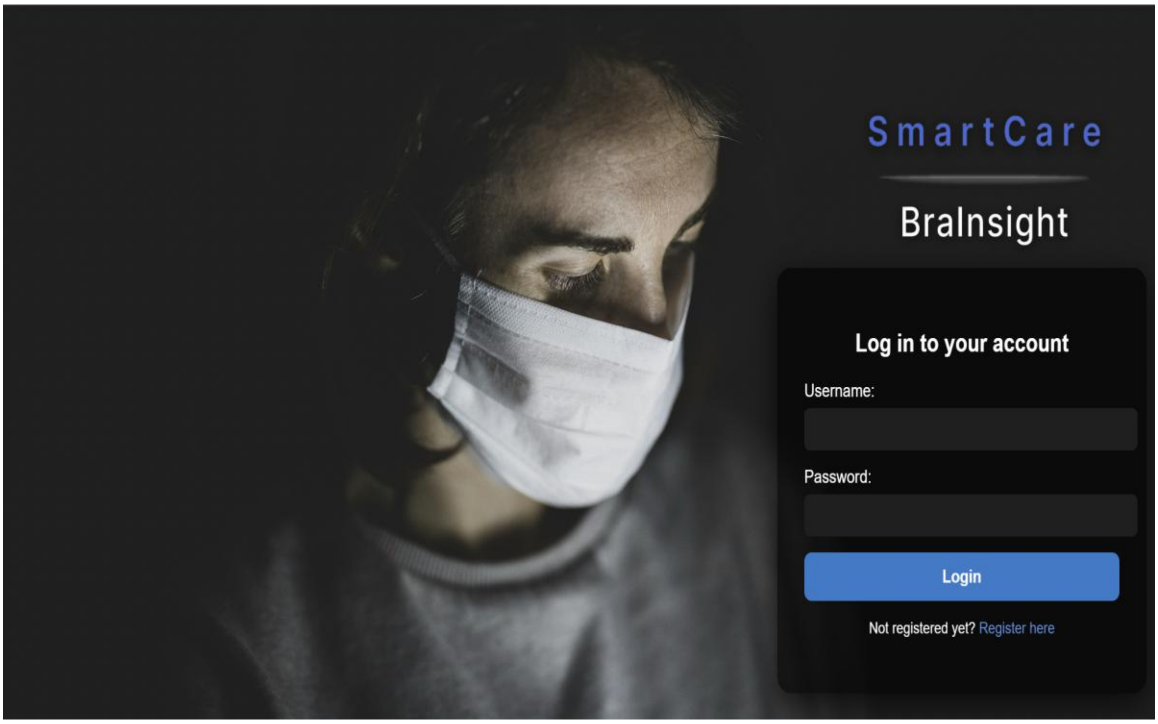
The results of the simulations confirmed that the system performed according to specifications. All external body regions and internal organs responded correctly to user clicks, with the name of the selected part and a descriptive paragraph displayed in real time. The 3D model rendered smoothly in modern browsers such as Chrome, Firefox, and Edge, with acceptable loading times even on mid-range devices. The interface ensured accessibility for a broad range of users. Feedback from supervisors highlighted the clarity of the UI and the educational value of the interactive content. Furthermore, the placeholder for AI-driven diagnostic visualization was successfully integrated, providing a visible framework for future functionalities.

10.5 Interpretations

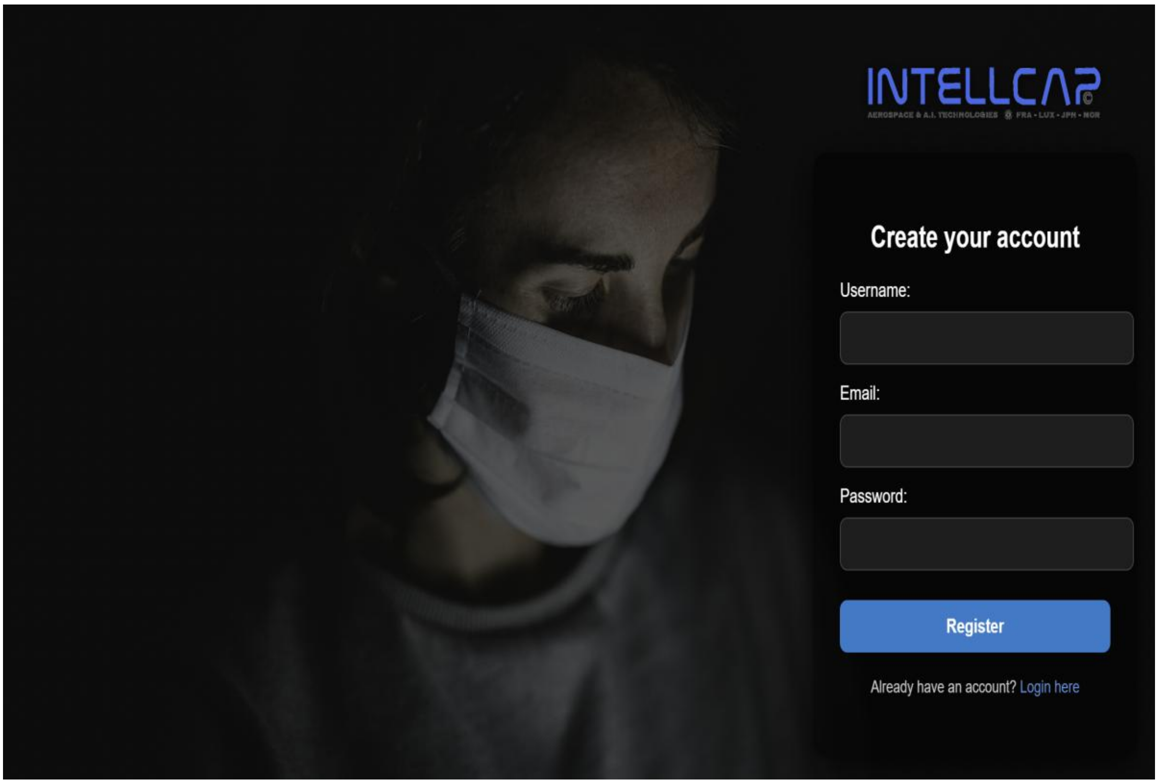
The successful completion of these simulations demonstrates that the project achieved its primary objectives: delivering a functional and educational interactive 3D model. The results indicate that SmartCare effectively reduces the communication gap between healthcare professionals and patients by transforming static medical content into an engaging learning experience. The ability to explore anatomy interactively, combined with textual explanations, makes medical information more accessible and less intimidating for non-specialists.

Although advanced AI features such as automated diagnosis visualization remain under development, the delivered system forms a solid foundation for future integration. This confirms that the internship not only met its immediate technical goals but also contributed to Intellcap's broader mission of creating patient-centered digital health solutions.

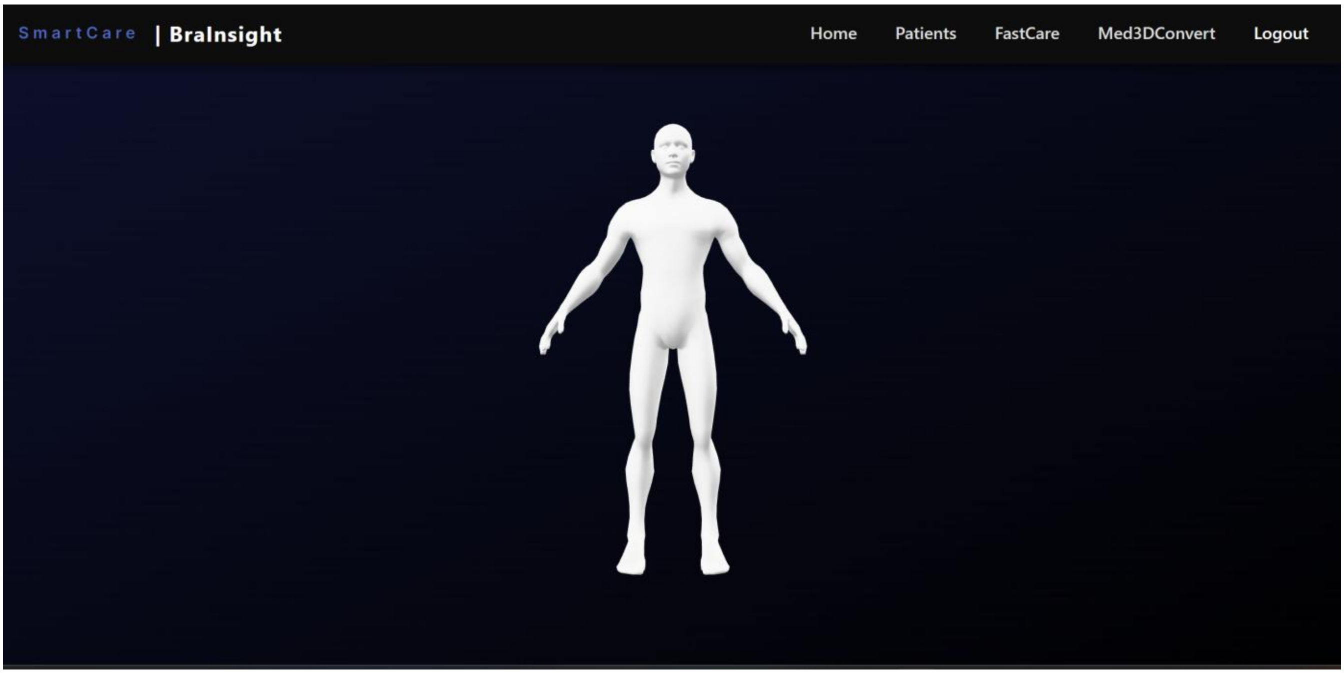
10.5.1 Login Page:



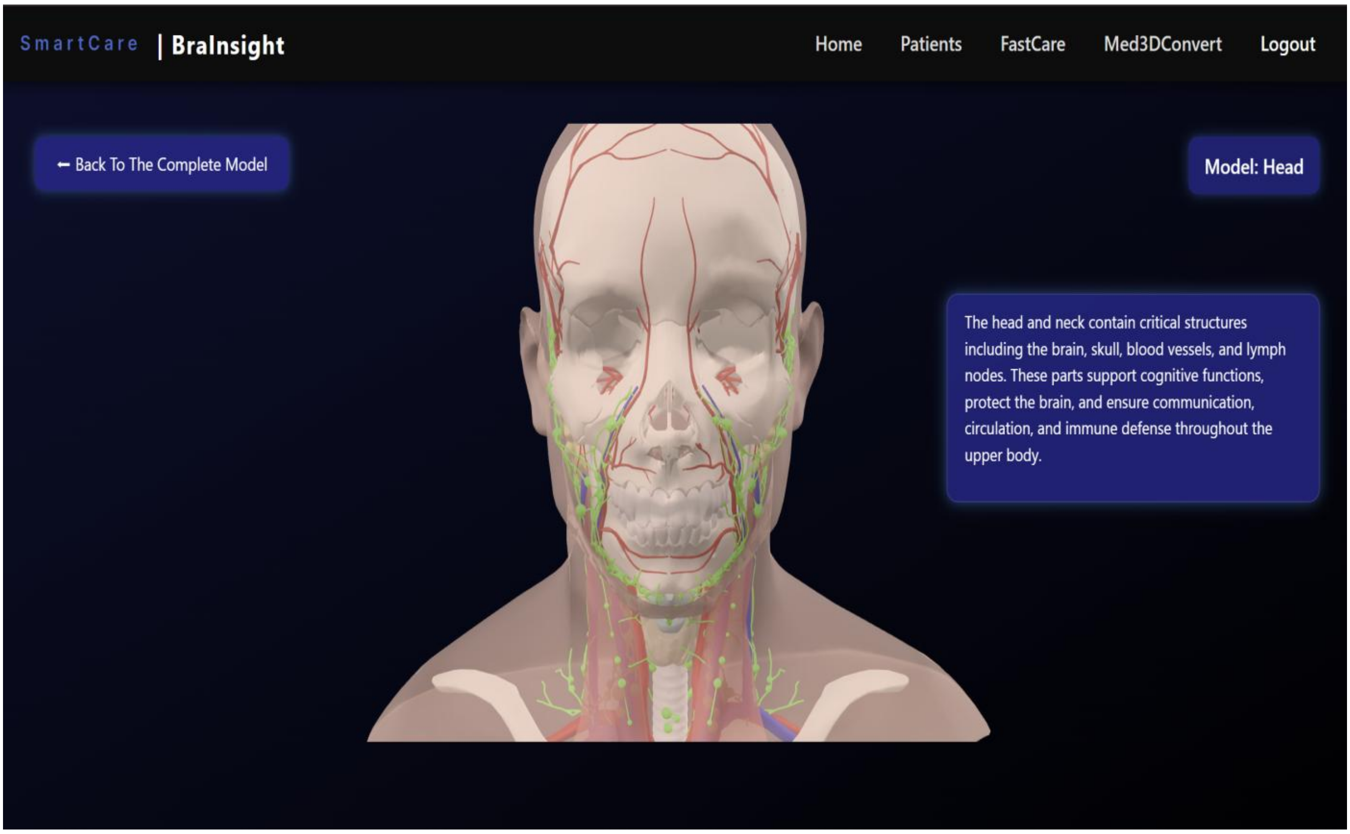
10.5.2 Sign Up Page:



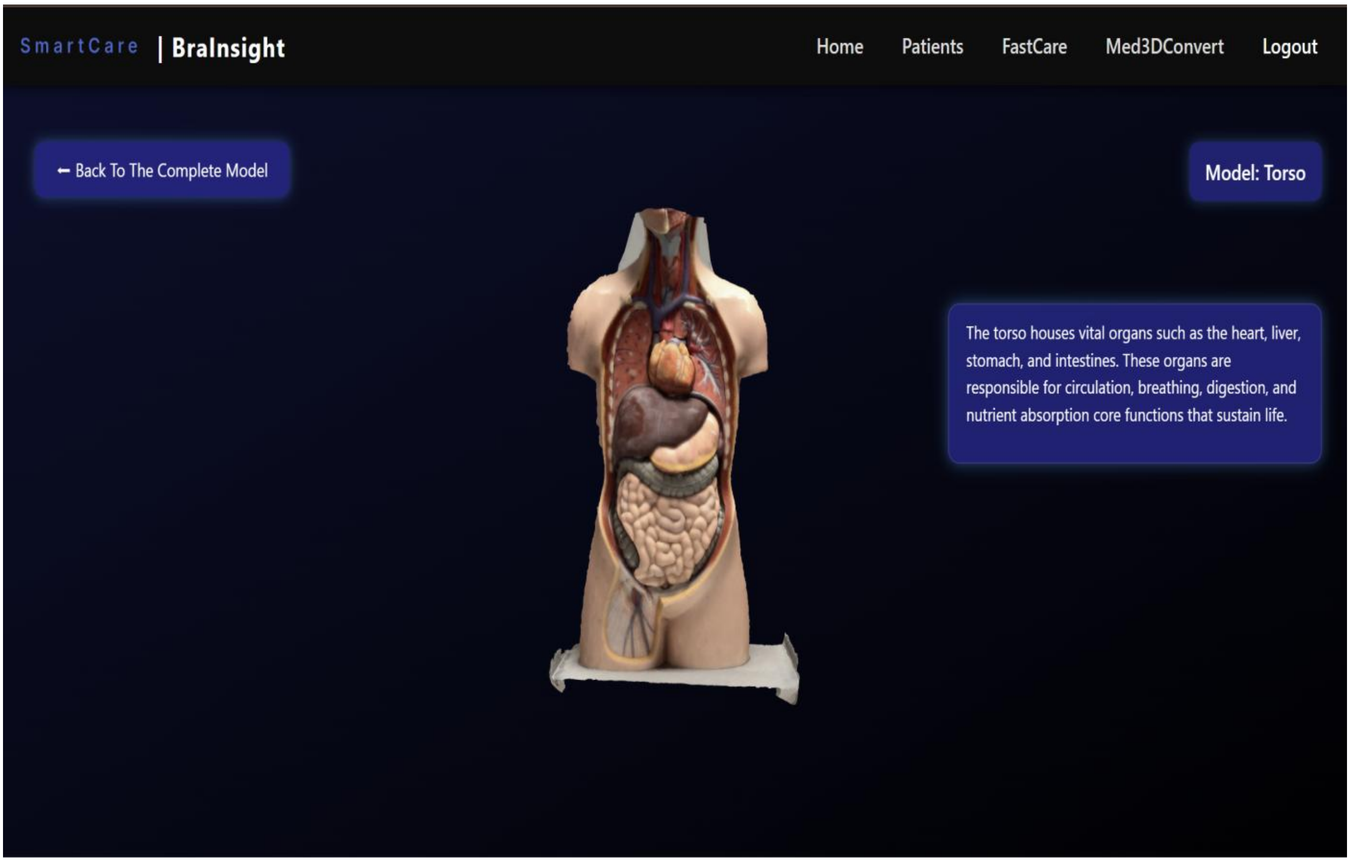
10.5.3 Home Page:



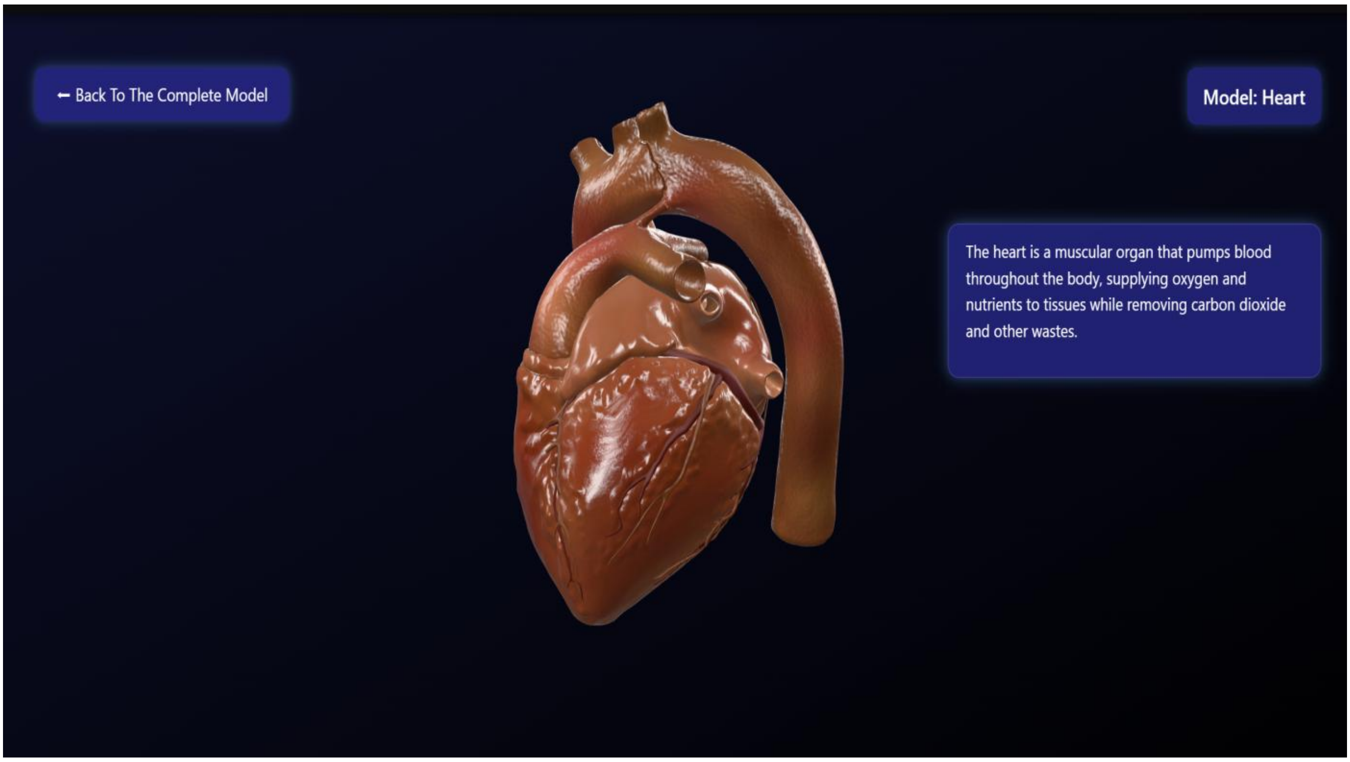
10.5.4 Head model:



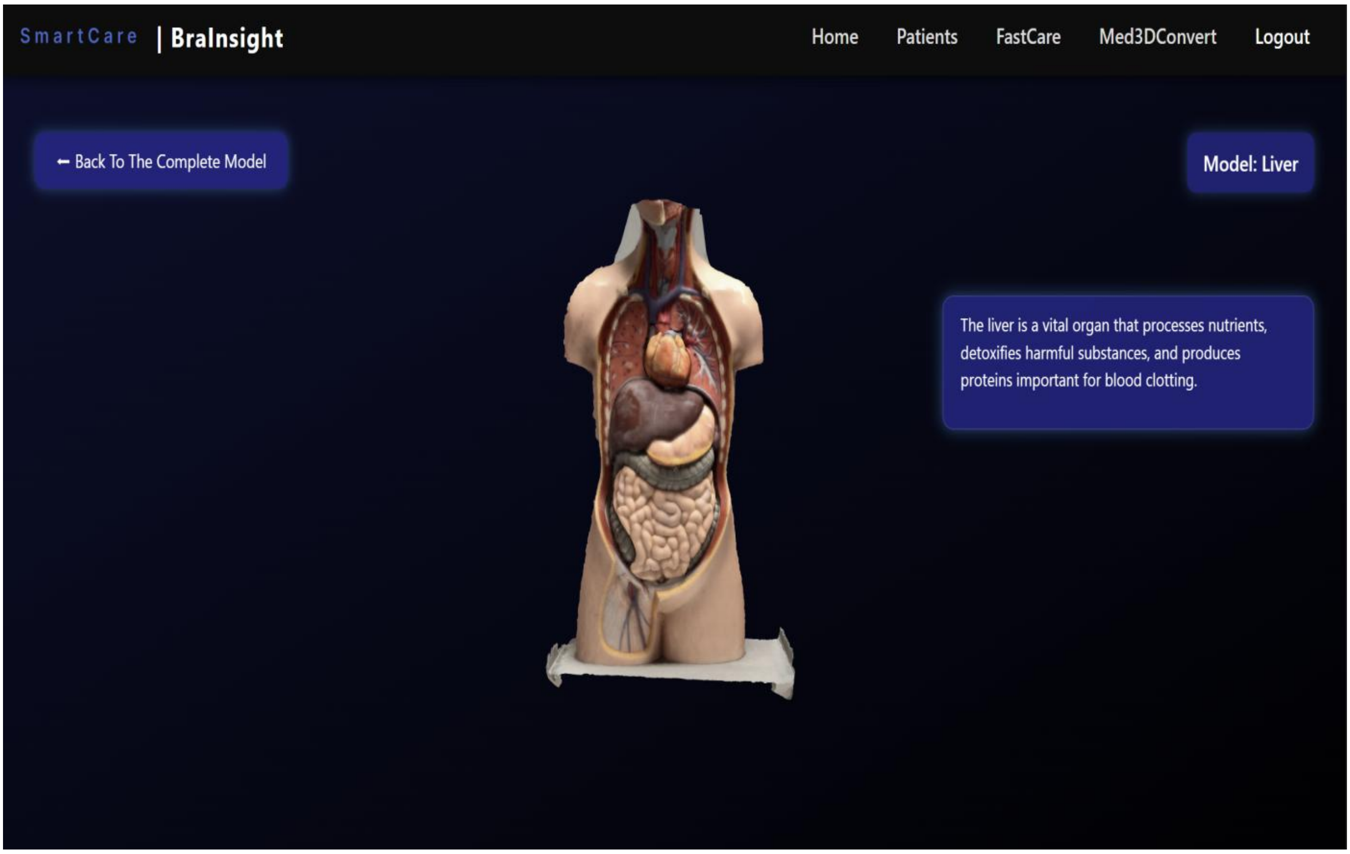
10.5.5 Torso Model:



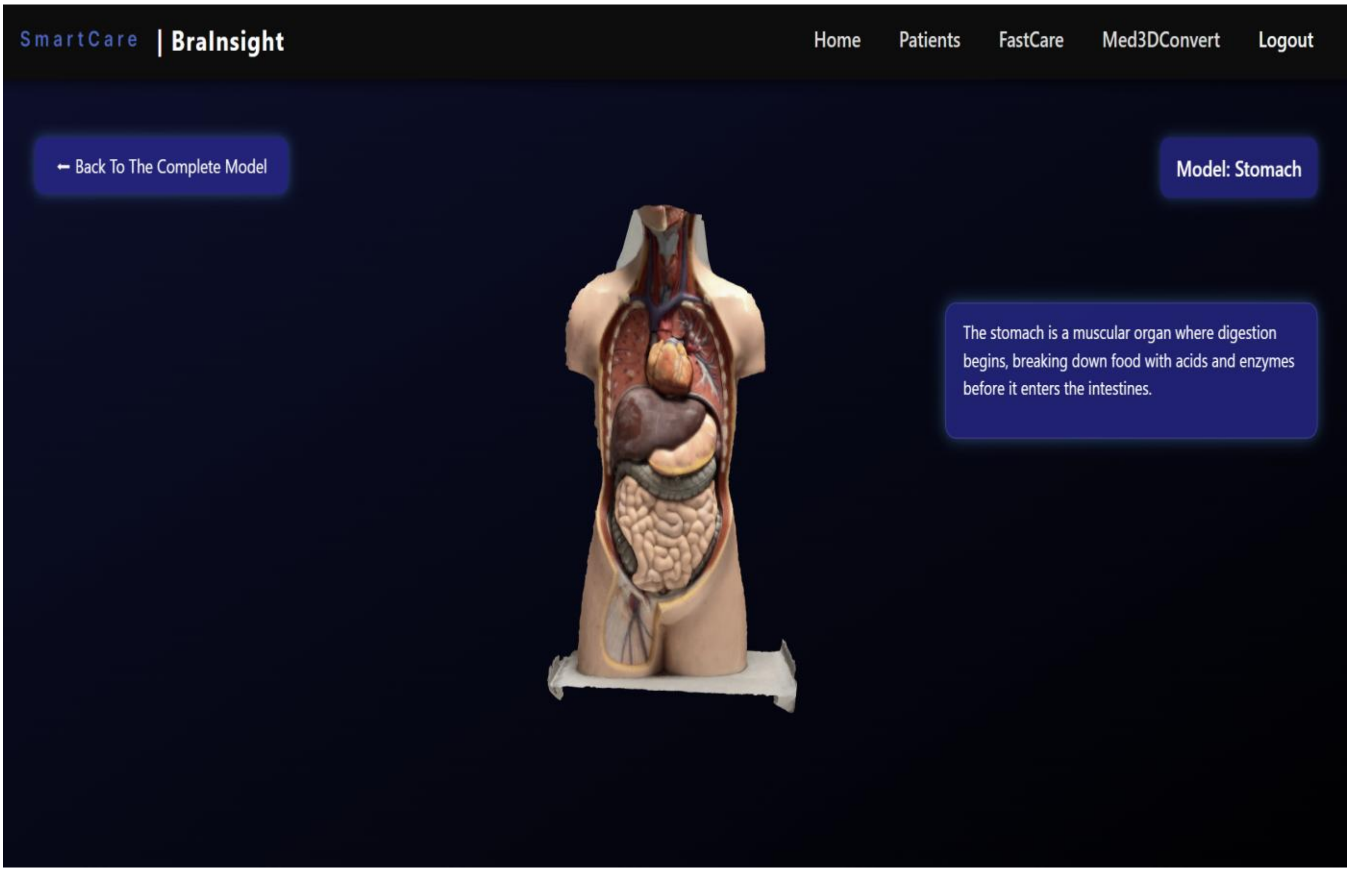
10.5.6 Heart Model (inside the Torso):



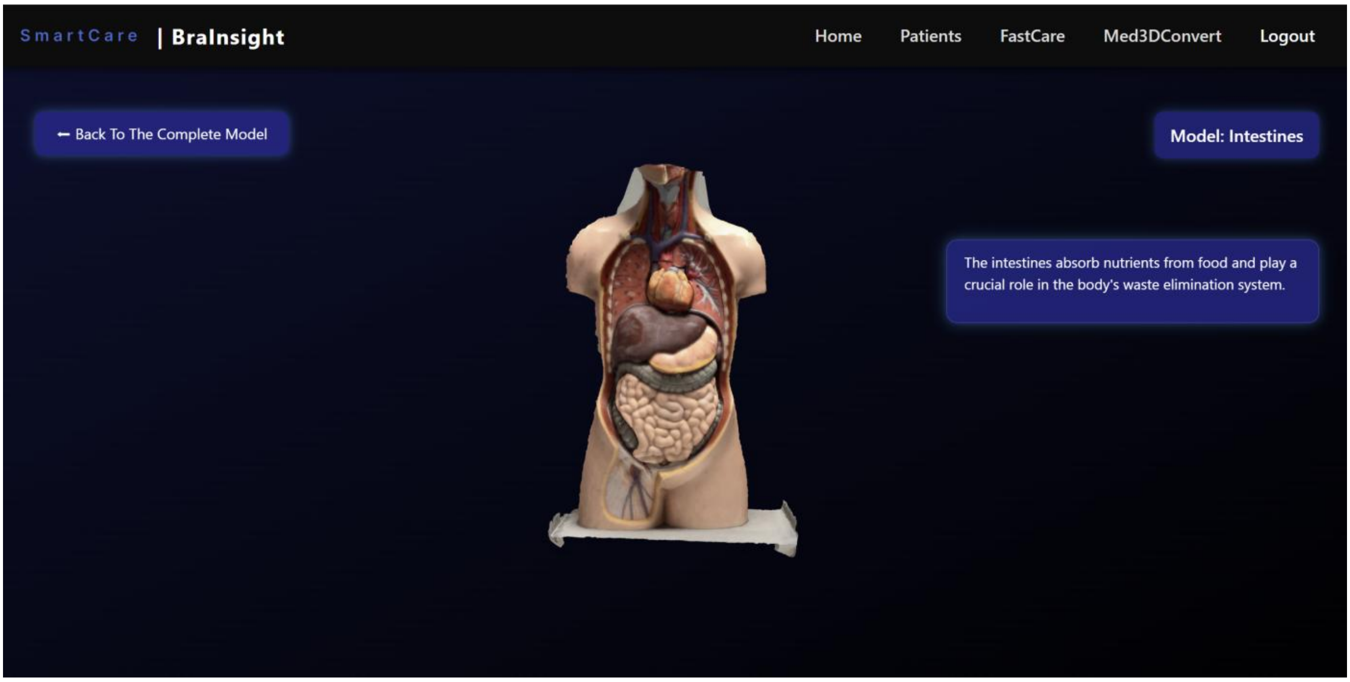
10.5.7 Liver Model:



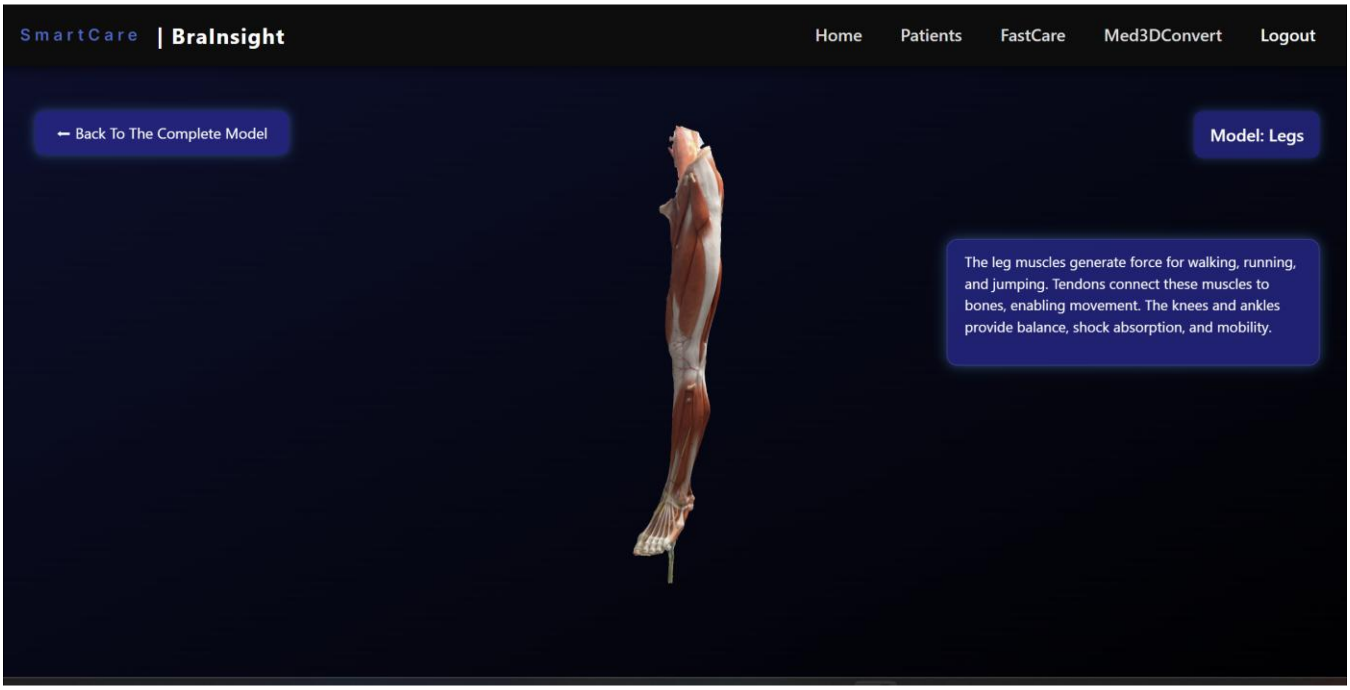
10.5.8 Stomach Model:



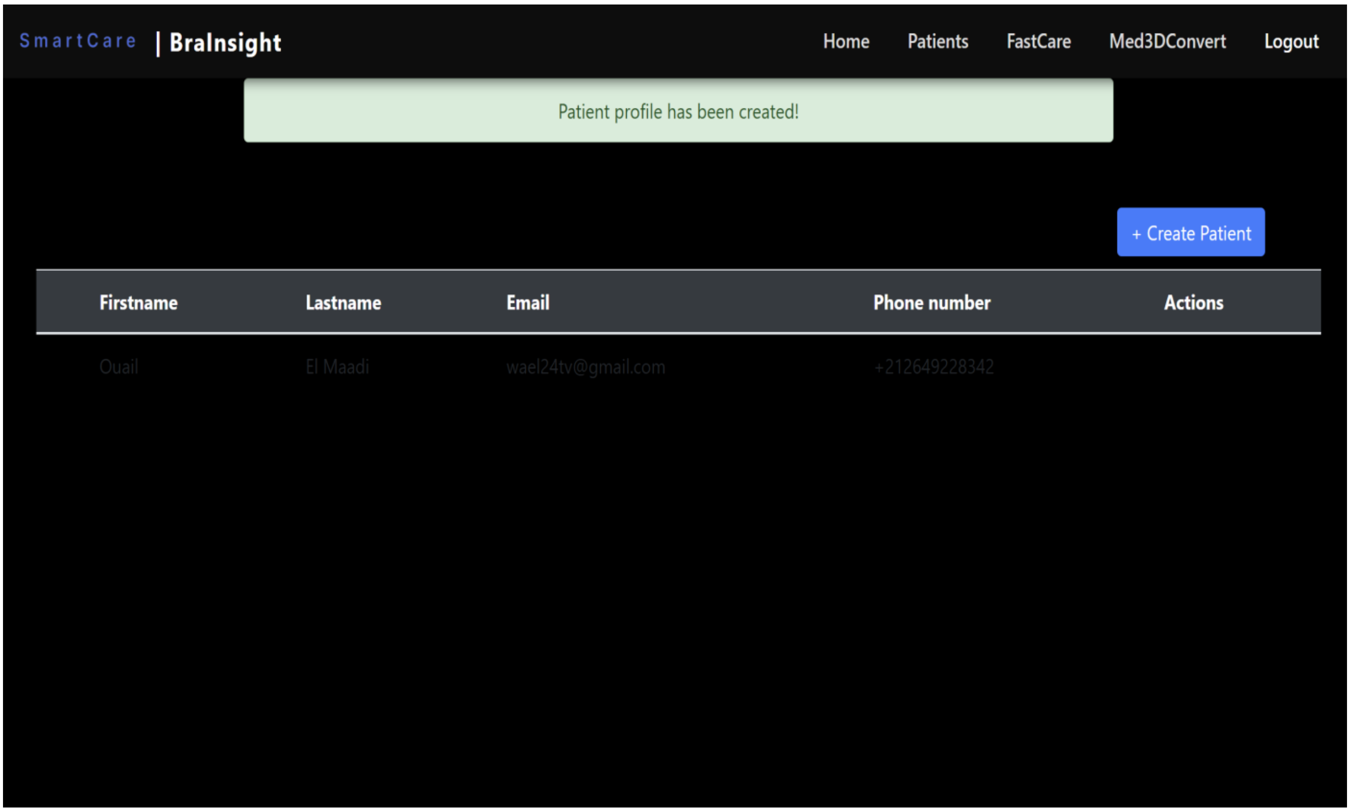
10.5.9 Intestines Model:



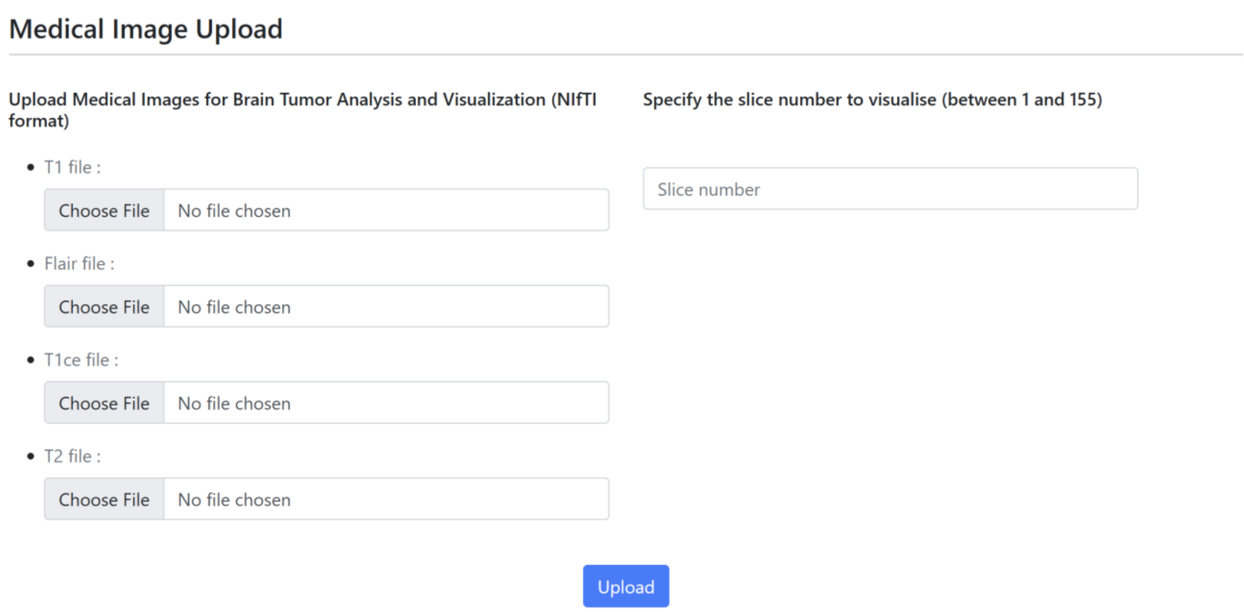
10.5.10 Legs Model:



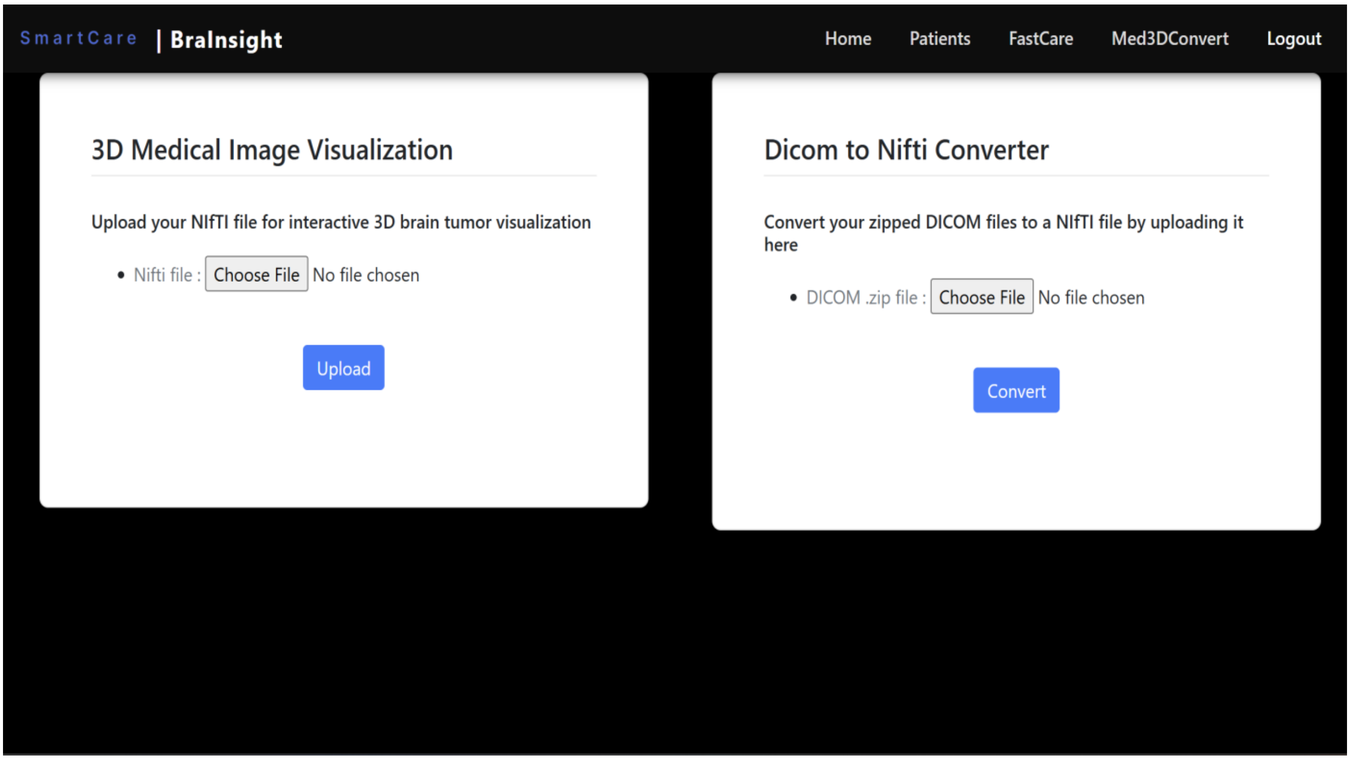
10.5.11 Patients Page:



10.5.12 FastCare Page:



10.5.13 Med3Convert Page:



11 LEARNING STRATEGIES

The internship at Intellcap provided not only technical experience but also an opportunity to refine and expand my learning strategies. Since the project combined new technologies, interdisciplinary knowledge, and practical problem-solving, I had to adopt a variety of approaches to ensure steady progress and successful outcomes.

One of the most important strategies was progressive and incremental learning. The technologies involved Three.js for 3D rendering, Flask for backend logic, and Blender for model preparation were unfamiliar at the beginning. Instead of attempting to master them all at once, I divided the learning process into smaller, manageable tasks. For example, I first focused on understanding how Three.js loads and renders a basic 3D object before moving to more advanced features like raycasting, object selection, and interaction. This incremental method allowed me to build confidence gradually and minimize errors.

A second strategy was self-directed research and use of digital resources. Online tutorials, official documentation, and community forums provided essential support whenever I encountered technical challenges. In addition, I often analyzed code snippets or examples from similar projects to adapt solutions to my own context. This independent research skill not only accelerated problem-solving but also gave me greater autonomy in handling unexpected issues.

At the same time, I relied heavily on supervised learning and feedback. Regular meetings with my supervisor were opportunities to validate my progress, clarify uncertainties, and align my work with the company’s expectations. This feedback loop reinforced the importance of collaboration and helped me improve both the technical design and the user experience aspects of the application.

Another key learning strategy was reflective practice. At the end of each development phase, I reviewed what worked well, what challenges I faced, and how I could adapt my approach moving forward. This reflection encouraged me to identify strengths, such as problem-solving with code optimization, and weaknesses, such as overcomplicating initial UI designs. Over time, this process improved my efficiency and adaptability.

Finally, I adopted a strategy of applied interdisciplinarity. The internship required me to connect computer science skills (programming, modeling, debugging) with medical knowledge (basic anatomy, user-centered design in healthcare). To do this, I studied anatomy references to ensure accuracy in labeling organs and combined this with UI/UX best practices to ensure that patients could easily interact with the system. This strategy demonstrated the importance of bridging disciplines to create solutions that are both technically sound and socially relevant.

Overall, these strategies incremental learning, self-directed research, supervised guidance, reflective practice, and interdisciplinary application enabled me to overcome challenges, acquire new skills, and deliver a project aligned with Intellcap’s vision of patient-centered digital health.

Conclusion

This internship at Intellcap provided me with an invaluable opportunity to apply my academic knowledge to a real-world challenge in the field of digital health. The development of the SmartCare interactive 3D anatomical model allowed me to explore the intersection of computer science, medical visualization, and user-centered design. By successfully delivering a fully interactive system covering external body regions and internal organs with descriptive educational content I was able to contribute a key component to SmartCare's mission of making healthcare communication more accessible and engaging.

Beyond the technical aspects, this experience reinforced the importance of adaptability, incremental learning, and collaboration. Working with technologies such as Three.js, Blender, Flask, MongoDB, HTML and CSS required both self-directed study and continuous feedback from supervisors, which together enhanced both the quality of the deliverables and my own professional growth.

Although the AI-driven diagnostic visualization features (such as brain tumor detection) remain under development by the AI team, my contribution established the functional and educational foundation upon which these advanced modules can be integrated. The project therefore not only met its immediate objectives but also positioned SmartCare for future expansion as a comprehensive patient-centered digital health platform.

Overall, this internship strengthened my technical skills, deepened my understanding of healthcare challenges, and demonstrated the impact of innovative digital tools in improving patient engagement. It represents a meaningful step in my academic and professional journey, and I am confident that the lessons learned here will guide my future endeavors in technology and innovation.

References

[1] Ha, J. F., & Longnecker, N. (2010). *Doctor–patient communication: A review*. The Ochsner Journal, 10(1), 38–43.

[2] Houts, P. S., Doak, C. C., Doak, L. G., & Loscalzo, M. J. (2006). *The role of pictures in improving health communication: A review of research on attention, comprehension, recall, and adherence*. Patient Education and Counseling, 61(2), 173–190.

[3] McMenamin, P. G., Quayle, M. R., McHenry, C. R., & Adams, J. W. (2014). *The production of anatomical teaching resources using three-dimensional (3D) printing technology*. Anatomical Sciences Education, 7(6), 479–486.

[4] Giansanti, D. (2020). *The role of digital health technologies in medical applications: The state of the art*. Healthcare, 8(3), 287. doi:10.3390/healthcare8030287.

[5] Dirksen, J. (2013). *Learning Three.js: The JavaScript 3D Library for WebGL*. Packt Publishing.

[6] Blender Foundation. (n.d.). *Blender Manual: Import/Export – glTF 2.0/GLB*. Available at: https://docs.blender.org/manual/en/latest/addons/import_export/scene_gltf2.html

[7] Blender Foundation. (2022). *Blender 3.0 Reference Manual*. Blender Documentation. Available at: https://docs.blender.org/manual/en/3.0/

[8] Grinberg, M. (2018). *Flask Web Development: Developing Web Applications with Python* (2nd ed.). O'Reilly Media.

[9] Mozilla Developer Network (MDN). (2023). *HTML, CSS, and JavaScript Documentation*. Mozilla Foundation. Available at: https://developer.mozilla.org