### **1. Project Title**

**Mobile App for Real-Time Skin Cancer Detection Using Machine Learning**

### **2. Names and Email Addresses of Team Members**

This project is being developed by a team of Computer Science and Engineering students composed of:

Nikiraj Konwar ([nkonwar2020@my.fit.edu](mailto:nkonwar2020@my.fit.edu))

Lawson Darrow ([ldarrow2023@my.fit.edu](mailto:ldarrow2023@my.fit.edu))

Nicolas Rincon-Speranza ([nrinconspera2022@my.fit.edu](mailto:nrinconspera2022@my.fit.edu))

Christian Stevens ([cstevens2023@my.fit.edu](mailto:cstevens2023@my.fit.edu))

The CSE members are the primary contributors responsible for the design, development, and integration of the machine learning model with the mobile app. Additional interdisciplinary collaborators may also participate in providing domain-specific knowledge, particularly in dermatology or human-computer interaction.

### **3. Faculty Advisor: Name and Email Address**

The project is guided by Dr. Nematzadeh, who will provide oversight on both the technical implementation and the academic rigor of the project. The advisor can be reached at [znematzadeh@fit.edu](mailto:znematzadeh@fit.edu). Their role includes evaluating progress, offering feedback on design and implementation decisions, and ensuring that the final deliverable meets both academic and professional standards.

### **4. Client: Name and Affiliation**

The client for this project is Dr. Nematzadeh. The client’s input helps to ensure that the app is not only technically functional but also practical, accessible, and aligned with the needs of real users in healthcare and consumer technology.

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### **5. Date(s) of Meeting(s) with the Client**

Initial discussions with the client were held on August 27, 2025, during which the project scope, user needs, and potential impact were clearly defined. Follow-up meetings are scheduled bi-weekly throughout the semester to review prototypes, receive feedback on usability, and validate the effectiveness of the implemented features. These interactions with the client are essential for refining requirements and ensuring the final app is user-centered.

### **6. Goal and Motivation**

Skin cancer remains one of the most common and deadly forms of cancer worldwide. Early detection is directly correlated with improved survival rates, yet many individuals do not have easy access to dermatologists or routine skin checks. Current systems heavily rely on medical appointments, which can be expensive, time-consuming, and geographically inaccessible for patients living in rural or underserved areas.

The primary goal of this project is to develop a mobile application that empowers users to capture or upload images of suspicious skin lesions and receive immediate feedback in the form of a preliminary risk assessment. By providing accessible, on-demand screening, the app aims to encourage individuals to seek professional medical advice earlier than they otherwise might. The motivation behind this project is rooted in addressing the limitations of the current system: barriers to access, lack of awareness, and delays in medical consultation. In short, the app’s purpose is to make users “happier” by reducing anxiety, giving them accessible tools for self-monitoring, and ultimately helping improve health outcomes.

### **7. Approach: Key Features of the System**

**Image Capture and Upload** The first major feature of the app is its ability to capture and upload skin lesion images. Users will have the option of taking photos directly within the app using their smartphone camera, or they may upload existing images from their photo library. To ensure quality input, the app will guide users with framing assistance such as overlays or visual indicators that help align the lesion in the center of the frame. This ensures consistency and clarity, which are essential for accurate machine learning predictions.

**Real-Time AI-Powered Prediction** The core functionality of the system is its ability to analyze images in real time and provide predictions. A Convolutional Neural Network (CNN), trained on the ISIC dataset of skin lesion images, will classify lesions as either benign or malignant risk. Predictions will be presented to the user in a clear format, along with confidence percentages that help communicate how certain the model is in its assessment. This feature directly addresses the overall project goal: equipping users with immediate, actionable information about potential health concerns.

**User Guidance and Medical Disclaimer** To avoid misuse and ensure responsible deployment, the app includes built-in disclaimers and user guidance. Results will always be framed as preliminary and informational rather than diagnostic. For example, if the model detects high risk, the app will provide specific recommendations such as “We recommend seeking professional consultation.” Additionally, the app will display educational content on skin cancer warning signs, prevention strategies, and links to professional resources. This feature enhances user trust and ensures that the app complements, rather than replaces, professional medical care.

### **8. Novel Features and Functionalities**

This project stands out due to several innovative features. First, predictions are made entirely on-device through TensorFlow Lite, eliminating the need to upload sensitive medical images to cloud servers. This privacy-first approach addresses one of the most significant concerns in digital healthcare: protecting user data. Second, the app is designed for low-latency inference, allowing users to receive results almost instantly without requiring constant internet connectivity. Third, the integration of educational resources makes the app more than just a prediction tool—it also serves as a platform for raising awareness and encouraging preventive care. Together, these functionalities make the app both novel and impactful.

### **9. Algorithms and Tools**

The system will rely on several advanced algorithms and software tools. The machine learning model will be based on convolutional neural networks using transfer learning from architectures such as MobileNet, EfficientNet, or ResNet. These models are well-suited for image classification tasks and can be fine-tuned to the ISIC dataset for skin lesion detection. TensorFlow Lite will be used to convert the trained model for deployment on mobile devices, ensuring efficient inference with reduced computational overhead. For mobile development, Flutter has been selected as the framework due to its ability to support both Android and iOS platforms with a single codebase. Additionally, OpenCV and related image preprocessing libraries will handle resizing, cropping, and normalization of images before they are fed into the model. Together, these tools ensure that the app is both technically sound and accessible across multiple platforms.

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### **10. Technical Challenges**

This project faces several significant technical challenges.

**Model Accuracy and Dataset Limitations:** One of the biggest challenges in skin cancer detection is dealing with class imbalance, since malignant cases are less common than benign ones. This can bias the model toward predicting benign outcomes.

**Mobile Performance Optimization:** Running deep learning models on mobile devices presents challenges in terms of memory usage, processing power, and inference speed. Achieving real-time predictions without sacrificing accuracy requires techniques such as quantization, pruning, and careful model selection. Balancing accuracy and efficiency is critical for ensuring usability.

**User Trust and Compliance:** Another challenge is ensuring that users interpret the app’s predictions responsibly. Without clear disclaimers, users may mistake predictions for medical diagnoses, which could have dangerous consequences. Addressing this requires careful UI/UX design, consistent language in results presentation, and adherence to ethical standards in healthcare technology.

### **Outcome**

By the end of the project, the team will deliver a fully functional mobile application that can capture and upload skin lesion images, analyze them using an optimized CNN model, and provide real-time predictions directly on the device. The app will not only demonstrate the practical integration of machine learning into mobile software but also serve as a tool that empowers individuals to take proactive steps toward monitoring their skin health. While the app is not intended to replace medical care, it has the potential to raise awareness, encourage earlier professional consultations, and contribute to the broader goal of reducing the impact of skin cancer worldwide.

### **11. Milestone 1 (Sep 29): Data Preparation & Initial Model Training**

* Compare and select technical tools for mobile app development (Flutter), machine learning (TensorFlow/Keras), and image preprocessing (OpenCV).
* Provide small “hello world” demos for app interface, model loading, and image capture functionality.
* Resolve technical challenges related to dataset preprocessing, initial CNN model integration, and Flutter–TensorFlow Lite compatibility.
* Compare and select collaboration tools for code management (GitHub), documentation (Google Docs), communication (Slack), and scheduling (Google Calendar).
* Create Requirement Document, Design Document, and Test Plan.

### **12. Milestone 2 (Oct 27): Core Implementation & Prototype**

* Implement, test, and demo **image capture and upload feature** with UI framing assistance.
* Implement, test, and demo **real-time AI-powered prediction feature** (integrated TensorFlow Lite CNN model).
* Implement, test, and demo **disclaimer and educational resource integration** (user guidance, preventive info, professional links).
* Validate prototype with test images and document early usability findings.

### **13. Milestone 3 (Nov 24): Final Integration & Evaluation**

* Implement, test, and demo **privacy-first on-device inference** with optimizations (quantization, pruning).
* Implement, test, and demo **cross-platform deployment** on Android and iOS.
* Conduct system-wide testing (accuracy, performance, latency).
* Refine UI/UX for user trust and compliance with healthcare standards.
* Deliver final project package: app, documentation, and presentation.

### **14. Task Matrix for Milestone 1**

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| --- | --- | --- | --- | --- |
| Task | Lawson | Nikiraj | Nicolas | Christian |
| Compare and select Technical Tools | TensorFlow/Keras | Flutter SDK | OpenCV | Flutter SDK |
| “Hello World” Demos | CNN model demo | UI/Camera demo | Model-app integration | UI/Camera demo |
| Resolve Technical Challenges | Data preprocessing | TensorFlow Lite Setup | API integration | TensorFlow Lite Setup |
| Requirement Document | 25% | 50% | 25% | 0% |
| Design Document | 50% | 25% | 0% | 25% |
| Test Plan Document | 25% | 25% | 50% | 0% |

### **15. Approval from Faculty Advisor**

"I have discussed with the team and approve this project plan. I will evaluate the progress and assign a grade for each of the three milestones."

Signature:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_