Riphah International University Lahore, Pakistan

Riphah School of Computing & Innovation

FINAL YEAR PROJECT

PROJECT PROPOSAL & PLAN

HAIRLYTIC

Project Team

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HairLytic

Change Record

Author(s)	Version	Date	Notes	Supervisor's Signature
	1.0		Original Draft	
			Changes Based on Feedback from Supervisor	
			Changes Based on Feedback From Faculty	
			Added Project Plan	
			Changes Based on Feedback from Supervisor	

Project Proposal

Project Title: Hairlytic

Executive Summary

Hairlytic is an **AI-powered web platform** that enables **at-home diagnosis and management of alopecia** through a combination of **live scalp analysis, medical questionnaires, report evaluation, and guided self-assessment tests**.

The platform guides users to capture scalp images using their device's camera while following on-screen instructions for proper angles and lighting. These images are analyzed using advanced machine learning models trained to detect **the presence, type, and severity of alopecia**.

To complement image analysis, Hairlytic incorporates an intelligent **questionnaire module** that gathers diagnostic data, including patient medical history, hereditary patterns, medication use, and lifestyle factors associated with alopecia. Users can also **upload medical or dermatological reports** that help refine the AI's diagnostic accuracy and confirm the probable alopecia type.

In addition, Hairlytic simulates standard **clinical hair assessments**—such as the **Hair Pull Test**, **Tug Test**, and **Hair Count Test**—through guided, camera-based procedures that users can perform easily at home. The outcomes of these assessments, combined with visual and historical data, are processed to generate a detailed diagnostic report and recommendations.

1. Introduction

Alopecia, a condition leading to partial or complete hair loss, affects millions worldwide and often causes both physical and emotional distress. Traditional diagnosis requires dermatological expertise and specialized equipment, making early detection difficult for many individuals.

Hairlytic addresses this challenge through an **AI-based web platform** that enables users to **diagnose alopecia from home**. The system combines **live scalp image analysis**, **medical questionnaires**, **report uploads**, and **guided self-assessment tests** such as the Hair Pull and Hair Count tests to identify the **type and severity of alopecia**.

2. Existing System / Competitive Analysis

Features	TrichoScan	MyHair.ai	MDhair	DermaQ	iHairium	HairSnap / HairLoss AI	Regrow Hair AI	Hairlytic
AI-Based Alopecia Detection	✓	✗	✓	✓	✗	✗	✗	✓
Live Camera Scanning	✗	✓	✓	✗	✓	✓	✓	✓
Questionnaire-Based Diagnosis	✗	✗	✓	✓	✗	✗	✗	✓
Medical Report Upload & Analysis	✗	✗	✗	✗	✗	✗	✗	✓
At-Home Test Simulation (Hair Pull, Tug, Count)	✗	✗	✗	✗	✗	✗	✗	✓
Real-Time Analysis & Results	✗	✓	✓	✗	✓	✓	✓	✓
All-in-One Alopecia Diagnosis Ecosystem	✗	✗	✗	✗	✗	✗	✗	✓

3. Problem Statement

Alopecia, a condition causing partial or complete hair loss, affects millions worldwide and often leads to emotional and physical distress. Accurate diagnosis usually requires dermatological expertise and specialized tools, making early detection difficult for most individuals. Existing apps focus mainly on general hair health or cosmetic advice, lacking medical accuracy and integrated support. There is a need for an **AI-based, accessible platform** that can help users **detect and understand alopecia types from home** and provide reliable management options.

4. Proposed Solution

Hairlytic is an **AI-powered web platform** developed to enable **at-home diagnosis and management of alopecia**. The system uses **live camera scanning** with guided head movements to capture clear scalp images, which are analyzed by **machine learning models** to detect alopecia presence, type, and severity.

In addition to image-based analysis, Hairlytic incorporates a **questionnaire and report analysis module** that collects user medical history, hereditary information, and uploaded diagnostic reports (such as blood tests or dermatology notes) to enhance the precision of diagnosis. The platform also simulates **at-home versions of standard hair assessments**, including the Hair Pull Test, Tug Test, and Hair Count Test, allowing users to perform simple guided evaluations through their camera.

5. Scope of the Project

The Hairlytic platform is an **AI-powered web application** focused exclusively on **alopecia detection and management**. It combines **machine learning**, **guided self-assessment tests**, **questionnaire-based analysis**, and **medical report evaluation** to provide users with accurate at-home diagnosis and practical treatment support.

5.1. Alopecia Detection Module

Uses **live camera input** to capture scalp images through guided movements. The AI model analyzes these images to **detect the presence, type, and severity** of alopecia, providing users with accurate, real-time diagnostic insights.

5.2. Questionnaire & Medical Report Module

Collects **user details**, including medical history, genetic factors, and uploaded diagnostic reports. The module uses this data to **support AI predictions** and improve diagnostic precision for different alopecia types.

5.3. At-Home Hair Test Module

Guides users through simple **self-assessment tests** such as the **Hair Pull**, **Tug**, and **Hair Count** tests performed via live camera. Results are analyzed to assist in determining hair strength and active shedding levels.

5.4. Recommendation & Dermatologist Module

If the diagnosis remains uncertain, this module recommends **consulting certified dermatologists or nearby clinics**, helping users seek professional evaluation when necessary.

Out of Scope:
Mobile app development, real-time video consultations, and integration with wearable devices are excluded in the current phase and may be considered in future expansions.

6. System Architectural Design

The Hairlytic system uses a **Microservices Architecture with Hybrid-Cloud AI Orchestration** to achieve scalability, modularity, and reliability essential for healthcare applications. The hybrid setup combines **public cloud services** for AI model execution and real-time image processing with **private cloud storage** for sensitive medical data, ensuring high performance and confidentiality.

This approach allows each services such as authentication, AI detection, testing, and marketplace management, to operate independently, making the system easier to **develop, maintain, and scale**. The AI integration layer connects all application modules with machine learning models, enabling **accurate alopecia detection** and **future AI enhancements** without altering the core structure.

Breakdown of Hairlytic Architecture

Frontend (User Interface):
- Web App (React)
- Live camera capture with guided motion for scalp scanning
- Questionnaire input and report upload interface
- Secure login and user profile management

Backend (Microservices):

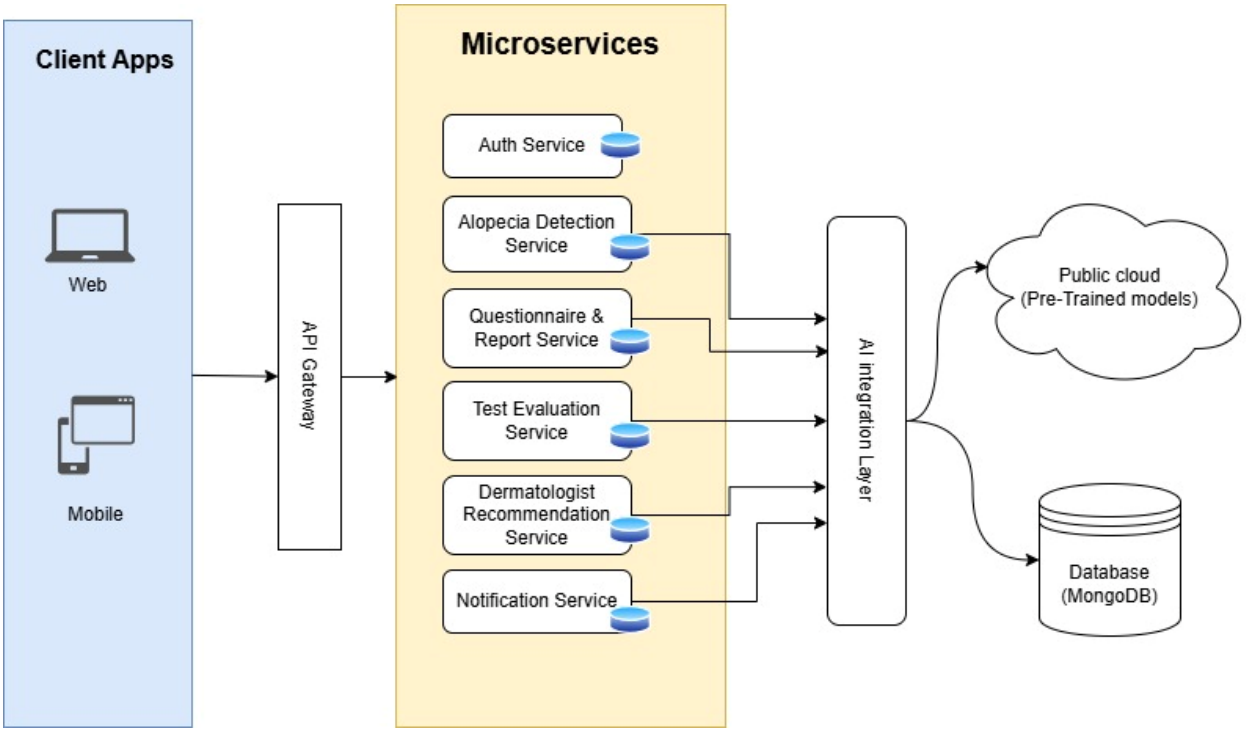
1. **Auth Service →** Manages user authentication, sessions, and access control
2. **AI Detection Service →** Processes scalp images using trained ML models to detect alopecia type and severity
3. **Questionnaire & Report Service →** Collects lifestyle, genetic, and medical data; analyzes uploaded reports to support diagnosis
4. **Test Evaluation Service →** Guides and evaluates self-assessment tests such as Hair Pull, Tug, and Hair Count tests
5. **Recommendation Service →** Provides insights, dermatologist suggestions, and next-step recommendations
6. **Notification Service →** Sends diagnosis summaries, alerts, and product updates
7. **Data Service →** Stores user images, reports, and responses securely

AI Integration Layer:

- Hosts trained ML models for hair and scalp image analysis
- Handles image preprocessing, feature extraction, and classification
- Connects backend services with cloud-based APIs (TensorFlow Serving or custom Python API)
- Supports continuous AI model updates and improvements

Hybrid Cloud Setup:

- **Public Cloud:** Runs AI processing, APIs, and web services for fast, scalable operations
- **Private Cloud / Local Server:** Stores sensitive user images, medical reports, and personal data.



7. Implementation Tools and Techniques

The implementation of **Hairlytic** follows a **modular microservices-based architecture** supported by an **agile development approach**. Each service from AI detection to marketplace and user management is developed, tested, and deployed independently to ensure scalability, maintainability, and faster iteration. Agile sprints allow continuous testing, integration, and improvement across modules such as AI model training, frontend design, and backend orchestration.

Frontend Development:
• Developed using **React.js**, with **HTML5**, **CSS3**, and **Tailwind CSS** for a responsive, guided camera interface and smooth user experience.

Backend Development:
• Implemented with **Python (Flask or FastAPI)** for RESTful APIs and microservice communication.
• Each microservice (Auth, Questionnaire, Recommendation, Marketplace, etc.) runs independently and communicates via **internal APIs**.

AI & Machine Learning Integration:
• Core models trained using **TensorFlow** and **PyTorch** for alopecia detection and classification.
• **OpenCV** handles image preprocessing and feature extraction.
• Models are deployed through a **dedicated AI Integration Layer** (e.g., TensorFlow Serving or custom FastAPI microservice) for scalable inference.

Database Management:
• **MongoDB** is used for flexible document storage of user profiles and analysis results.
• Separate logical databases ensure isolation between modules (Auth, AI, Marketplace).

Cloud Infrastructure:
• **AWS** or **Google Cloud** hosts both the web application and AI inference services.
• **GPU-enabled instances** process images and ML models efficiently.
• Hybrid deployment separates **public cloud (AI services)** from **private storage (user data)** for optimized performance.

Version Control & Collaboration:
• **Git** and **GitHub** are used for source control, issue tracking, and CI/CD workflows.

Testing & Quality Assurance:
• **Postman** for API testing, **PyTest** for backend unit tests, and **Selenium** for end-to-end interface testing.
• Load and stress testing ensure system stability under concurrent access.

This setup ensures Hairlytic is **efficiently developed**, emphasizing **performance, security, scalability, and user trust**.

8. Project Plan

This section describes how the Hairlytic project will be managed and executed through clearly defined milestones and deliverables. The project is divided into two major phases: documentation and implementation. The documentation phase spans from **6th October 2025 to 10th January 2026**, focusing on research, requirement gathering, system design, and final report preparation. The implementation phase begins on **12th January 2026 and continues until 18th May 2026**, during which the actual development, integration, and testing of the Hairlytic system will be completed. An agile approach will be followed, ensuring continuous feedback and progress tracking through milestones and sprints.

8.1. Work Breakdown Structure

A Work Breakdown Structure (WBS) provides a deliverable-based decomposition of the entire project scope, covering 100% of the project work including documentation, system design, development, testing, and deployment. The duties are distributed between two team members **Fizza** and **Minahil** ensuring balanced workload and clear accountability.

WBS Hierarchy

1. **Project Management**
   1.1 Work Breakdown Structure (WBS)
   1.2 Roles & Responsibility Matrix
   1.3 Change Control System

2. **Reports / Documentation**
   2.1 Final Documentation Introduction
   2.2 Literature Review / Market Survey
   2.3 Requirements Analysis
   2.4 System Design
   2.5 Implementation Plan
   2.6 Testing & Performance Evaluation Plan
   2.7 Conclusion & Outlook
   2.8 End User Documentation
   2.9 Application Administration Documentation
   2.10 System Administrator Documentation

3. **System Development**
   3.1 Development Environment Setup
   3.1.1 IDE and Tools Installation
   3.1.2 Version Control Configuration (Git/GitHub)
   3.1.3 Cloud Server Setup (AWS/GC)
   3.1.4 Database Initialization (MongoDB)

   3.2 Presentation Layer (Frontend)
   3.2.1 UI/UX Design (React.js)
   3.2.2 Responsive Dashboard Development
   3.2.3 User Authentication Screens

   3.3 Business Logic Layer (Backend)
   3.3.1 API Development (FastAPI/Flask)
   3.3.2 AI Model Integration (TensorFlow/PyTorch)

   3.4 Data Management Layer
   3.4.1 Database Schema Design
   3.4.2 Data Storage & Retrieval APIs

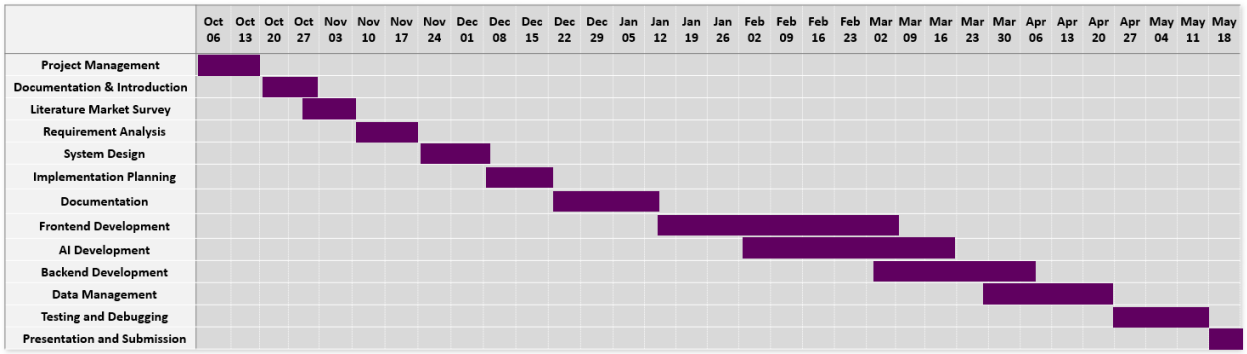
Roles & Responsibility Matrix:

The purpose of roles & responsibility matrix is to identify who will do what.

#	WBS Deliverable	Activity #	Activity to Complete Deliverable	Duration (Days)	Responsible Team Member(s) & Role(s)
1	Project Management	1.1–1.3	Define WBS, roles, and change system	7	Minahil , Fizza
2	Documentation Introduction	2.1	Draft executive summary & objectives	14	Minahil
3	Literature / Market Survey	2.2	Collect and summarize previous studies & competitors	12	Minahil
4	Requirements Analysis	2.3	Define functional/non-functional requirements	14	Minahil & Fizza
5	System Design	2.4	Create architecture diagrams & design specifications	17	Fizza
6	Implementation Planning	2.5	Define module-based plan & milestones	14	Both
7	Documentation	3.1	Creating SRS and SDS Documents	23	Fizza
8	Frontend Development	3.2	Design UI, build responsive interface, user flow	60	Fizza
9	AI Development	3.3	Development and integrate AI	50	
10	Backend Development	3.3	Build APIs, integrate, secure backend	30	Fizza
11	Data Management	3.4	Schema creation, API linking, encryption	28	Both
12	Testing & Debugging	2.6	Perform unit, integration & system testing	20	Both
13	Final Documentation & Reports	2.7–2.10	Prepare final report, user & admin manuals	14	Minahil

14	Presentation & Submission	-	Prepare final presentation & demo	7	Both

8.2. Gantt Chart



Milestones Summary

Milestone ID	Title	Completion Date	Description
M1	Project Proposal & Topic Approval	9-Oct-2025	Initial project topic finalized, approved by supervisor, and preliminary research initiated.
M2	Project Documentation Completion	2-Nov-2026	All project documentation including proposal, requirements, and design fully completed.
M3	AI Model Development & Training	15-Mar-2026	Machine learning model for alopecia detection developed, trained, and validated.
M4	System Prototyping Completion	30-Apr-2026	Functional prototype integrating frontend, backend, and AI engine completed for testing.
M5	System Testing & Cloud Deployment	11-May-2026	Complete system deployed to cloud environment and tested for performance, security, and reliability.
M6	Final Submission & Demo	18-May-2026	Fully tested system finalized, documented, and presented to the supervisor for evaluation.

References

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List of Faculty Proposed Changes

HairLytic

Proposed Change	**Proposed By**	**Supervisor's Decision**
	Name of Faculty Member(s) who proposed this change	Approved/Disapproved and/or Comments

Date: _____ **Supervisor's Signature: _____**

APPROVAL

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Project Supervisor

Comments: _____

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Name:_____

Date:_____ Signature:_____

Project Manager

Comments: _____

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Date:_____ Signature:_____