UNDERGRADUATE INDIVIDUAL PROJECT

CST3990

Redefining Tutor-Student Dynamics: A Mobile App Development Initiative

Coursework 1: Project Proposal

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1. Background of study

The modern educational landscape is undergoing a profound transformation, primarily influenced by the growing digitization of learning tools and methodologies. This shift has been greatly accelerated by the global COVID-19 pandemic, which required a re-evaluation and reimagination of traditional educational practices and interactions. As a result, there has been an increased emphasis on the importance of technology in education, prompting both educators and learners to gravitate towards more digitally inclined platforms (Williamson, Eynon, & Potter, 2020).

In Mauritius, private tuition plays a crucial role, especially at the secondary education level, where personalized learning experiences and individual attention are highly valued. Almost every student partakes in private tuition during their secondary education years, underlining the need for robust digital solutions in this sector. These solutions must be capable of not only facilitating but also enhancing the unique and direct interactions between tutors and students (Selwyn, 2019). The current situation presents a unique opportunity to reimagine educational delivery at this critical educational stage, making it more adaptable, personalized, and accessible through digital platforms. The focus on secondary education in Mauritius reflects the significant demand and potential for transformative digital solutions in this domain, where technology can play a pivotal role in shaping future learning experiences.

2. Problem statement

In the contemporary landscape of education, tutors and students grapple with a plethora of challenges that can hinder the learning experience. The following list outlines these pressing issues that underscore the need for innovative solutions:

1. **Fragmented Communication**:

The abundance of digital communication tools, such as WhatsApp, Email, and Microsoft Teams, has fragmented interactions across multiple platforms, leading to inefficient communication and lower student engagement (Greenhow & Askari, 2017).

2. **Inefficient Resource Sharing**:

The efficient sharing of learning resources is challenging due to the lack of a centralized platform. This fragmentation often results in students missing key materials, which can adversely affect their educational progress (Trust, 2021).

3. **Homework engagement Issues:**

Tutors often face difficulties in monitoring consistent student engagement with homework, leading to a lack of supervision that can negatively affect students' academic performance and learning outcomes (Cooper, Robinson, & Patall, 2006).

4. **Payment Inefficiencies**:

Handling financial transactions manually can be cumbersome and prone to errors, lacking the speed and convenience of digital solutions (Nicoletti, 2017). The importance of transparency in digital transactions is increasingly crucial in modern educational contexts.

5. **Lack of Personalized Feedback**:

In modern education, particularly in larger classrooms, providing personalized feedback to each student is challenging due to limited resources, time constraints, and the diverse learning needs of

students. Personalized feedback is crucial for enhancing student learning and addressing individual understanding gaps (Hattie & Timperley, 2007).

6. **Limited Performance Tracking**:

Tutors often lack a holistic overview of a student's performance over time, and in relation to their peers. Without a comprehensive understanding of a student's academic journey, it becomes difficult to identify patterns, strengths, and areas needing improvement, consequently hindering the development of effective teaching strategies and interventions (Ifenthaler, 2017).

3. Description of project

Our tuition app, **SmartTutor**, is designed as a cutting-edge mobile platform tailored for Mauritius' private tutoring sector, particularly for secondary education across all subjects. It aims to address the unique challenges of the modern educational landscape, providing a comprehensive solution for tutors and students.

For students, the app will offer access to class-specific learning materials, a platform to submit homework, and a convenient payment system for tuition fees. Each student will be able to view their personal test scores and receive individual feedback, fostering a more tailored educational approach.

On the other side, tutors will be equipped with tools to upload educational content, manage homework submissions, verify payments, and provide scores and personal feedback for tests. They will also have access to a sophisticated dashboard that illustrates students' performance and predicts future marks through a machine learning algorithm. This predictive analysis will assist tutors in identifying learning gaps and potential areas of improvement.

Moreover, the app will feature both public and private messaging functionalities. A public chat room will encourage student interaction and collaborative learning, while private messaging will allow for direct, confidential communication between the student and the tutor.

3.1. Aim & Objectives

Aim:

The aim of our application is to enhance the quality of private tutoring through a comprehensive digital ecosystem, specifically designed to meet the diverse needs of tutors and students.

Objectives:
The key stages involved in the development of the application are:

- Requirement Analysis and Planning
- System Design and Prototyping
- Frontend and Backend Development
- Integration of Machine Learning Features
- Testing and Quality Assurance
- Deployment and Iterative Improvement
- Documentation and Final Reporting

4. Key activities of the project

Methodology:

For the development of the mobile tutoring application, the Prototyping methodology will be adopted. This approach revolves around developing early prototypes, which are then refined iteratively based on feedback from educators and students. It facilitates the tailoring of the app to meet specific tutoring needs, ensuring the final product is both user-centric and educationally effective. This method aligns with the project's aim to create an impactful and intuitive educational tool, incorporating continuous user feedback and adaptability (Rudd et al., 1996).

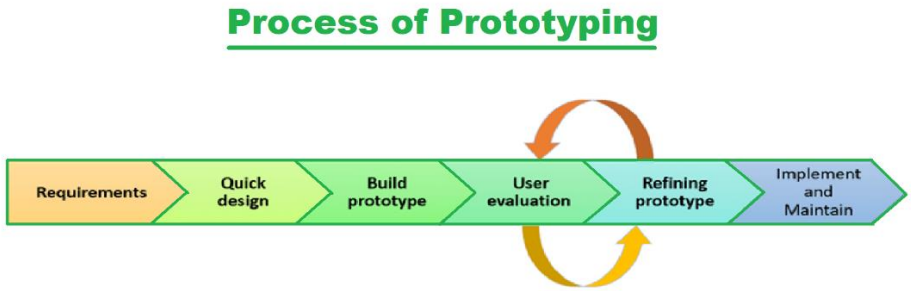

Figure 1: Process of prototyping

Key activities:

The project commences with drafting a detailed project proposal, setting the stage for all subsequent activities. This is succeeded by a thorough literature review to establish the project's conceptual basis. Following this, user requirements are gathered and analysed, leading to the system design and prototyping phase, where a user-centric interface is developed. After this phase, user feedback will be solicited to refine and enhance the prototype, ensuring that it aligns closely with user needs and expectations. The project then advances into the main development phase, encompassing the full frontend and backend development, as well as the integration of machine learning. A comprehensive testing and quality assurance phase follows to ensure the app's functionality and reliability. The project prioritizes continuous improvements both before and after deployment, with a strong emphasis on integrating user feedback throughout the development process to enhance the app's functionality and user experience. The culmination of the project involves thorough documentation and a final report that summarizes the development journey, followed by a viva presentation to showcase the completed work and its outcomes.

4.1. Literature review

For the literature review of this project, a comprehensive approach will be employed, encompassing a thorough examination of scholarly articles, industry reports, and relevant books. This process will involve delving into existing mobile educational solutions, various machine learning models, technology stacks typically used in such applications, and the methods employed for testing and evaluating these applications. Academic databases like Google Scholar, IEEE Xplore, and ACM Digital Library will be primary sources for current and relevant academic literature.

4.2. Systems Analysis and Design

In the systems analysis and design phase of the tutoring application, we will conduct a detailed review and finalization of the application's features and the technology stack, ensuring alignment with user needs and project goals. The system architecture will be precisely defined and represented through Unified Modeling Language (UML) diagrams to illustrate the system's structure and interactions clearly.

The database schema will be designed for optimal data management. Concurrently, UI/UX mockups will be developed to guide the creation of an intuitive user interface. API endpoints will be established for efficient frontend-backend communication. Additionally, the specifications for the machine learning model will be outlined, detailing its role in leveraging student performance data for predictive analytics.

4.3. Implementation and Testing

Implementation:

After extensive research on various technologies during the literature review and thorough planning, the implementation phase of the project will commence. This phase encompasses the development of a cross-platform frontend, ensuring a user-friendly interface that aligns with the finalized UI/UX mock-ups, and is compatible with both Android and iOS platforms. Concurrently, backend development will focus on establishing the server, crafting API endpoints, and integrating key functionalities, including the machine learning model for performance prediction. Efficient data handling will be ensured by configuring a robust database system. The development approach will be characterized by a prototyping process, focusing on the creation and continuous refinement of prototypes, allowing for iterative improvement and integration of features based on user feedback.

Testing:

The testing of the application will adopt a comprehensive, multi-layered strategy to ensure its functionality, reliability, and overall user experience. This will begin with unit testing to validate the functionality of individual components. Integration testing will follow, focusing on the seamless interaction between different parts of the application. Comprehensive system testing will be conducted to assess the app's overall performance. Finally, User Acceptance Testing (UAT) will involve actual end-users to evaluate the application's usability and practical functionality in real-world scenarios. This thorough approach to testing is critical to ensuring the application meets all specified requirements and user expectations.

4.4. Evaluation

A proper evaluation on this tuition app project is crucial to understand its impact, utility, and areas of improvement. Here's a structured approach for the evaluation:

1. **Usability Testing:**

Conduct usability testing with tutors and students to evaluate the app's interface and user experience, including task-based assessments to gauge navigation ease and action completion (Hartson et al., 2013).

2. **Feedback Surveys and Interviews:**

Post usability testing, conducting surveys will be crucial to obtain structured feedback and assess user satisfaction, helping identify areas for improvement (Leung, 2015). Additionally, interviews will offer insightful qualitative feedback.

3. **Feature Testing:**

Systematically test each feature to ensure they function as intended.

4. **Compatibility Testing:**

Ensure the app works across different devices, operating systems, and screen size to cater to a broad user base (Charland & Leroux, 2011).

5. **Technical Performance Evaluation:**

This involves monitoring app load time, server response time, and tracking any instances of downtime. These metrics are crucial for ensuring the technical robustness and reliability of the application.

6. **User engagement analysis:**

Key indicators such as the number of active users, average session length, and feature usage rates will be tracked to provide insights into how users interact with the app, highlighting popular features and areas for potential improvement (Lehmann et al., 2012).

7. **Learning Outcome Analysis:**

Evaluate student performance data before and after app launch to assess its impact on learning outcomes and collect tutors' feedback on the app's role in enhancing teaching and learning.

8. **Machine Learning Model Evaluation**:

Standard model evaluation metrics such as accuracy, precision, recall, and the F1 score are typically employed to assess the predictive performance of machine learning models (Provost & Fawcett, 2013). Upon selecting the specific ML model tailored to the project's requirements in the literature review, additional evaluation methods suited to the model's characteristics and the nature of the prediction task will be specified to ensure a thorough assessment of its performance.

9. **Financial Transactions:**

Verify the accuracy and security of the payment system by running tests for various payment methods and checking for any discrepancies or security issues.

10. **Feedback Iteration**:

After collecting feedback, make necessary modifications to the app. Subsequently, reassess with the same group and a new set of users to understand if the changes improved the user experience (Hattie & Timperley, 2007).

5. Project Plan

Deliverables

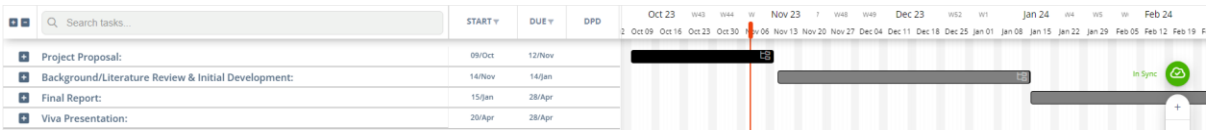

Figure 2: Deliverables

Milestones

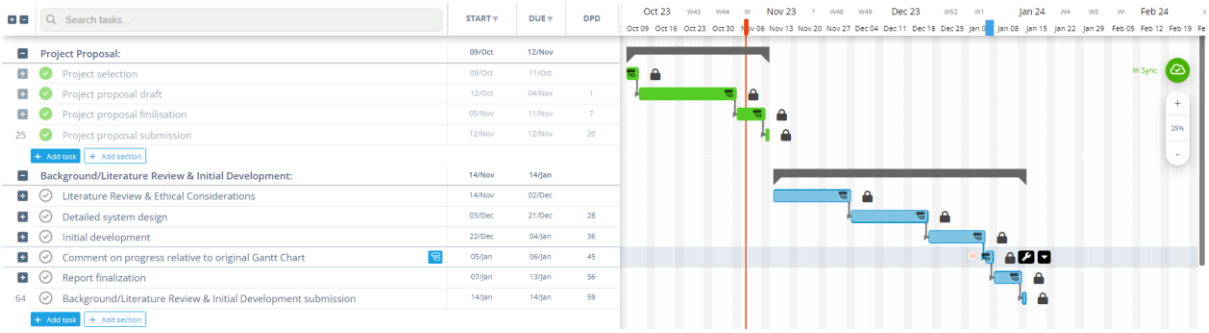

Figure 3: Milestones (part 1)

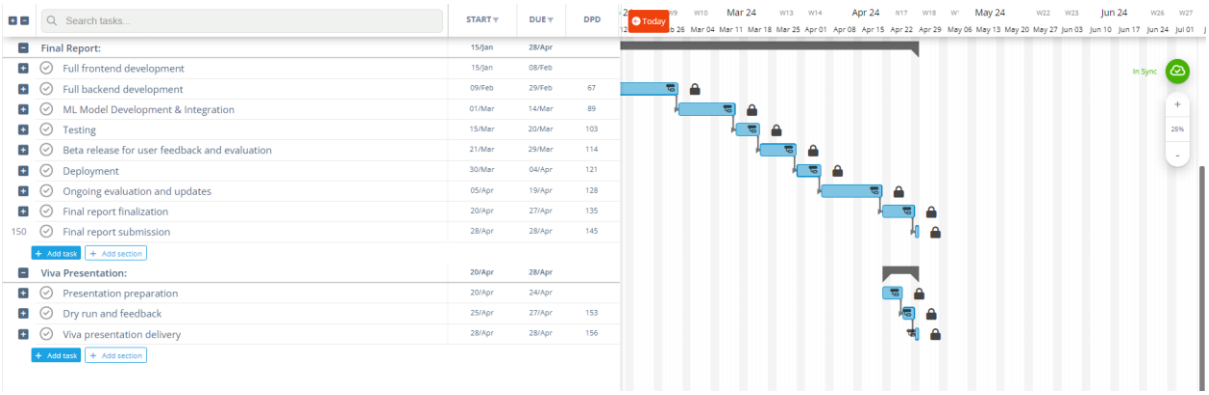

Figure 4: Milestones (part 2)

6. Project resources

Below is a list of resources that will support various aspects of the project, encompassing management, design, development, and research:

Project Management Tools:

- **Instagantt**: Utilized for creating Gantt charts, scheduling, and tracking project progress.

Design Tools:

- **UMLet**: Employed for drawing UML diagrams crucial for system design.
- **Figma**: Used for UI/UX design and prototyping.
- **dbdiagram.io**: For designing and visualizing the database schema.

Development Tools and Environment:

- **Visual Studio Code**: Serves as the Integrated Development Environment (IDE) for development activities.
- **Postman**: Assists in API testing and backend integration.
- **GitHub**: Utilized for version control and as a code repository.

Learning Resources:

- **Internet Access**: For research, accessing online tools, software documentation, and community support.
- **Academic Journals and Databases**: Resources like IEEE Xplore, Google Scholar, and ACM Digital Library for accessing scholarly articles and research papers relevant to the project.
- **Books and eBooks**: Cover a range of subjects related to software development, design principles, and project management.
- **Online Forums and Communities**: Platforms like Stack Overflow and GitHub communities for problem-solving, networking, and keeping up with industry trends.
- **Educational Platforms**: Websites like Udemy for learning new technologies and methodologies.

The specific technologies for frontend and backend development will be determined following a comprehensive literature review and analysis.

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