PARIKSHA

A PROJECT REPORT
BY

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DECLARATION

We hereby declare that the work which is being presented in the report entitled "PARiKSHA", is an authentic record of our own work carried out during the period from JUNE, 2020 to November, 2020 at Department of Computer Science and Engineering, Bennett University Greater Noida.

The matters and the results presented in this report has not been submitted by us for the award of any other degree elsewhere.

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LIST OF ABBREVIATIONS

Abbreviation	Explanation of the Abbreviation
GCP	Google Cloud Platform
WebRTC	Web Real-Time Communications
GKE	Google Kubernetes Engine
AI	Artificial Intelligence
UI	User Interface
UX	User Experience
UFM	UnFair Means
OCR	Optical Character Recognition
CI	Continuous Integration
CD	Continuous Delivery
P2P	Peer to Peer

ABSTRACT

Through PARiKSHA, our website for conducting online assessments, we have developed an online platform with the common problems faced by students and teachers today in mind. Students and teachers can take advantage of the user-friendly and feature-rich experience and educational institutions can efficiently manage their on-premises hardware resources with our work on PARiKSHA.

We used Flask and Jinja for web development, trained and integrated AI models for automated invigilance, built a P2P video call system using WebRTC, and built a hybrid model of on-premises and cloud for deployment.

From our own experiences such a platform is the need of the hour which could outlast its usefulness in the current digital-only mode of education and find its way into the market of online certification exams, online degree programs and much more. Currently in the prototype stage, with more work on the system it can be quickly made into a fully functional service.

1. INTRODUCTION

Assessing the understanding and knowledge of students is an integral part of every education system and conducting examinations has been one of the most preferred ways of doing that. The COVID-19 pandemic has made it difficult to do so in a way that is accessible to the students, fair in the undertaking, and can help the educators assess the class on a group as well as individual level. The online medium of education took a lot of time and effort on the educators' end to implement to reflect their physical counterpart, but a few things have still not transitioned and online exams are one of them. During the initial time the tools and platforms used for this purpose were the ones designed for survey and feedback tasks. A lot of companies and developer then started to work on those tools to improve the experience of teachers and students. New startups and platforms also emerged catering to this market but all of them only focused on certain aspects and none provided a complete suite of features. We discovered some gaps in the process based on our experience, did technical and market research, and started working on PARiKSHA.

1.1. Problem Statement

Features one might want to use for conducting online exams are scattered over different services and no one platform that has all of them. A major functionality needed for conducting exams is monitoring students and checking for cheating. This cannot be done for large test batches as live proctoring requires a lot of manpower. AI-based proctoring in exams that our platform will offer can solve the problem. Google forms and other such applications are often used for taking tests, the scores that examiners get are in the form of spreadsheets making it difficult to understand performance at individual as well as group scope. A lot of platforms also are not user-friendly, something that a lot of online quiz creation platforms lack when they make a tradeoff between features and UI intuitiveness. The biggest problem that we identified so far, with respect to higher education institutions, is the frequent crashes and failures that their on-campus networking infrastructure faces when there is a big spike in traffic

2. BACKGROUND RESEARCH

In the current situation of the ongoing pandemic online teaching and learning is the only option that educational institutions have. We did our research on the existing methods of conducting online assessments, their functionalities, and limitations. We referred to the following research work [1] [2]. Although these can be considered old in the current technological scenario, they provided us with the basic set of features such a platform should implement, and the challenges involved in development of the same. To understand the current trends and technologies used in conducting online examinations we did competition and market analysis the result of which can be observed in the points we noted about how our platform will be different from the existing solutions. These resources were referred to form guidelines for developing our project – [3] [4]. Getting to know the views of teachers about designing and implementing this platform and in general about what they feel about the tools they use now and what features they wish those tools had. We referred to these resources for this – [5] [6] [7]. The experience of students is also an important factor to take into consideration while developing this system. These resources were used – [8] [9]. And to understand the entire situation in the Indian context we referred to these – [10] [11].

2.1. Proposed System

This project aims to be a unified platform for teachers and students to conduct online assessment. By using Flask, Jinja, Bootstrap with HTML, CSS, JavaScript, Python and MySQL we will be creating the dynamic website where the teachers can make an account, create quizzes, and activate them for the students, the students would attempt them and get graded, from the stored results performance analytics would be generated for the teacher. Using the tools and services from GCP we will be implementing a hybrid model of on-premises and cloud deployment. Using TensorFlow we will be creating and training AI models for automated invigilation of students that will send alert to the teacher on detection of any suspicious activity and the teacher would then focus their attention to the said student.

2.2. Goals and Objectives

Table 1: Goal and Objectives

#	Goal or Objective
1	Get a dynamic and user-friendly website working
2	Make the system easy to support – provide good documentation, configuration/build files, administrator's manual
3	Make the system very easy to use – users would agree that minimal to no training is needed
4	Build a prototype that demonstrates the user interface by early October - to get early feedback from the customer/users
5	Make the dependency tree of all components easy to replicate by mentioning version numbers everywhere

3. PROJECT PLANNING

This section covers the details of the project planning. Selecting the lifecycle of the development, project stakeholders, resources required, assumptions made (if any) are detailed in the sections below.

3.1. Project Lifecycle

The team will use an agile approach. Our team will gather requirements and create high level development plan at the onset of the project and then implement the gathered requirements. The day-to-day development of the project would be done by creating issues and feature requests on Github and getting them assigned to the team members. Once a set of features are completed, they will be tested and put up for taking feedback to improve upon. The team will follow a SCRUM-like approach with an emphasis on frequent meetings and collaboration.

3.2. Project Setup

Table 2: Project tech stack

#	Decision Description
1	General: Windows 10, Ubuntu 18.04, Python, Github
2	Web: Flask, Jinja, Bootstrap, npm, WebRTC
3	Deployment: GCP, GKE On-prem, Anthos

4	AI: Python, TensorFlow

3.3. Stakeholders

Table 3: Project stakeholders

Stakeholder	Role
Dr. Gaurav Singal	Mentor
Anushka Garg	Team Member
Chirag Saxena	Team Member
Pulkit Vyas	Team member
Vibhu Upamanyu	Team member
Yoshi Bansal	Team member

3.4. Project Resources

Table 4: Project resources

Resource	Resource Description	Quantity
Capstone Team	Our team of students who will be the primary developers of the project.	5
Dr. Gaurav Singal	The mentor who will be able to provide us with technical assistance.	1
Linux Workstation/Server	A powerful computer which will be used to implement the on-premises deployment of PARiKSHA	1
GCP Credits	For testing and finalizing the deployment process	$300+ worth

3.5. Assumptions

Table 5: Assumptions

#	Assumption
A1	The capstone team and mentors will be able to meet on conference call once a week
A2	Enough (labelled) data will be available for training the AI models
A3	Completing the dependencies of the Webrtc system would be done in time
A4	Team will have sufficient time to complete a working model to present by mid-sem
A5	The free credits given by GCP would be sufficient for developing, testing, and deploying the hybrid cloud model

4. PROJECT TRACKING

4.1. Tracking

Table 6: Project tracking

Information	Description	Link
Code Storage	Project code will be stored in GIT repository.	Link
Project Documents and Assignments	Weekly reports, specification, and design documents, etc. will be stored in our GIT repository.	Link

4.2. Communication Plan

Table 7: Regularly Scheduled Meetings

Meeting Type	Frequency/Schedule	Who Attends
Conference Call/Skype	Three times a week	Project team
Team Meeting	Weekly	Project team
Short Meeting	Two times a week	Project team
Project Status Meeting	Start of each week	Project team and mentor

Table 8: Information to Be Shared Within Our Group

Who?	What Information?	When?	How?
Project team	Task assignments & General scrum information	Weekly	Team meetings, listing in Project Specification.

Table 9: Information to Be Provided to Other Groups

Who?	What Information?	When?	How?
Mentor	Final deliverables	At completion of project	Project specification doc., code, Power Point presentation
Mentor	Weekly report	Weekly	Conference call

Table 10: Information Needed from Other Groups

Who?	What Information?	When?	How?
Mentor	Requirement changes	Start of each week	Conference call

4.3. Deliverables

Table 11: Deliverables

#	Deliverable
1	Code
2	Project description and demo video
3	Build and install process documents ***(available on repository readme)***
4	Final report (final PowerPoint presentation, 3-minute video, and final sprint)

5. SYSTEM ANALYSIS AND DESIGN

This section describes in detail about the design part of the system.

5.1. Overall Description

This project is an attempt to ease the process of online assessment for students, teachers, and educational institutions by solving the common problems they face using web, AI, and cloud architectures. Using the AI models developed and trained by us, tests of hundreds of students can be conducted at once with the presence of as low as one manual invigilator at the same time and still be free of any UFM. On the detection of any suspicious activity, unlike many other similar systems which expel the students, our system generates flags and when the number of flags crosses a set threshold the invigilator is notified via our socket system about the particular students so they can see the live video feed of those students using the WebRTC video communication system that we developed.

With the carefully designed UI and UX of our website the tasks from account creation to activating and attempting tests are simplified for all stakeholders involved. The frontend of PARiKSHA is made using HTML, CSS and JS with popular frameworks and libraries like Bootstrap. This was done to give us the maximum amount of control over the UI and not be constrained on anything framework-specific for working on the UX. Then Jinja templating engine was used as we used Flask for the backend of the website. Features like E-mail verification, handling routes, performing checks and validations and, the performance analytics section are part of the backend made using Python.

Institutions that use their own onsite infrastructure consisting hardware such as servers and intranet often face problems such as crashes on high traffic and application and website shutdowns for maintenance purposes. The once that use cloud services have their own set of problems. We have used services from GCP's toolbox such as GKE On-prem and Anthos for developing a hybrid model of onsite and cloud deployment. Using this the interested customers can take the advantages of both.

5.2. Users and Roles

Table 12: Users and roles

User	Description
Developer	A capstone team member or mentor who is tasked with developing the website, creating initial deep learning models, and do the deployment
Teacher	Would first create a teacher account, create tests, activate them, access the results, and analytics
Student	Would first create a student account, attempt tests, view previous results

5.3. Design diagrams/ UML diagrams/ Flow Charts/ E-R diagrams

5.3.1. Use Case Diagrams

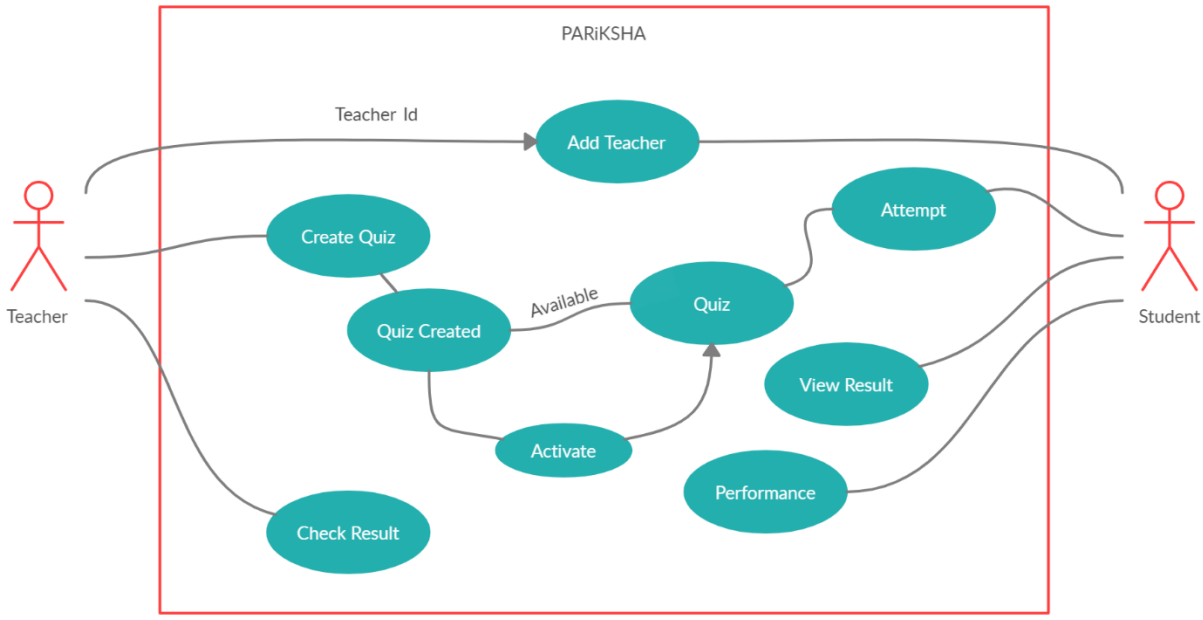


Figure 1: PARiKSHA use-case diagram

5.3.2. Activity Diagrams

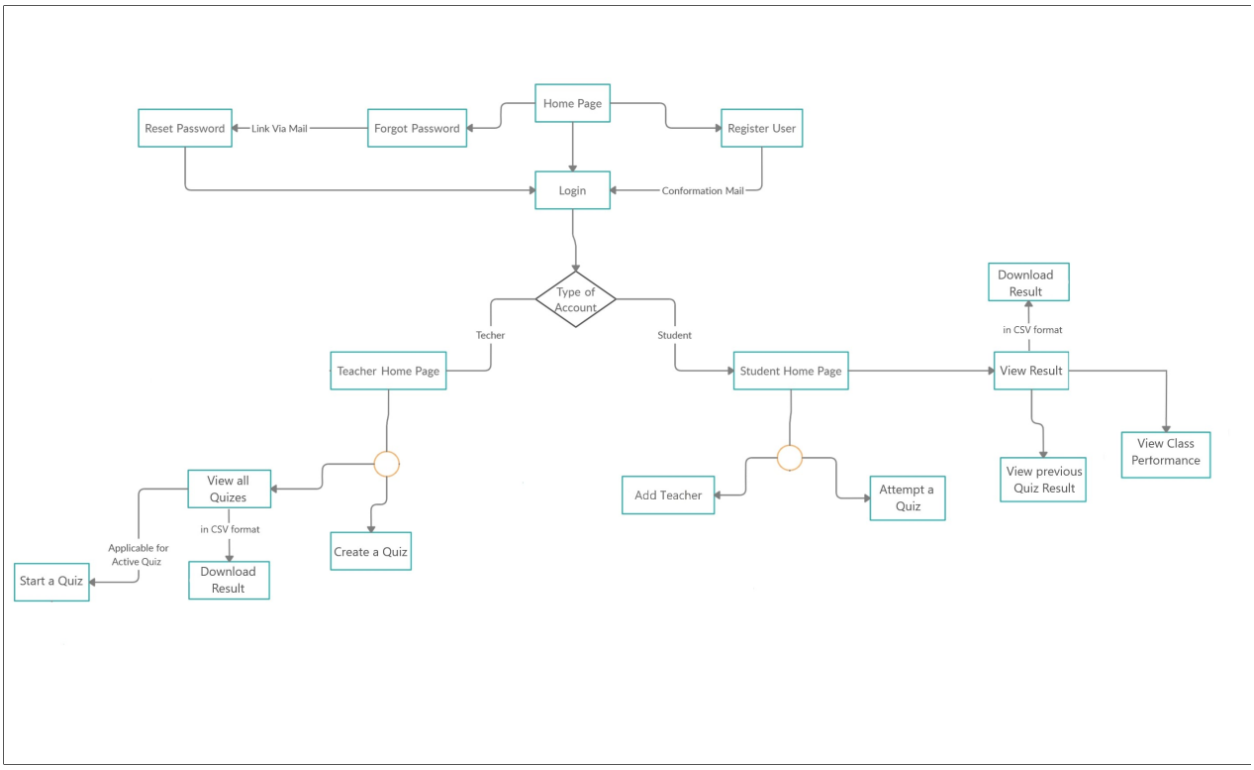


Figure 2: PARiKSHA activity diagram

5.3.3. Data Architecture

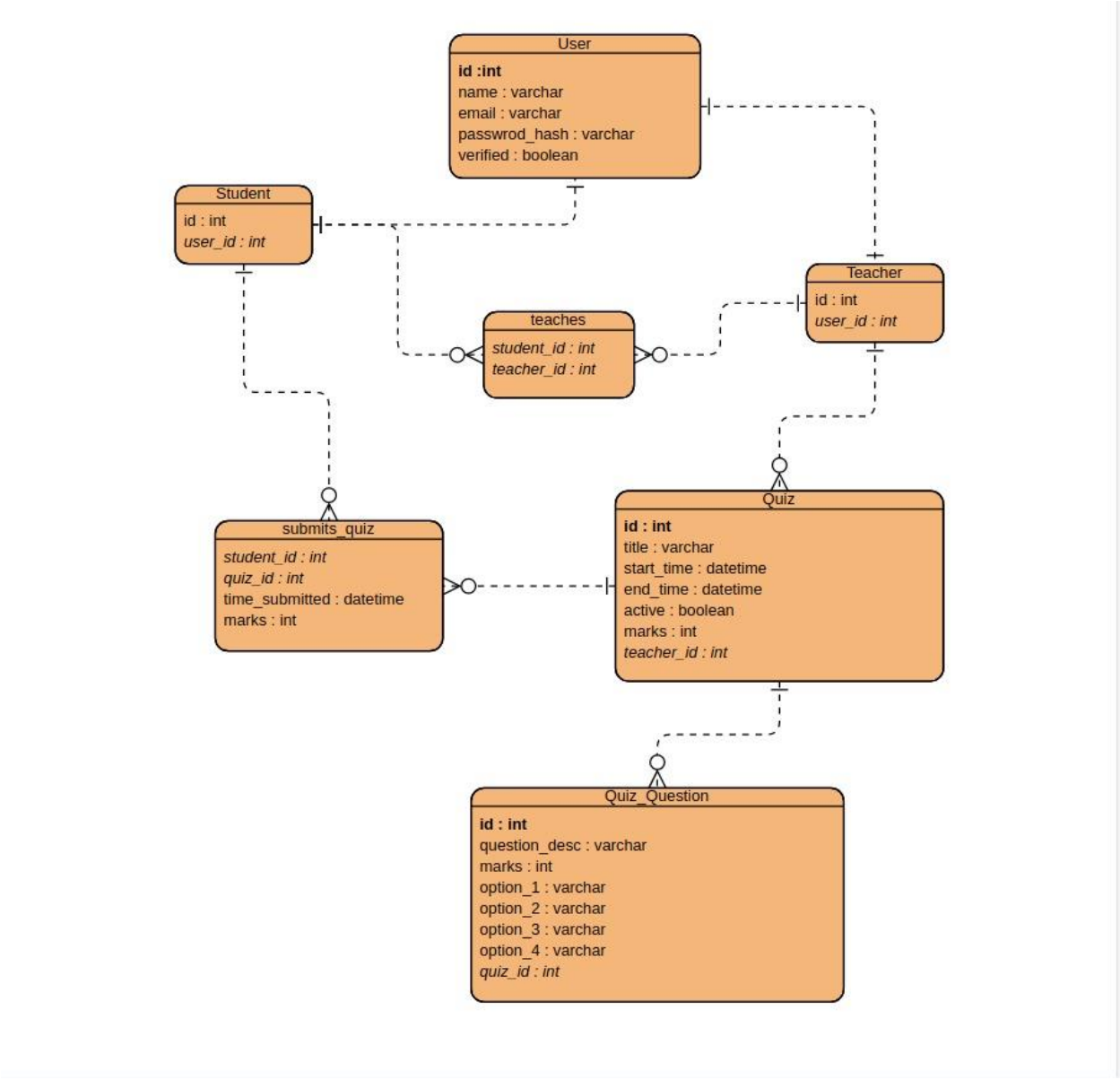


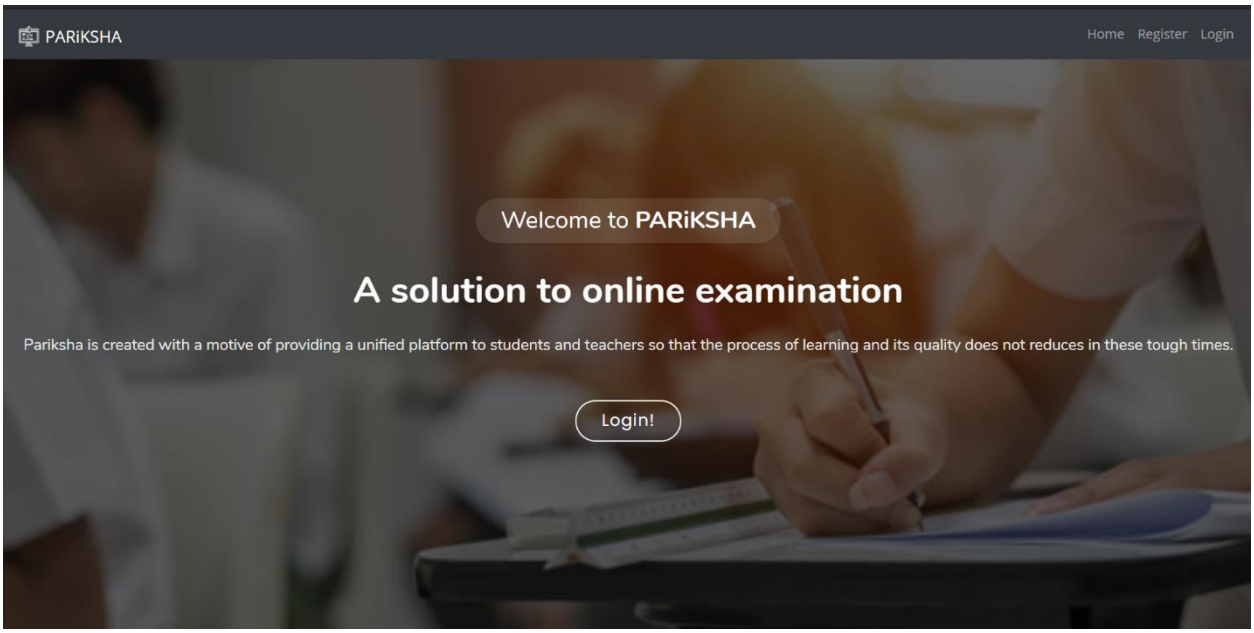
Figure 3: PARiKSHA data architecture

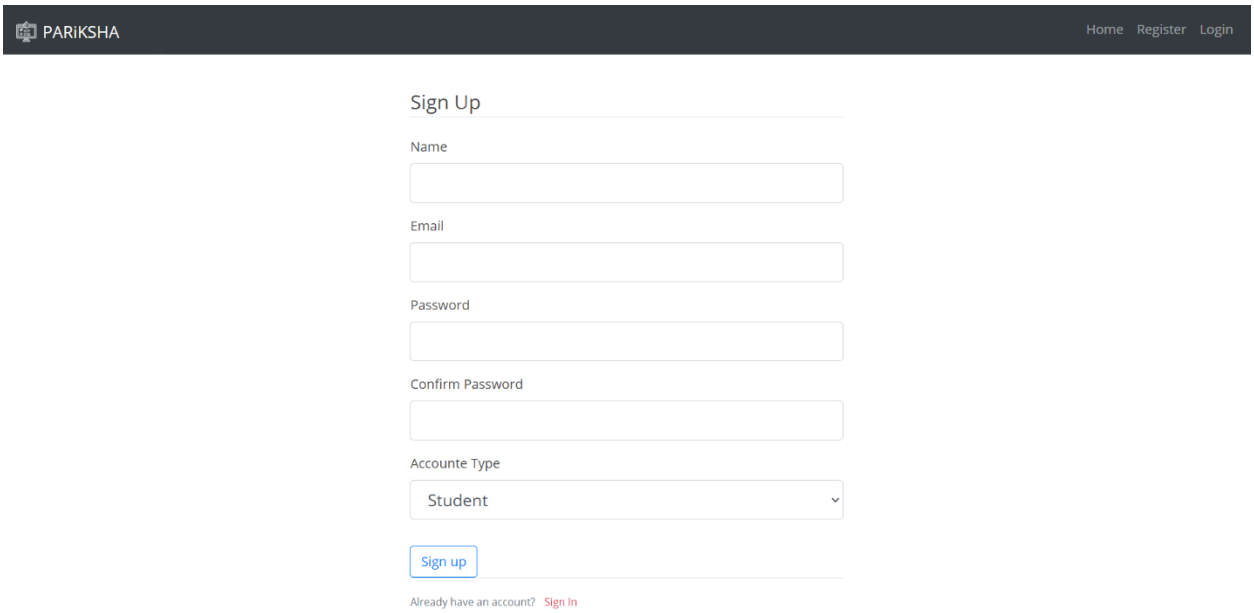
6. USER INTERFACE

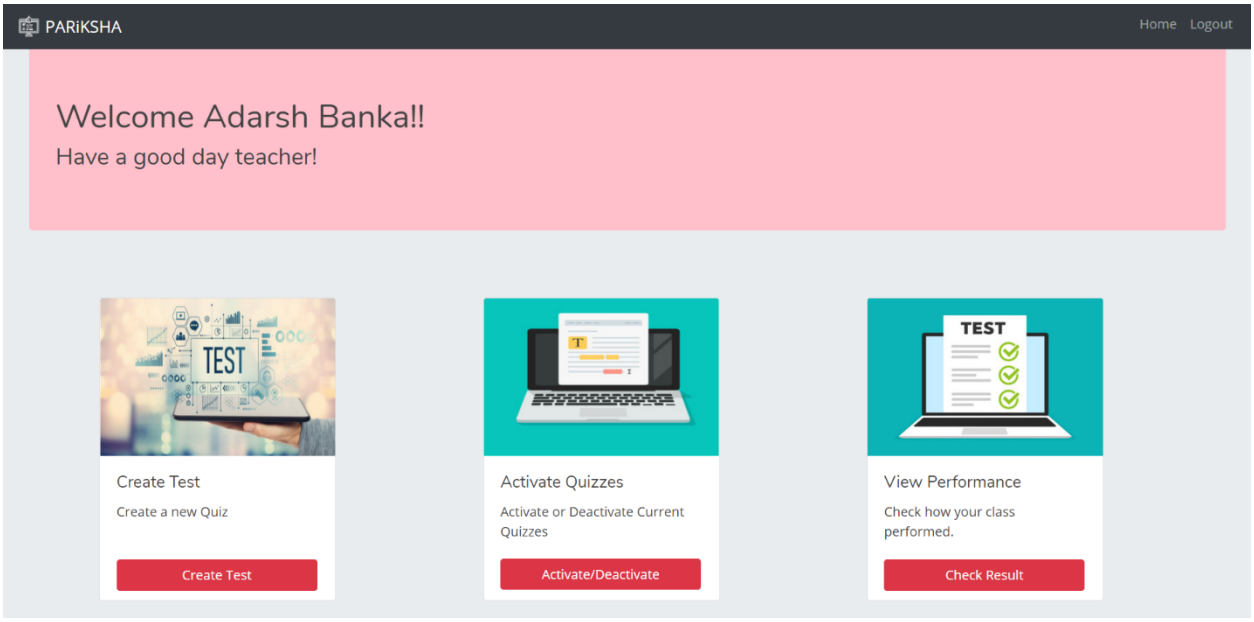
6.1. UI Description

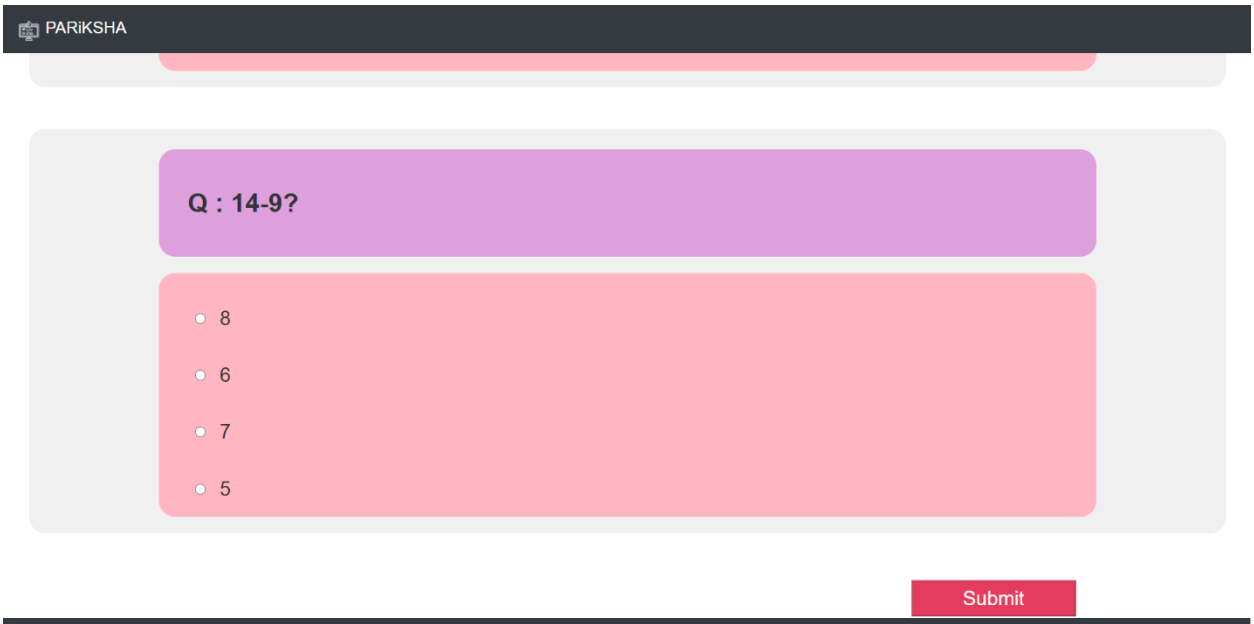
Designing and building an intuitive and feature-rich UI is a significant part of our project. We use HTML, CSS, and JavaScript with Jinja templating engine to create a dynamic website frontend. The UI would be responsive i.e. adapt to any screen size – desktop, tablet, mobile – which is needed to serve a wide audience of users who might not have access to certain devices. For this we have used Bootstrap framework providing us with not only adaptive templates but also many other classes which would have taken a long time to implement in pure html and CSS. We have also used online image hosting which not only frees up space but also reduces the loading time.

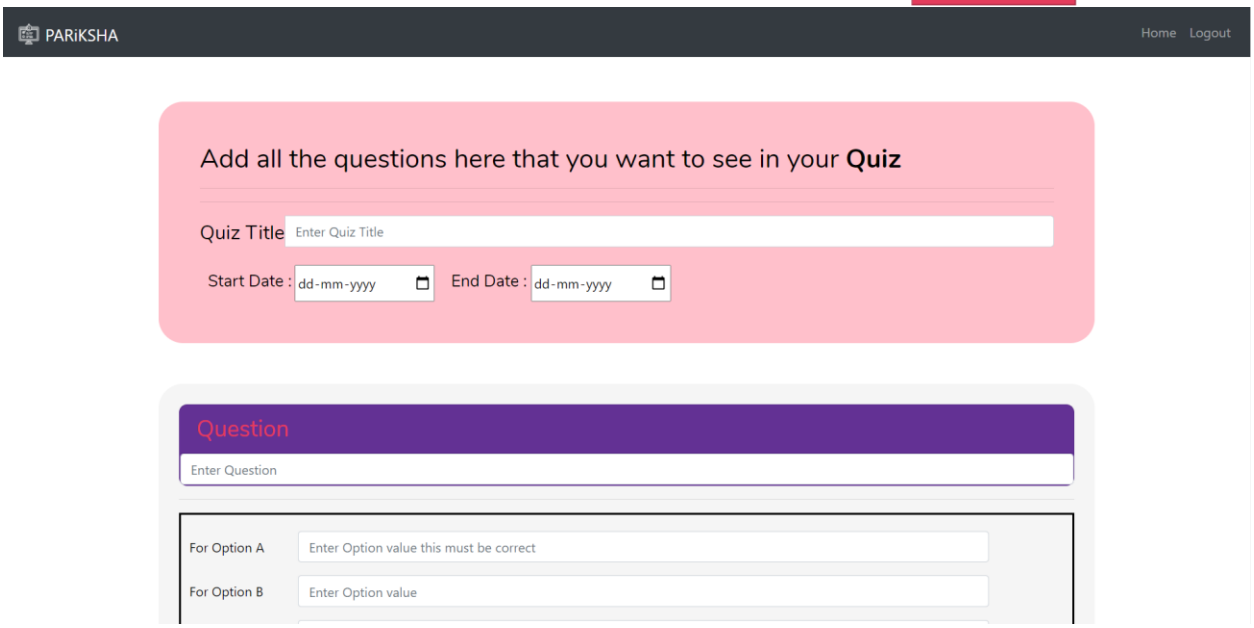
6.2. UI Mockup




PARiKSHA
Home Register Login
Sign Up
Name
Email
Password
Confirm Password
Accounte Type
Student
Sign up
Already have an account? Sign In


PARiKSHA
Home Logout
Welcome Adarsh Banka!!
Have a good day teacher!
TEST
Create Test
Create a new Quiz
Create Test
Activate Quizzes
Activate or Deactivate Current Quizzes
Activate/Deactivate
TEST
View Performance
Check how your class performed.
Check Result


PARiKSHA
Q : 14-9?
8
6
7
5
Submit


PARiKSHA
Home
Logout
Add all the questions here that you want to see in your Quiz
Quiz Title
Enter Quiz Title
Start Date :
dd-mm-yyyy
End Date :
dd-mm-yyyy
Question
Enter Question
For Option A
Enter Option value this must be correct
For Option B
Enter Option value

7. PROJECT CLOSURE

This section elucidates the overall lookup at the project and some of the future works that may enhance the solution.

7.1. Goals / Vision

Our original goals for this project was to make a unified online assessment platform with the biggest feature as the hybrid AI model that would automatically invigilate a large number of students giving a test and alert the teachers if any suspicious activity pertaining to cheating on the test is detected. Acquiring enough data to train such a model turned out to be a big challenge and although h at the end we were able to train the models and integrate them into one, the accuracy of the system remains very low to be ideal for production. We pivoted a bit and worked on the hybrid cloud model deployment of the PARiKSHA.

7.2. Delivered Solution

Our solution delivered primarily consisted of a fully featured website along with the AI models trained by our team, the video conferencing tool for manual invigilation and a teacher alerting system in case of any cheating action detected by the AI system.

7.3. Remaining Work

We created a prototype of a website for conducting online assessments for making the test creation and attempting process easier. We were at a stage of integrating all these components into a fully functional web platform, as we envisioned PARiKSHA to be, when we had to tradeoff between the integration of the components and completing the components as separate entities. In the end we were able to create demonstrable prototypes of all parts of our projects. We have a list of potential features to be added including paper-and-pen to digital exam via OCR, training of better AI models, addition of CI/CD pipelines, support for assignments and fetching test results from other websites.

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