Web Application for Quiz Monitoring System using NODE.JS and FIREBASE

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Abstract: *The objective of the Quiz Web Application is to minimize the manual work of the examiner and make it easy for them to conduct an online exam. The target users will be staffs and the students. This project will not only overcome the manual system but also help the staff to track who attended their quiz. It will provide a dashboard for the examiner so that they can keep track on their quiz. The proposed system provides features to create quiz by authenticated user, automatic evaluation of the response and dashboard for monitoring the quiz.*

Keywords: Web Application, Quiz Application, Monitor, Automatic Evaluation, Report Generation, Nodejs

I. INTRODUCTION

The quiz applications played a major role during the covid-19 pandemic. It helped most of the educational institutes to conduct online multiple-choice question examinations with ease. These quiz applications eliminated the manual work and facilitates automatic evaluation of the result. The result produced is spontaneous and precise, unlike manual evaluation. The proposed quiz application is developed to overcome the manual system. Checking the answer sheets after an exam could be a time-consuming process. So, this application not only provides facilities for the examiner to evaluate the responses automatically but also helps monitor the attendee. The examiner don't need a high programming or computing knowledge to use this system.

1.1 System Overview

The proposed system uses **NodeJS** for handling requests and responses which uses event driven model and non-blocking asynchronous tasks that runs on single thread, thus making it extremely efficient and scalable. This quiz application uses **Google's Firestore** as database which makes it easier to handle and organize data. It stores data in the form of documents and collection which provides a high-performance query engine that can be utilized by developers to run complex queries against NoSQL database. NodeJS and Google's firestore works together to create a powerful and secure system that makes the application scalable and reliable.

II. RELATED WORKS

Krenare Pireva Nuci, Rabail Tahir &et. al., (2021) [1]: Distance teaching and e-learning are gaining popularity, especially during covid-19 crisis. Many institutions the transition from on-campus classes to online lecturing involves challenges including keeping students motivated, interactive and alive. This paper reports on online learning using game-based digital quiz tool within the University in Kosovo. Two key motivation parameters-students' engagement and interaction - are compared and analyzed using two different online quiz platforms. The result shows that the learning curve is steeper when using in-lecture quiz (73%) compared when quizzes are not used (57.5%).

Abdul Wahab Muzaffar, Muhammad Tahir& Muhammad Waseem&et.al., (2021) [2]: E-learning in higher education is exponentially increased during the past decade due to its inevitable benefits in critical situations (Natural Disaster and Wars). Exams through E-learning platforms takes place without the presence of students and instructor at the same place. This poses several issues like integrity and security. This review is performed to select and analyse 52 studies published during last 5 years. Five leading features targeted in the selected studies are identified and implementation solutions are explored. To conclude, this article helps to select appropriate features along with underlying development tools, and techniques for the implementation of online exams solution.

Jestin Joy& Kannan Balakrishnan &et. al., (2019) [3]Sign Language is one of the media of communication for deaf people which one should learn in order to interact with them. There is only few study material available for sign languages. So the process of learning becomes difficult. This paper discusses Sign Quiz which is a cost effective web based fingerspelled sign learning application for Indian Sign Language utilizing automatic sign language recognition technique. This is the first attempt in ISL for learning finger spelled signs using deep neural network. The results indicate that SignQuiz is better than the printed medium for fingerspelled sign learning.

Dhawaleswar Rao CH & Sujan Kumar Saha (2020) [4]: Automatic multiple-choice question (MCQ) generation from a text is a popular research area. Researchers have been attracted toward automatic MCQ generation since the late 90's. Since then, many systems have been developed for MCQ generation. We perform a systematic review of those systems. This paper presents our findings on the review. We outline a generic workflow for an automatic MCQ generation system. The workflow consists of six phases. For each of these phases, we find and discuss the list of techniques adopted in the literature. We also study the evaluation techniques for assessing the quality of the system generated MCQs. Finally, we identify the areas where the current research focus should be directed toward enriching the literature.

Inmaculada Pardines& Marcos Sanchez-Elez et.al., (2014) [5]: This paper presents a proposal for assessing the laboratory sessions of a subject of the first year in computer science degrees. This methodology is based on online short-answer exam questions related to the concepts studied in each session. After analyzing the academic results of a large group of students, we may conclude that this way of evaluating knowledge is precise. The obtained grades neither underestimate nor overestimate the student's work, being similar to the ones achieved in a final exam. Moreover, there is continuous feedback, which allows the teacher to go into detail about those aspects of the subject that students have not understood.

III. EXISTING SYSTEM

1   Manual evaluation of quiz or multiple-choice questions requires multiple persons to produce result in time.
2   When an evaluator manually evaluates a quiz, they might be partial to certain participants.
3   The existing system of quiz application allows only the registered users to monitor the quiz.

IV. PROPOSED SYSTEM

1   This web application not only overcome the manual method but also minimized the examiner's job while conducting a online quiz.
2   Allows non-registered users to monitor the quiz if they possess the monitor key.
3   Provides a feature that allows the examiner to convert the result of the quiz into a excel sheet with just a click.

V. METHODOLOGY

The proposed system makes use of five modules that work together to build an efficient system Authentication Module, Quiz Creation Module, Key Generation Module, Attend Quiz Module and Student Monitor Module. The behaviour and interaction of the above-mentioned modules are represented in the figure 1
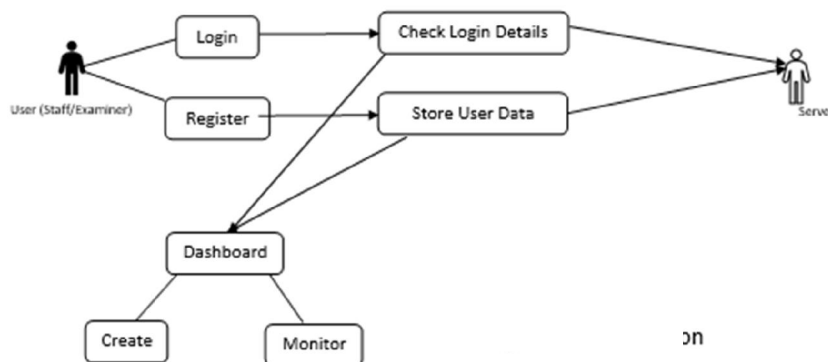
5.1 Authentication Module

The authentication module is a vital part of any application that uses database. This module is responsible for allocation of a storage space for every user who registers. In this case, cloud firestore allocates a whole document for each user and quizzes they create.

The authentication module allows the user to login or register in order to use the quiz application's features. Users must register with a username, email address, phone number, and designation. Firebase authentication is used to verify these data. After verification, Firebase assigns a u-id to each user. The Cloud Firestore stores U-id as well as other user data. During the login process, the stored data can be retrieved and sent to the dashboard. Users are sent to their Dashboard after the verification and data collecting processes, where they can create and monitor quizzes. The behaviour of authentication module is shown in fig. 2
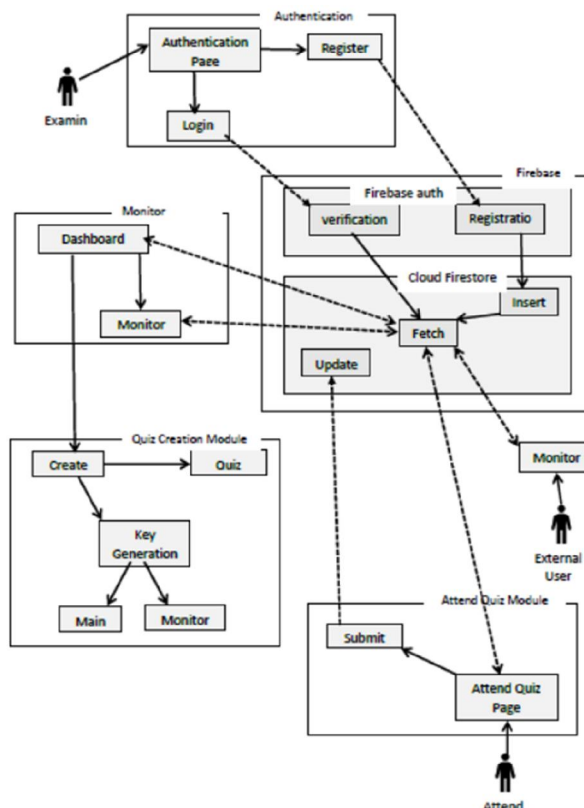
Figure 1: System Architecture of Proposed System

Figure 2: Authentication Module

5.2 Quiz Creation Module

This module is responsible for storing the quiz data in cloud firestore. From the dashboard, the users can navigate to the quiz creation page. During this process two ID's or key are generated by the system. The whole process of key generation is explained in the Key Generation Module. In order to proceed and build the quiz, the user must give a topic and at least one question with four options. The question, choices, and answer, as well as the IDs, are saved in the Cloud Firestore after entering the relevant information. The behaviour of the Quiz Creation module is depicted in the fig. 2. After the quiz is created, it is displayed in the dashboard with two options: i) Copy ID and ii) Monitor. The Copy Id option copies the Main-ID or Student ID to the clipboard, which may then be shared with attendees so they can participate in the quiz. Figure 3 represents the behaviour of the quiz creation module.
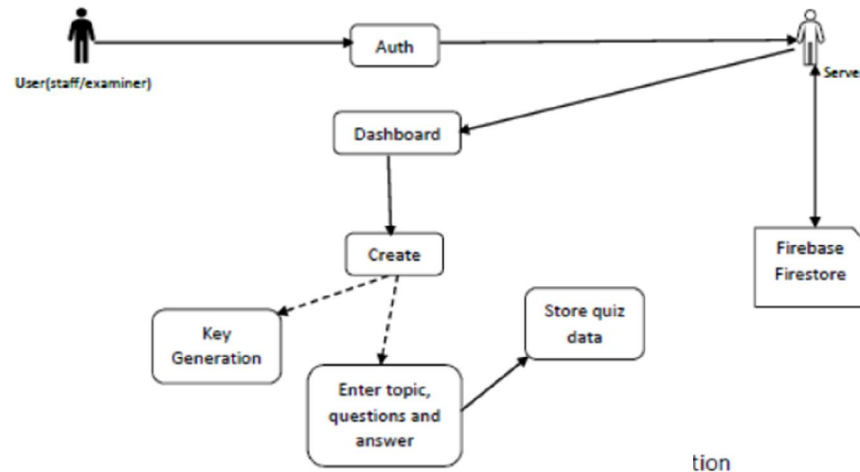
Figure 3: Quiz Creation Module

5.3 Key Generation Module

Key generation takes place during the quiz creation. So, it is safe to say that key generation module is a sub-module of Quiz Creation module. Two ID's or Keys are generated. One that redirects the user to attend quiz is called main ID, another that redirects the user to monitor page is called monitor ID Generating a key is a complex process. The ID of every quiz created by every user is unique. Because the quiz ID depends upon the user ID and the server ID.

5.4 Attend Quiz Module

This module facilitates the user to attend the quiz if they possess the main-ID. Once the ID or Key is entered the user will be redirected to the corresponding quiz to which they can choose the answer from the given options. The attendee will be asked to enter their name and register number before submission. Without register number and name the quiz won't be submitted. It will throw an error saying Register number is mandatory or Name is mandatory.

After submission of the quiz, the response will be evaluated by the system and score will be generated. The attendee details along with the score will be stored in the cloud firestore and the user will be redirected to the home page indicating that the quiz is submitted and evaluated successfully. The attendee won't be able to view their score. If they want to know their score, they have to contact the examiner. The figure 4 represents the behaviour of attendquiz module.
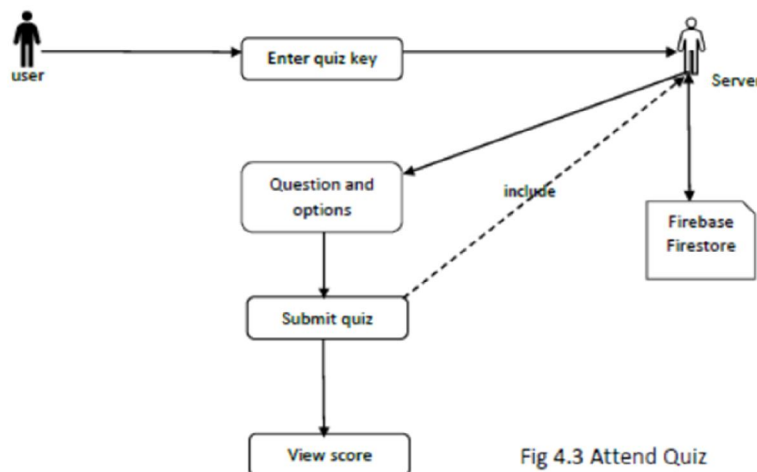

Fig 4.3 Attend Quiz

Figure 4: Attend Quiz Module

5.5 Monitor Module

Monitor module allows the user to monitor the quiz. There are two ways to utilize monitor module. One is through the dashboard, where users can manage their quiz. This also includes monitoring their quiz. Another method is by using monitor-ID or Key. Monitor key is one of the two keys that are generated during the quiz creation. Only the author of the quiz knows the monitor key. The main objective of generation of monitor key is that, the author could share the monitor key with another examiner so that they can monitor the quiz instead of author.

The difference between using a monitor key and using dashboard is that, while using monitor key the user won't be logging in to an account. The user doesn't have to register and create an account for themselves. Instead, they can directly monitor the quiz without logging in. But they cannot create quizzes as registered users do.

The monitor module also provides a feature where the user can open or close the quiz whenever they want. Initially, after creation of a quiz, the quiz is closed as default. No attendee would be able to attend the quiz when it is closed. The examiner has to open the quiz when needed and can close the quiz at dead line. The figure 5 shows how the monitor module behaves when a user interacts with the system.
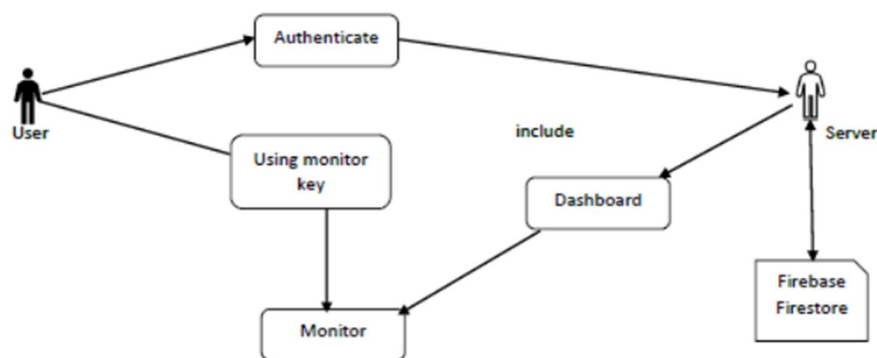

Figure 5: Monitor Module

VI. IMPLEMENTATION

The VS code editor and chrome web browser is used to implement the code. It provides millions of extensions for the developers to make the development process simple and enjoyable.

This system uses 5 modules.

1. Authentication
2. Quiz Creation
3. Key Generation
4. Monitor
5. Attend Quiz

These modules collaborate together and makes the system work efficiently. Each module does a significant job to ensure the perfect data flow and user experience. The behaviour of all the mentioned modules are explained in chapter III.

6.1 HTML

HTML or Hypertext Markup Language defines the structure of a webpage with the use of various tags. A hypertext is a piece of text that contains a hyperlink. HyperText is a method of linking two or more web pages together. A markup language is a computer language that allows you to format and arrange text documents. It also enhances the dynamic and interactive nature of text. Some of the basic tags used in HTML is mention below, in the table.1

Tags	Description
<html>	Defines an HTML document
<head>	Contains metadata for the document
<title>	Defines a title for the document
<body>	Defines the document body

<h1>…<h6>	Defines HTML headings
<p>	Defines the paragraph
<input>	Defines an input control
<button>	Defines a clickable button
<select>	Define a drop-down list

Table 1: Basic HTML tags

6.2 W3.CSS

- W3.CSS is a modern, responsive CSS framework developed by w3schools. It is a free to use and no license is required. We can download the w3.css by using the following link https://www.w3schools.com/w3css/4/w3.css.
- W3.css aims at speeding up the web development process. Usually, to design a responsive webpage using CSS, developers have to utilize media query. This makes the process very complicated and time-consuming. But with the help of W3.css, designing a responsive webpage becomes effortless and the code becomes simpler and optimized.
- W3.css is easy to learn and ideal for beginners. Since the framework is inspired by Google's Material Design, it is safe to say that w3.css provides a professional look to the website.

6.3 JavaScript

JavaScript is considered to be the world's most popular programming language, which is considered as easy to understand and learn. It is a lightweight and interpreted language. The single most important feature of JavaScript is that the functions are objects. Understanding this feature will open up a whole new understanding of this programming language. Because a JavaScript program is built using functions. This is why JavaScript is called as Functional Language.

It was developed primarily as a client-side language that can only run on a browser because of the inbuilt existence of JavaScript V8 engine. The community of developers grew big and the idea to implement JavaScript not only in a browser but in every platform that is available is born. As a result, Nodejs is created
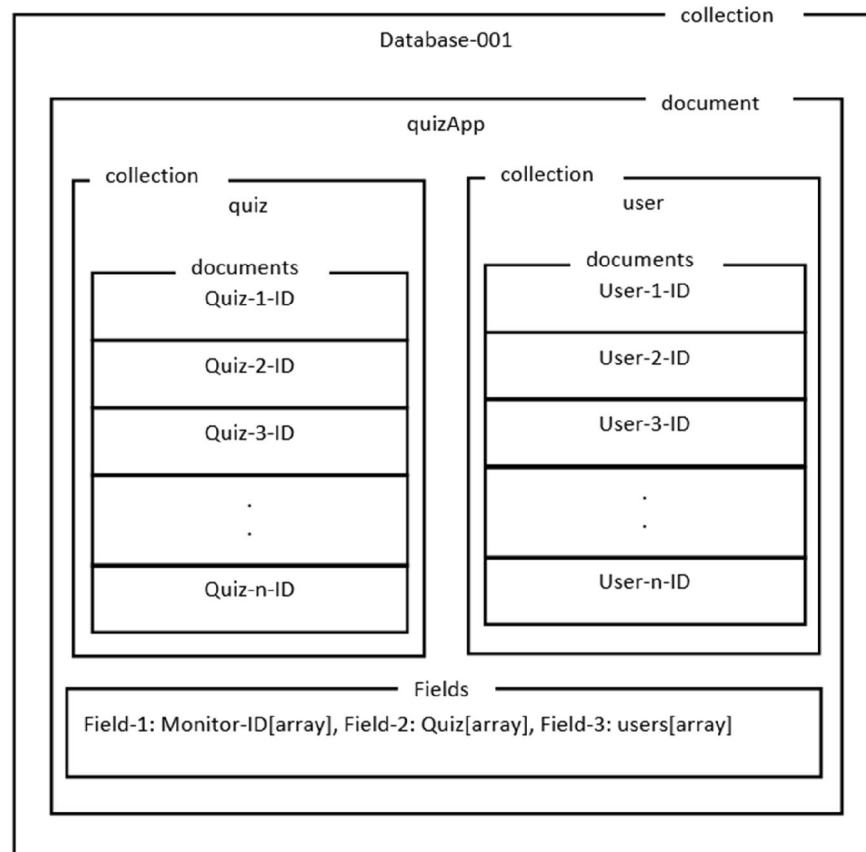
6.4 NodeJS

Node.js can be defined as an open-source server environment for JavaScript. Which means, any system with node.js will have the ability to execute a JavaScript code. Node.js is primarily used for non-blocking, event-driven servers due to its single thread nature. It can be used in traditional websites and to create backend API services.Node.js is not a framework or library, but a runtime environment based on Chrome's V8 engine.

NPM or Node Package Manager is considered to be the largest Open-Source Software Registry. It is a vital part of the NodeJS as it contains over 800,000 code packages. Open-source developers use NPM to develop, install or manage the node packages. The NPM has a huge community where developers discover, publish and develop node packages.

6.5 Firebase

Firebase is a cloud platform provided by Google which helps developers to build, manage and grow their apps with ease. It is used to build apps faster and more secure way. It provides services to android, iOS, web and unity. The firebase's cloud storage uses NoSQL for storage of data.The services provided by Firebase includes Hosting, Test Lab, Cloud Messaging, Crash Reporting and Authentication for Development of an application.

The **Realtime Database** manages huge amount of data at a blazing speed if milliseconds. It is considered as big JSON file.The **Cloud Firestore** which is a database service provided by Firebase that uses NoSQL document database. It stores data in the form of objects known as documents.

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Figure 5: Structure of Cloud Firestore

VII. CONCLUSION

As a conclusion, this quiz application makes it easier for an examiner to conduct a online exam and also provides facility to download the report of the quiz conducted. It is very efficient as the evaluation process is automated and systematic which eliminates error while evaluating a MCQ exam.

The targeted users are students and examiners but the priority is given to examiners. Not much features were added for students but for examiners creation of quiz and monitoring through dashboard is provided after authentication.

The ability to generate over 420 million unique Main keys and Monitor keys for each users makes the system durable and stable. The monitor id or key allows the user to monitor the quiz even without logging in. It directly connects the user with the monitor page, skipping the authentication part. This comes in handy where the author wants another examiner to monitor the quiz but doesn't want the examiner to enter their dashboard.

A. Future Scope

Since the database used in this application is Google's firestore, they provide various services including AI assist which analyse the data in the database and produce a result that helps in effective organization of the cloud. Since the proposed application is a basic model, there is not much features available. It can be upgraded in so many levels depending on user requirements.

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