Revolutionizing Education Accessibility: Smartoems - Bridging The Connectivity Gap In Online Exams

Dr. Hanmant N. Renushe[1*], Dr. Sandeep N. Jagdale[2], mrs Sandhya V. Sankpal[3], Mrs. Shravani Pawar[4], Dr Bajirao R. Patil[5], Dr. Prashant P. Patil[6], Mr. Vikas V. Patil[7], Mrs. Archana B. Thorat[8], Sheetal Deshmukh[9], Mr. Prasanna R. Rasal[10]

[1*,2,5,6,7,8,9,10] BVDU – Yashwantrao Mohite Institute of Management Karad
[3] Sadguru Gadge Maharaj College, Karad
[4] Bharati Vidyapeeth's– Institute of Management and Information Technology, CBD Belapur Navi Mumbai

*Corresponding author: Dr. Hanmant N. Renushe
*BVDU – Yashwantrao Mohite Institute of Management Karad

Abstract:

Academic instruction and student evaluation were among the challenges faced by educational institutions amid the COVID-19 pandemic. Learning management system (LMS)-based training and assessment solutions are offered by numerous companies [1]. An internet connection was necessary for the online assessment and training. As per the Government of India's Statistical Report [2], 43% of Indians will have internet connectivity by the end of 2021. While the country's cities have strong connection, the rural areas still have limited Internet access. As a result, the suggested remedy is inadequate. This study focuses on a new way of administering online tests for academic and administrative courses without Internet connectivity, and it considers all academic fields.

Keywords: SmartOEMS, LMS (Learning Management Systems), SEE, PocketPC, CAPEX, SSID, AI, ML (Machine Learning)

1. Background of study

The COVID-19 pandemic has mandated that educational institutions offer online courses. An integral component of online learning is online testing. A plethora of tools, instructions, and resources are available for the creation of online quizzes and polls. Internet connectivity is necessary for all applications. To solve the problem, we recommend taking online examinations without an Internet connection by using an embedded software. The test can be administered via any of the many gadgets, such as a laptop, desktop, tablet, smartphone, etc. The most recent advancements in the industry, including features, procedures, datasets, and development tools, must be examined to comprehend the progress made in the domain of online testing. It takes a thorough literature search to accomplish this.

2. The objectives of the study:

1. To study the existing Online Examination System.
2. To Design, Develop, and Implement feasible solution to overcome the problem of Examination Assessment.

3. Review of Literature:

The review of relevant literature comprising of research articles published by Indian and international authors in national and international journals, conferences, and proceedings.

The research investigated through a focus group the proctors of online exams to identify root causes of academic malpractice at the same time interview exam content creators on possible approaches on exam questions generators that allow a validity of measure of outcomes. Generally, a final validation done by the focus group respondents and end users for effectivity and usability [3].

The deployment of the item bank system can more successfully accomplish the testing goal by ensuring the stability of the problem level and the quality of the exam questions. In light of evolving current teaching methodologies and ideas, the classic item bank system requires additional examination and refinement in this era of rapidly expanding remote learning. An enhanced genetic algorithm is incorporated into the item bank system to address the test paper problem, utilizing the connotation of EAI and a thorough analysis of the theoretical test paper method to make the system more intelligent. As a result, not only are the test papers' validity and reliability increased, but the test paper system's efficiency is also enhanced. The network item bank system has been optimized at last [4].

The researcher investigates how to categorize questions using a data mining approach and a soft computing technique. The research determines how complex the questions are. Fuzzy c-means clustering is used to group the questions into several groups, such as easy, moderate, and tough. Additionally, evaluations are given to pupils who attempt easy, moderate, and difficult questions [5].

In contrast to written tests, assessments have the potential to improve didactics, efficiency, objectivity, flexibility, accessibility, and even sustainability. They do, however, also come with significant obstacles, including those related to

security, dependability, integrity, and the availability of large enough computer rooms. We used the "Secure Exam Environment" (SEE) to administer extensive online tests. Using their own devices, students can take online tests in any lecture hall thanks to the SEE. while preventing access to unapproved files or websites. Following the SEE's boot, assessments are carried out using Moodle, and other programs (such as Excel, GeoGebra, or Eclipse) may also be utilized[6].

An internal, web-based examination management system is built using a three-tier architecture. It allows defining and setting up exams according to a flexible tree-based exams structure. Additionally, it incorporates a rich text editor for creating tests appropriate for various linguistic and engineering specialties. To relieve teachers of these tiresome duties, it also automates the scheduling, grading, and reporting procedures. Additionally, because of its features and database integration, it can provide a variety of security techniques that identify impersonation, provide robust multifactor authentication and authorization, and stop cheating. Additionally, it offers a user-friendly and educational wizard that lets pupils take tests. Lastly, the results of the user surveys indicate that the system is also very available, fast, dependable, sophisticated, and user-friendly[7].

Analysis of the review of literature
1. A list of an online exam's qualities is provided, including verification and unusual behaviour, security, the creation and assessment of question banks, and usability. The creation, assessment, and verification of question banks as well as anomalous behaviour are the key areas of concentration, according to the literature, with security and usability also considered.
2. Considering the literature review MySQL, Java, PHP, and C# are the most often utilized development languages for online exam solutions. Few applications make advantage of ML and AI techniques.
3. The conclusion drawn from the literature review is that most of the suggested methodologies and algorithms are based on concepts from machine learning and artificial intelligence.
4. It has been established that the most frequently used implementation languages in the selected studies are Python and PHP. Furthermore, the top storage systems MySQL and Firebase have been used in the selected research. Additionally, Open CV is the machine learning library that is most frequently utilized in selected research.

4. Significance of Study:
Internet usage is 43% more prevalent in India. It is so low that even in the absence of internet connectivity, elements like online examination verification, security, question bank production & evaluation, and usability must be used. The research is concentrated on the utilization of all features in a controlled environment.

5. SmartOEMS - is an innovative Examination Management Solution for schools, colleges, and universities. It works on a pocket size computer with smart phone clients. It works with and without Internet (offline).

6.1 Hardware and Software Infrastructure
1. Examination Software Built on LAMP Stack
2. Single Board Pocket Computer
3. Router / Hotspot
4. Connector cables
5. Power supply / Power Bank

System Architecture
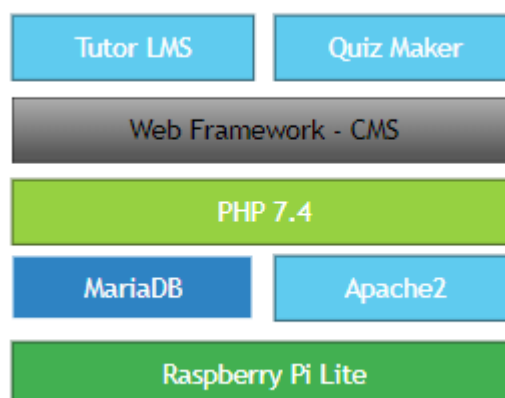
Hardware Module	Particulars
Processor	Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.8GHz
RAM	8GB LPDDR4
Wireless Connectivity Module	2.4 GHz and 5.0 GHz IEEE 802.11ac wireless
Wired Connectivity & Range Extender Module	AX1500 Gigabit Universal Repeater
Devices Connect	150
Storage	NvME SSD 256 GB
Power	5V DC via USB-C connector , Power over Ethernet (PoE) enabled.
Operating temperature	0 – 50 degrees Celsius

We recommended a wireless model since a client can connect to a maximum of one SSID over a wireless connection. All clients can connect to the Application software using a System hotspot. The client's internet connectivity abruptly stopped as soon as it connected to the system hotspot. 150 clients connected at once to the system for testing, and it allows them to access the examination and finish it. The perform task without any errors or delays. The total number of test cases conduction 50.
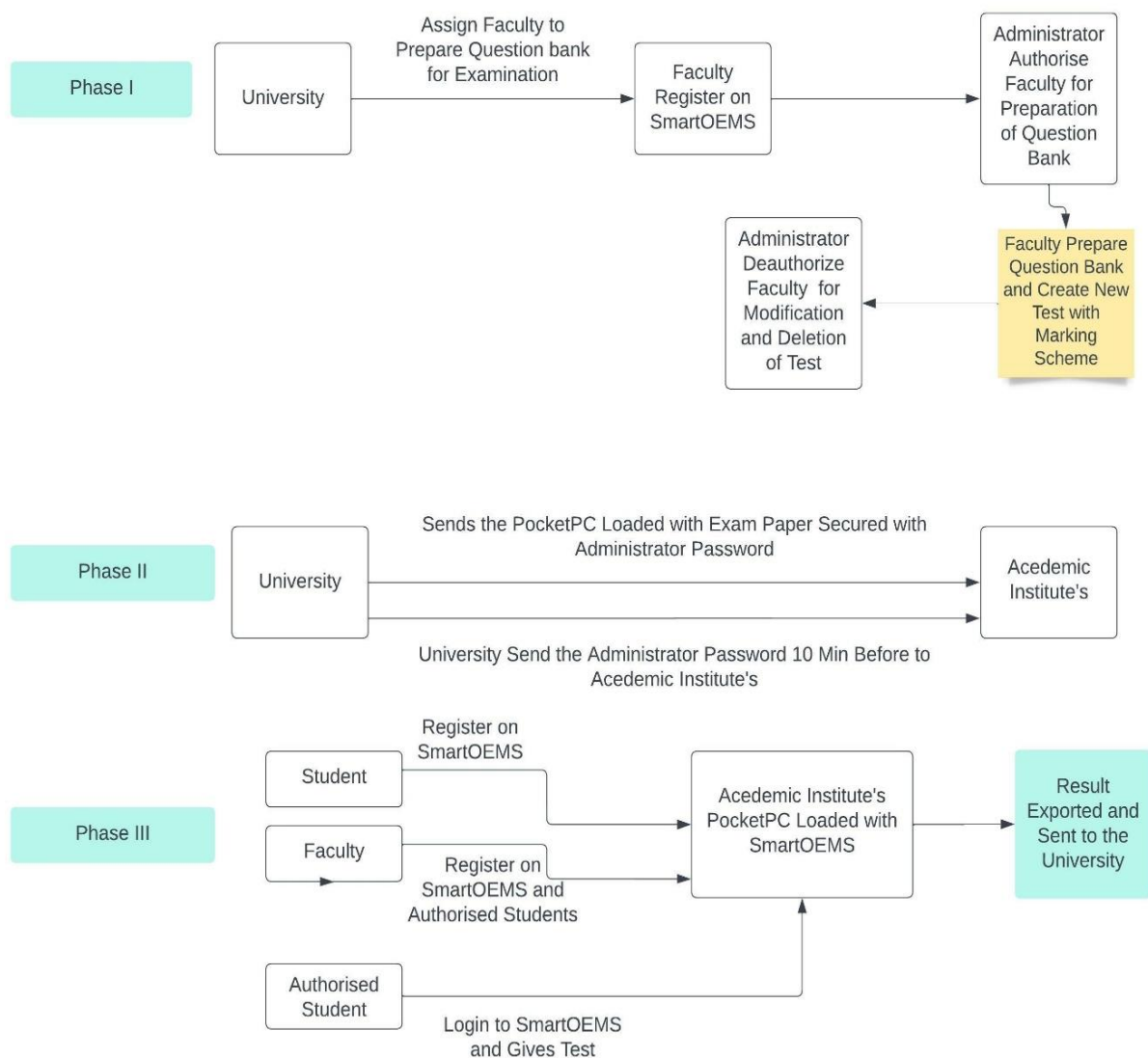
6.2 Working Model of SmartOEMS
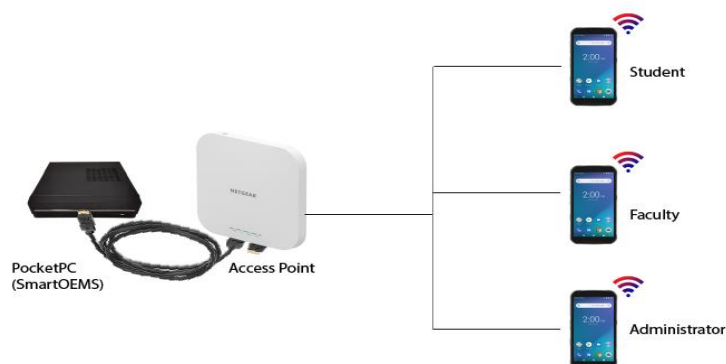
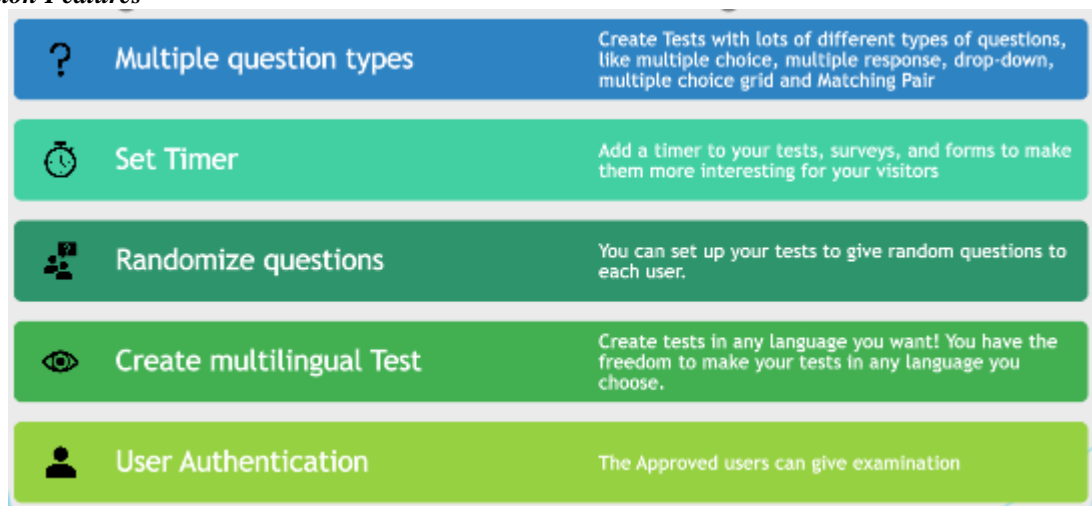The Software allows multiple roles (Administrator / Faculty /Student).
1. The administrator role has been given the power to Authorization and Authentication of Faculty and Students, Import/Export of Question Bank, Report and Analytics of Student Performance, Backup and Restore of Student and Question Bank Data, and Authorization and Analytics of Student Performance.
2. A faculty member is given the authority to authorise and authenticate students for exams as well as create, alter, and delete subject-specific examinations and question banks.
3. The student role is assigned with the ability to examine reports, participate in exams, and appear for them.

The faculty-prepared question bank will be placed into the pocket PC-based exam software before it is given to the institutions. Each institute will have a unique administrator password, which will be sent to the institute 60 minutes prior to the exam. Students register for exams using their exam number as their username and password (a secure password with a minimum of 10 digits). One or a number of attempts are permitted during the exam, depending on the administrator. The software automatically evaluates the results when the student submits their paper , and the outcome will be recorded in the examination program. The obtained result may be exported and sent to a university.

6.3 Phases of Using SmartOEMS

Application Features

Multiple question types	Create Tests with lots of different types of questions, like multiple choice, multiple response, drop-down, multiple choice grid and Matching Pair
Set Timer	Add a timer to your tests, surveys, and forms to make them more interesting for your visitors
Randomize questions	You can set up your tests to give random questions to each user.
Create multilingual Test	Create tests in any language you want! You have the freedom to make your tests in any language you choose.
User Authentication	The Approved users can give examination

Form of Question allowed: Plain Text / Image /Audio File /Video File

System Operation

How to Operate

1. Connect to the Access Point Named xldigital
2. Scan the QR Code to Get Weblink
3. Open the Link in the Browser
4. Default Home Page Open
5. Click on Menu

1. Student Registration
2. Student Dashboard
3. Instructor Registration
4. Courses
5. Tests
6. Select Appropriate Menu

1. Student Registration – To Keep Track of All Courses and Tests the Registration is Needed
2. Student Dashboard – Shows Enrolled Courses with Progress and Test with Result
3. Instructor has Assigned Role (Contributor) and Provided Limited Access to Test Dashboard, to Create Test or Question Bank
4. Course Display Each Course with Course Content in the Form of Video, Exercise and Quiz on the Topic
5. To appear to the scheduled Test student must visit Test Page

6.4 Student Examination Dashboard

Student's Exam Screen
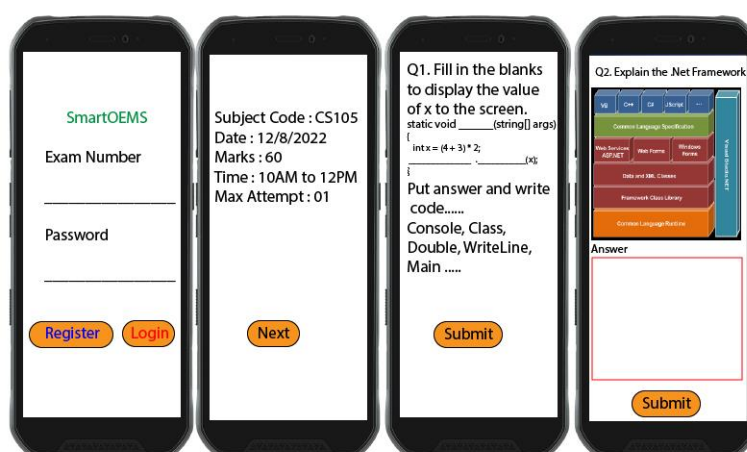
6.5 Faculty Dashboard with Analytics
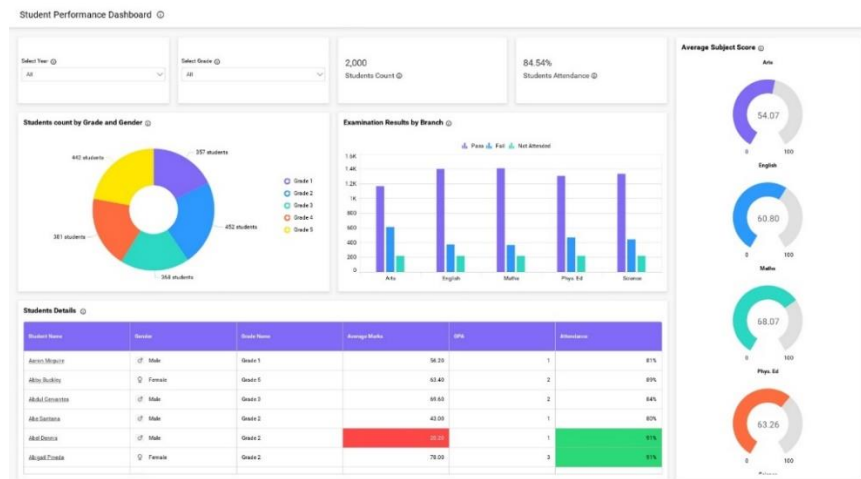
6.6 Benefits of the Examination System

1. Save in CAPEX (no need of server, desktop, laptop)
2. Portable plug and play unit.
3. Smartphone client (works with laptop, desktop as well)
4. On the go quiz solution
5. Works online and offline
6. Better engagement with student / participants / attendees
7. Works on smartphone, laptop, desktop, tablet (all devices)

This examination system is Useful For online or offline as per requirement to the

1. School / College / Universities / Academic Institutions
2. Classes / Training centres
3. Workshop / Seminars
4. College festivals (quiz games)

The said examination removes the barrier of internet connectivity for smooth working of examination in rural area.

6. Conclusion

Other academics can use this data as a resource for research in adjacent fields of study, and the study will be an essential part of the university's Smart Examination Management. The study's recommendations may be considered for implementation by the school, colleges, universities, academic institutes, classes, training centers, workshops, seminars, event show organizers, quiz shows, etc.

References

[1] Mariia Zabolotniaia, Zhichao Cheng, Evgenij Dorozhkin, Anton Lyzhin , "Use of the LMS Moodle for an Effective Implementation of an Innovative Policy in Higher Educational Institutions" International Journal of Emerging Technology in Learning, Kassel, Germany

[2] Gaurav Chopra, IAMAI "Internet Adoption in India" Jun 2021 **KANTAR- ICUBE 2020** , Website https://www.iamai.in

[3] S. S. Chua, J. B. Bondad, Z. R. Lumapas and J. D. L. Garcia, "Online examination system with cheating prevention using question bank randomization and tab locking", *Proc. 4th Int. Conf. Inf. Technol. (InCIT)*, pp. 126-131, Oct. 2019.

[4] Zhang, "Analysis and design of item bank system based on improved genetic algorithm", *Proc. Int. Conf. Comput. Artif. Intell. (ICCAI)*, pp. 139-143, 2018

[5] V. P. Mahatme and K. K. Bhoyar, "Data mining with fuzzy method towards intelligent questions categorization in E-Learning", *Proc. 8th Int. Conf. Comput. Intell. Commun. Netw. (CICN)*, pp. 682-687, Dec. 2016.

[6] G. Frankl, S. Napetschnig and P. Schartner, "Pathways to successful online testing: eExams with the 'secure exam environment' (SEE)", *Proc. Int. Conf. Comput. Supported Educ.*, pp. 231-250, 2018

[7] F. Al-Hawari, M. Alshawabkeh, H. Althawbih and O. Abu Nawas, "Integrated and secure Web-based examination management system", *Comput. Appl. Eng. Educ.*, vol. 27, no. 4, pp. 994-1014, 2019.