Mobile-enabled web platform for web-based assessment in undergraduate teaching: The SMART Exam

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Abstract: The increased popularity of digital pedagogy and technology in education has greatly transformed the teaching and learning process and evaluation strategy, especially in remote leaning. This disjunction also forms an irresistible argument in favor of using mobile platforms as the vehicle of academic evaluation especially in the developing countries like India where most undergraduate students do not have access to personal computers though the mobile telephone remains ubiquitous. In the current paper, it is proposed that SMART, an online personal examination system, SMART- Examination Software has been developed. The framework aims to intensify accessibility, versatility, and efficiency of examination delivery all the while being stable and intuitive. SMART was developed on ASP, AJAX, Visual Studio .NET and MySQL giving it a sound back-end and a simplified user interface. It is a system that expands three major user roles, which are administrators, instructors, students and parts, such as user authentication, the creation and management of tests and the real-time access through mobile devices. Mixed-method evaluation strategy that comprised of use and usability testing and user satisfaction survey were used on the participants or the sample population selected in several engineering institutions. The ended evidence shows that the system is efficient as well as being practical and acceptable among the students and faculty members as well. However, such insignificant issues, such as the readability of the screen, in some instances, having connectivity problems were noted. The framework proves to have a high potential in the development of flexible mobile based testing conditions even though the obstacles have been identified. The artificial intelligence integration to automatically create questions and allow adaptive testing is one of the suggested ways to improve in the future. The proposed system can be deemed an addition to the current efforts with digital education as it provides a scalable and inclusive system of online assessment delivery in low resources environments.

Keywords: Online test framework, e-Assessment platforms, Undergraduate education, Web based examination system, SMART Examination Software

1. Introduction

Today, many students are preparing for their tests studying, at parks, or else on a bus through a cell phone within their hands. The test arranged through web-based frame- works, presently, has been an option for the individuals who get ready for their examinations by utilizing their PCs or other cell phones. Fundamentally, undergraduate students must be in their homes or in a spot that gives previously mentioned conditions to access such electronic test frame- works. In this investigation, we look for answers to empower undergraduate students to get to these frameworks at what- ever point. Any place they need as opposed to being must be in a specific spot. Because of the reasonableness and the upsides of cell phones and the arrangements they have given, the progress from conventional work area frameworks to cell phones has quickened, and the employments of these gadgets have become changed and progressively increasing. One of the employments of cell phones is "portable realizing," which can characterize as "all kinds of learning that do not take place in certain predetermined fixed places" [20]. The objective of this analysis is directed towards the development of an online examination system to assist undergraduate students preparing for their assessments, enabling access via their personal mobile devices. This is in contrast to the speed and performance distinctions observed with computer-based and traditional paper-pencil examinations [3]. The framework created inside the system of the current examination furnishes its clients with a quick, compelling, and active electronic condition because of the present different versatile applications of the mobile. A new approach has to be created to help under graduate students to attempt exams by utilizing their cell phones at whatever point and any place they wish. Portable education is a kind of education acknowledged through versatile specialized gadgets. Portable training given through cell phones; for example, pouch PCs, PDA (Personal Digital Assistant), and portable phones as an option in contrast to conventional study situations [18]. Portable learning with the help of 'Mobilim: Mobile learning management framework system for engineering education' is an instruction form of model liberated as of instance and spot.

Mobile knowledge bolsters individual and agreeable learning, notwithstanding its capacity to empower quick and straightforward access to the mentioned whenever and anyplace [11]. The urge of undergraduate students is to create a sentiment of duty, underpins together person with agreeable learning, moreover, to make checking along with an appraisal of undergraduate students during the learning process. Additionally, found in remote situations, and learners will utilize them by using means of cutting-edge cell phones [12]. The mainly significant element of this is to give situations to understudies and educators liberated from point and spot. Notwithstanding electronic learning, several extraordinary remote learning procedures, for instance, satellite-based learning is as yet being utilized [22]. The findings indicated that individuals of Caucasian descent possessing a minimum of a four-year bachelor's degree were the most inclined to engage in online therapy. The primary reasons cited for this preference included the anonymity offered, the convenience of the service, and the qualifications of the educators.

2. Review of literature

In the studies of Aung S.T. et al. [2] asserted that the web-based personalized platform for JPLAS, utilizing Node.js and referred to as NPLAS, has been adopted. Docker is employed for its straightforward and robust implementation to accommodate novice students. The function for updating prototype strings has been integrated to facilitate instructors in disseminating the strings of new or revised problem prototypes to students, utilizing Angular and Laravel APIs. Zhou, X et al. [33] planned a assets research facility, named M2PLab, is effectively planned and connected for test courses. The M2PLab framework has preferences, like as web predicated motivation, in free get to, graphical calculation plan, reenactment, code era, and test integration. Considering the equipment taken a toll, measure, and calculating execution, the M2PLab framework is introduced into the equipment of Raspberry Pi. Lei, Z., et al. [15] adopt a front-end and back-end segmentation strategy based on React at the front-end and Nginx at the back-end. A solitary proxy deployment has been executed to enhance the user experience. The integrated framework facilitates all functionalities associated with online algorithm design, parameter optimization, visual configuration of a customized user interface, and real-time management with remote and virtual laboratories, encompassing the entire spectrum of activities in control education experimentation. Wang, T. H. et al. [30] proved that, it is conceivable to utilize mobile knowledge either on the web or offline. These two alternatives have two points of interest and burdens. Bulun, M. et al. [6] suggested that despite the additional accompanying points of interest, for example, continually being forward-thinking and the nearness of hypothetically boundless data and intelligent instruction offices, a sadly certain measure of the cost charged from the client, which fluctuates as per the size of the information downloaded or transferred through the cell phones utilized. Rao, N. et al. [21] proved that undergraduate students use tablet gadgets through their education using cloud computing. The lessons are significant as it uncovers to public education is acknowledged extensively, viably utilizing cell phones through cloud computing. Seppälä. P, Alamäki. H. [24] builds the network gateway with Amazon’s "cloud computing service" to empower natural learning forms and the readiness of original learning materials inside mobile learning. This helps educators a chance to structure internet learning forms rapidly, not including the essential to contain any sort of encoding and specific information. Georgiev et al. [9] developed one application and equipment created to be able to utilize inside cell phones have Android plus IOS working frameworks. There are six achievement factors to facilitate portable Web 2.0 methodologies. Torkul et al. [26] investigated to check whether undergraduate students can be given a powerful and productive versatile instruction process through "learning design studio". The form tried through undergraduates of Haifa University seen as valuable in a portable training process. Saran Murat et al. [23] developed another framework to show unknown dialects by utilizing Short Message Service (SMS) in addition to (MMS) Multimedia Messaging Service administrations were built. In this, anonymous dialect messages advanced through illustration innovations sent to the learner’s cellular devices through SMS as well as MMS in average spans. Laroussi, Mona, and Alain Derycke [14] formulated a conceptual model termed "UBI-Learn," which is a decentralized educational system featuring mobile entities and pedagogical utilities. They established an online educational resource accessible to undergraduate students and educators via mobile devices. The framework’s assessment shows that this is a serviceable mobile learning condition. Yousif, A. B., Al-Ajeeli, A [31] studies in another framework, the digital recordings arranged for an aggregate of 6 courses through the assistance of 1244 undergraduate going to ’Law University of New England.’ The assessment completed after the precise application planned for deciding the impacts of digital broadcasts in learning just because of the desires and the encounters of the undergraduate students with the web recordings. Toward the conclusion of the execution, it discovered the level of the undergraduate students. They were inexperienced through digital records preceding the application diminished as of 46 percentages toward 3.5 percentages at the finish of the semester. Kissinger, Jeff S [13] in another investigation, a framework that included static and

dynamic data was building up. By utilizing this framework, undergraduate students going to an advanced education organization would have the option to get to different snippets of data, for example, mobile e-books for their learning. Cell phones have the accompanying favorable circumstances concerning their utilization in Mobile learning like mobility, penmanship, simple correspondence with different gadgets, boundless access at whatever point, and any place required, sensible expense, and prevalence. Be that as it may, small screen size, inconsistent activity frameworks, and information security issues are the weaknesses of these portable gadgets. Wang.C. Y. et al. [29] stated that online tests can consider as a technique where the test content distributed on the web, and the test results are naturally broken down and detailed. It is straightforward to shape tests by utilizing the inquiries that went into the framework by the educators, as indicated by specific rules applied in online test frameworks. The queries may be in different structures, for instance, "multiple choices," "fill-in-the-blanks," and so forth. Bull, Joanna, and Colleen McKenna [5] adopted one of the conventional approaches to get quick tests in distance education training frameworks is "email administration". Within this strategy, the instructor sends examination inquiries to the students through email. The students get these inquiries, respond to them, and send them back to the instructor. The test assessed by the individuals who are answerable designed for this appraisal. The time for this procedure takes 1 to 5 weeks. Because the number of learners significantly high, giving input to every student may not be conceivable. Gülseren. D [10] tested mechanized test frameworks as another technique upheld by modern advances. Test organization and appraisal processes are completed naturally through a confined area network or the web. Tufekci.A [27] limited "multiple choices" plus "matching type". It is essential to prepare the instructors and students regarding the test line utilized inside this strategy to be acquainted with the procedure in detail earlier than the real use. Present, there are tons of online test frameworks through various structures and produced intended for different purposes. Amongst a remarkable good one given below: Meletiou et al. [17] created online test framework to guarantee the arrangement of a quick and compelling learning process for the clients based on ‘Android’ platform. Tynan et al. [28] created an Android activity framework is vast as well as powerful application lying on "exam management and performance analysis," taking place through cell phones. An online test framework created by utilizing J2EE innovation designed for the tests conducted in law enforcement divisions. Yu. Y. [32] created the examination results indicated that this application is valid due to its online highlights regarding effectiveness and outstanding tasks. Mor, Yishay, and Orit Mogilevsky [19] explored the utilization of portable electronic devices, including mobile phones and PDAs, in the capture and acquisition of Sign Language (SL). Similarly, Abou El-Seoud et al. [1] investigated the potential application of these handheld systems in facilitating SL acquisition. The implemented system employs visual applications. The user engages with the graphical system to explore and gain an understanding of sign grammar and syntax grounded in the regional vernacular. De Siqueira, J. M et al., [4] conducted "The PAULEX Universitas Project," the framework was steered within Valencia with 200 students. The impact of paper, as well as pencil tests versus PC- based tests, examined. The sample comprised 55 students who knew about PC based test interface use. Of these 55 understudies, 28 directed to a similar analysis as the PC-based test and 27 in the paper-pencil group. The test comprised 30 inquiries arranged from the track "Educational Psychology" and had multiple-choice questions through 4 alternatives, and the extent of the test was 35 minutes. In this, the "ActiveInk" online track administration framework utilized. No alter was conceivable following the students marked their answers in a computer-based test. There was no critical contrast between paper-pencil and PC-based test designs concerning examination grades; the paper and pencil analysis establish around 4 minutes longer than the PC base. Cochrane, Thomas Donald [7] concluded that the test type doesn’t have any impact on the evaluations got, yet it influences the span of the test. Talu, F., et al. [25] tested a frame work on the undergraduate students and educators can use the test automation system online framework, which just requires a Java-bolstered internet browser, "webserver" plus "relational database server". The correspondence through a database was acknowledged by the ODBC interface (Open Database Connectivity). Dwyer et al. [8] in one of the frameworks, an online appraisal and test exam web server developed. The device is a "trio-A model (Assembling, Administering, and Appraising)", called "WATA," modified through utilizing PHP plus Pearl. The information recovered is put away in the MySQL database. The instructors get to the framework employing their password. In the WATA framework, it is conceivable to insert mixed media segments to the text, such as photos, liveliness, and recordings. Li et al. [16] stated at long last, certain factual computations can also be made by the consequences of the tests, for example, thing trouble, typical test trouble, and thing segregation, mobile interactive learning trails.

3. Methodology

3.1 SMART – Examination Software

SMART– Examination programming software created to guarantee to test this framework through the web

and the association of cell phones. The advancements and stages utilized while creating this framework are as per the following:

- In the progress of web applications, "Visual Studio.Net"as well as smart devices is going to be used.
- We want to use through the encoding stage, "ASP dynamic inquiry language," for mutually the activitiesacknowledged through a server plus a database application.
- It is a programming language, additionally, AJAX scripting verbal communication utilized.
- We want to use the database used within the frame- work "MySQL" because it doesn't need any boundary controller besides it is legitimately open from beginning to the end of programming language, enjoyable,cost-proficient, and exceptionally safe.
- To get to MySQL database starting as of a nearby PC Navicat 8.0 designed for MySQL program to be utilized.
- The spiral programming improvement model may beused in the advancement process.
- This model comprises four stages, specifically investigation, plan, investigation, and use. Improvement forms perform by beginning from littler sides of the framework to the greater and further developed ones.The clients tried the product during the advancementprocedure.

3.2 Examination Model

Concerning the examination model of the investigation, the "scanning model "utilized to decide hypothetical establishments, "Scanning models," are commonly arranged below two original titles, specifically "general" and "test sample." Examining analysts might want to look at the article or the individual straightforwardly or allude to already recorded data, authentic remains, and educated people in the field of engineering education. Afterwards, they should decipher the acquired information by consolidating them with their perceptions into a framework. The quantitative strategy was utilized to condition and calculated the data obtained from this examination numerically. In this respect,the accompanying methodologies given below:

- Online test programming used for this framework andreasons for this examination distributed on the web.
- The product to guarantee student's entrance to a versatile test framework through cell phones was introduced into cell phones.
- A review was created to gauge the ease-of-use level and useful reasonableness in the wording of imagining and connection that foreordained by inspecting the online item assessment considers accessible in the related writing.
- The number of inhabitants in the study comprises undergraduate students, educators, and a few administrators in differentengineering colleges

Fig. 1: Examination organization

3.3 Information Collection Tools

An examination overview structure form has developed to decide the assumptions about the utilization of online test framework through portable gadgets. Need investigation overview regulated to individuals from different engineering colleges. The review comprises three parts: specific individual data, cell phone use information, and we use data. An- other overview we want to utilize in this is "client fulfillment study." Regulated after the ease-of-use test, "client fulfillment study" acquired information about the assessments and remarks of the members who additionally given the ease-of-use test. Along these lines, an overview comprised of picturing and connecting the site controlled to decide the fulfillment levels of students, instructors, and administration members who utilized online test framework through the web. Ease of use tests comprises individual

foreordained assignmentsthat clients may regularly see and use to finish considerableactivities in the interface.

4. SMART – Examination Software and its Structure

The product framework created for the reasons for the investigation is available through versatile gadgets, for example, workstations, advanced mobile devices, PDAs through utilizing Wi-Fi associations. Fig. 1 speaks about the framework structure designed for this which is shown in above. Here 3 types of clients in this framework; be specific, educators, undergraduate students, and few system administrators. The elements of each kind of client are as per the following: system administrators are answerable for the framework; instructors or educators get ready with the question paper and oversee the test and undergraduate student admission and acquire the test through web otherwise cell phones. Fig. 2 and Fig. 3 display the instructor and student frameworks, respectively. Fig. 4 displays the utilized cases chart for the administrator framework that shows the client types and their liable errands.

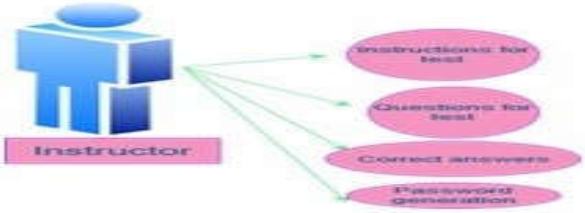

Fig. 2: Instructor framework

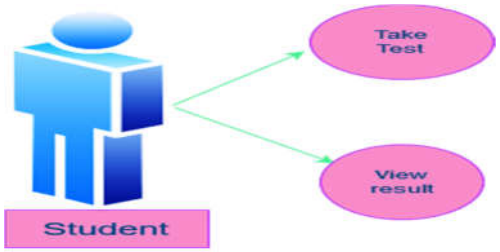

Fig. 3: Student framework

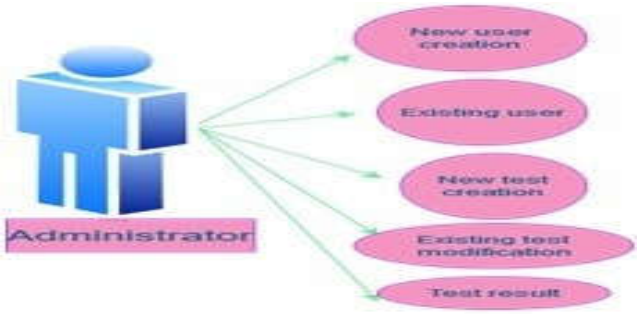

Fig. 4: Administrator framework

4.1 The module used through students

The modules that may use by the college undergraduates in this structure can be arranged equivalent to:

4.1.1 Web component

Undergraduates can get to the product framework by submitting the client's name in addition to the password. On the off chance that an undergraduate student not listed in the context, he can join by following some straightforward advances. The enrollment process finishes just after an administrator affirms the enlistment completed by the student. When an undergraduate enters the framework, he can see the rundown of tests and explicitly the ones he wants to take. These tests can see just while the instructor affirms the test. The student can choose the exam he wants to acquire and hit on "Enter to the Exam" as well as contact the sheet screening the test information. Accurate data concerning the examination introduced on the "test data page." Now, tapping on the "Start the Exam" push-button takes to the test.

4.1.2 Portable component

The versatile component uses 2 particular programming structures. Simultaneously, get to the system through phones; far off web advancement through windows operating system, the portable working structure requires additional programming for the affiliation. These two programming structures associate with the context through web administrations. These web administrations work autonomously and can be grown effectively in current application stages, such as .Net plus Java. PDAs with windows portable working system, programming developed unequivocally. The initial step designed for the establishment is towards downloading the document

"sinavpda.cab" keen on the versatile device. While this document executes, the pane that shows the client name and secret phrase puts away pops naturally. When undergraduate students enter the essential data, the rundown of the tests that transferred formerly display on the monitor. Students can get to the consequences of beforehand accepted exams also by choosing the test. To get to a particular test, students be able to choose the test as well as snap on the linked button designed for beginning the test. The inquiries meant for every test posed individually. It is conceivable to show the queries in a specific request or understudies can respond to the question they need by composing the inquiry number. Utilizing a cell phone with remote web association work is crucial if students need to get to the framework through their cell phones. Through an internet browser accessible on the cell phone, a student enters in to the site. Even though getting to the context and test systems are comparative, standard test techniques may vary as indicated by various web programs gave on multiple cell phones. In versatile modules, a term of the exam shown to lessen test tension, plan understudies for actual tests and empower them to get ready for the test liberated from place and time limitations.

4.1.3 Convenience of SMART– Exam framework and challenges

The assurance of the individuals relied upon deliberateness. The individuals may advise that they skirt the parts they come across problematic and yet total test when they suffer depleted. There was no correspondence among the individuals throughout the test. Exactly when the time designated to complete the test ended, some tiny explanation was given to the individuals. The global challenges we thought of the conduction of exam through this framework given below:

- While interfacing through cell phones, the members needed to sit tight at times because of the internet.
- There will be no problem in the utilization of mobile gadgets by undergraduate students.
- Student members responded to the inquiries in the provided request form.
- Sometimes it was hard to peruse the questions on the screen since some portable devices don't have realistic presentation work.
- It was moderately increasingly hard to get to the data for the right, wrong addresses and unanswered inquiries in versatile programming than web programming.

Online test frameworks utilized to test capability just as to screen undergraduate students learning process. Along these lines, the accompanying issues that ought to think about in online test frameworks are

- The inquiries in the framework must set up to guarantee a simple understanding.
- Test framework ought to be executable in like manner activity frameworks and internet browsers.
- Questions ought to be introduced and requested in a manner to stay away from interruptions on students' side.
- An online test framework should be easy to use to guarantee simply utilize even by the clients with essential PC information.
- The plan of the online test framework's database ought to be necessary enough not to hinder the general structure.
- The context should report crucial details about the learners attempting the tests.

5. Recommendations and Future Work

For the most part, the facts confirm that numerous under- studies experience the ill effects of test uneasiness, besides, to learn for their tests in a better sitting room at whatever point they discover time to perform as such. The creators try to build up a framework that permits undergraduate students to read for their tests easily whenever and anyplace they need by utilizing their cell phones. Moreover, it realized that setting up various decision questions takes a longer time than other inquiry types. In this way, shaping an inquiry bank among instructors was likewise one of the goals of this framework. One of the elements of the framework, which is supported by the clients is to empower instructors to compose their remarks and scrutinizes the inquiries arranged by different instructors. The aftereffects of the investigation additionally show that the framework has been discovered fascinating by educators and undergraduate students. One reason for this end is the undeniably acute utilization of versatile gadgets in this day and age. There is an expanding enthusiasm for cell phones, and these gadgets fundamentally utilized for different purposes as opposed to instruction. Lastly, individuals didn't know about the capacity of cell phones. Growing new frameworks that may urge undergraduate students to utilize gifted education is critical because learning with the highest maintenance is conceivable just when individuals get to data at whatever point they need emerges. Later on, these proposals may likewise cause performing more current examination chips away at the related framework.

- First of all, it may be an intriguing perspective to concentrate more on the framework's visual structure and perform if clients consider any fundamental corrections on currently visible types of the framework.
- It may be significant and intriguing logical examination ways to deal with empowering students from various

institutions to check whether utilizing encounters may contrast in various institutions what's more, and multiple criticisms may originate from the related students.

- It likewise may be a fascinating way to deal with utilizes the framework in numerous types of courses to assess its adequacy on different course types and structures.
- To use the structure alongside their instructive strategies, and survey if the use of an arrangement may create it progressively ground-breaking to show under- studies and get better understudies' accomplishment stage close to the end.

Notwithstanding the communicated proposals, which are identified as a possible prospect job among the creators, there are likewise some extra, arranged opportunity attempts to get better the present type of the portable framework. This planned mechanism incorporates improving the entire structure utilizing skill by giving additional alternatives while getting ready inquiries – tests, and using astute (human-made reasoning based) methods to frame progressively exact tests or get programmed assessment results after taking any test.

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