

Design and implementation of JAMB Computer-Based Test System with Voice Command

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Abstract:- This work was motivated by the desire to develop a Joint Admission and Matriculation Board (JAMB) Computer Based Test (CBT) system for the physically challenged. Since JAMB introduced a computer based software, examination candidates are only allowed to read questions from the computer screen and input answers to the questions via the mouse or keyboard. This computer based test software came with some challenges especially for candidates who are physically challenged. These candidates do not find it easy to read from the computer screen and or make input through the keyboard. Hence the design and implementation a JAMB CBT with voice command was embarked on. Object oriented analysis and design methodology (OOADM) was adopted in this study. Microsoft Visual Basic.NET was used to implement the system. This was supported with MySQL database, a free distributed database engine. The system is a desktop application based on behavior and states of objects. The system reads onscreen questions to candidates, using the earpiece and allows candidates most especially the physically challenged to make input or control the system using voice.

Keywords: CBT, Handicapped, JAMB, UTME, Voice command

1 INTRODUCTION

1.1 Background

Computer Based Test (CBT) is a series of questions, problems, or practical tasks issued on a computer in order to gauge somebody's knowledge, ability, or experience. It is the use of computer to issue question to an examination candidate, allow the candidate to give in answers through the computer and provide a bases for evaluating the candidate. (Alabi et. A., 2012) All agencies are exploiting its use for effective service delivery and that is why testing agencies are taking advantage of it to achieve quality service. Pragmatically, candidates who opt for computer-based tests will have access to a computer, a keyboard and a mouse. In CBT, testing is done in person, on a computer, at an approved testing center. Similar to paper testing centers, computer-based test centers are reviewed and approved to ensure test-takers receive the best, fairest experience possible for their test. Training for jurisdiction and test center administrators is included in set up of a new testing center. Testing centers can use desktop computers or laptop computers, as long as minimum requirements are met. Computer-based testing is the standard for many other test delivery programs. And as technology continues to advance,

it is also becoming the standard format for most of the key assessment programs. (Davey, 2011)

1.1 Statement of the Problem

Since CBT was introduced in UTME by JAMB, a lot of complaints and problems have been associated with it. The problems are:

1. Candidates with physical disabilities may not be able to use the input devices as they want.
2. Candidate with impaired vision may find it difficult to read the questions on the computer screen.
3. There is no submission status page to identify candidates who have submitted.
4. Unfairness in timing due to system lagging.
5. The candidates have no alternative input device in the event of keyboard and mouse failure.

1.2 Aim and objectives of the Study

The aim of this work is to design and develop a CBT system with voice command for UTME.

The specific objectives are to:

- a. Develop a system that will allow candidates with physical disability to make input using voice instead of mouse and or keyboard.
- b. Develop a CBT software that is capable of reading questions on the screen for candidates that have poor vision.
- c. Apply the Object-Oriented Analysis and Design Methodology in developing the CBT system.
- d. Create a distributed database system for CBT multi-user mode using MySQL, a free database engine.
- e. Incorporate speech and voice library to UTME CBT software using an event driven programming language Visual Basic .NET.

1.3 Significance of the Study

Computer-based test equipped with voice command has great significance which recommend it to innovative test agencies all over the world. But I recommend it specially to JAMB for their UTME exams. Handicapped students will perform better if voice were added to computer based exams. But sadly, little has been done about adding voice facilities to computer based examinations. Hence this project will make a huge difference to what has been in existence and thereby add to the body of knowledge. Computed Based Testing (CBT) with voice command would curb examination malpractices, reduce the waste of resources and the need to follow the technological trend in examination. Candidates do not need pens and pencils, and calculators. Testing agencies would not be involved in the printing of millions of question papers. It would also not be involved in the distribution of bulky questions papers to examination towns across the country. With the CBT, preparing schools can now deploy human and material resources to areas of need that would improve efficiency. Examination performance is displayed immediately. Paper and pencil tests are typically “fixed item” test in which the examinees answer the same question within a given test booklet. Since everyone takes every item, all examinees are administrated items that are either very easy or very difficult for them.

These easy and hard items are like adding constants to someone’s score. They provide relatively little information about the examinee’s ability level. Consequently, large number of items and examinees are needed to obtain a modest degree of precision. With computer adaptive tests, the examinee’s ability level relative to a norm group can be iteratively estimated during the testing process and the items can be selected based on the current ability estimate. Examinees can be given the items that maximize the information (within constraints) about their ability levels

from the item responses. Thus, examinees will receive few items that are very easy or very hard for them. This tailored item selection can result in reduced standard errors and greater precision with only a handful properly selected items. CAT employs a great deal of a theory called “item response theory”.

2 Review of Related Works

2.1 Cambridge Assessment

Luis (2015) noted that the Cambridge Assessment are usually arranged to take place in smaller venues, as they require places with a computer per candidate. These venues are normally language schools, academies or colleges that have previously been authorized by the local examination center. Again, this depends on your exam center. Sometimes speaking tests take place on the same day of the exam. However, for long exams, such as First, Advanced or Proficiency, the speaking paper may take place on a different day. No matter what, the speaking test will be with two examiners, not on the computer. As for the venue, it will be chosen by your local exam center. When you do your exam on a computer, your answers are stored automatically every time you make a change (e.g.: answer a question, edit a sentence, etc.). These answers are stored on your computer and uploaded to Cambridge English servers at the end of each part of the exam. The timing for each part of the exam is the same, regardless of the format you take it in. However, candidates usually find that time is less limited during the writing paper on a computer, as typing is generally quicker than writing by hand. Furthermore, on a PC you can edit your text more easily than on paper. On paper, candidates usually write a draft and then rewrite a final version, whereas on a computer, all this happens at the same time, so it is more time-saving. However, this depends on the student’s preference.

The results take only 4 weeks to come out. When you take a paper-based exam, this usually takes around 6-8 weeks. Therefore, if you are in a bit of a hurry to get a certificate, you should definitely wait.

2.2 Computer Based Adaptive Testing

Butner et al., (1998) explained computer adaptive testing (CAT) as a peculiar computer based testing that tailors exams to the individual abilities of each examinee based on their abilities. When an examinee is administrated a test via the computer, the computer can update the estimate of the examinee ability after each item (questions). And then that ability estimate can be used in the selection of items (questions) with the right item (question) bank and high examinee ability variance, CAT can be much more efficient than a traditional paper and pencil test.

Paper and pencil tests are typically “fixed item” test in which the examinees answer the same question within a given test booklet. Since everyone takes every item, all examinees are administered items that are either very easy or very difficult for them. These easy and hard items are like adding constants to someone’s score. They provide relatively little information about the examinee’s ability level. Consequently, large number of items and examinees are needed to obtain a modest degree of precision.

With computer adaptive tests, the examinee’s ability level relative to a norm group can be iteratively estimated during the testing process and the items can be selected based on the current ability estimate. Examinees can be given the items that maximize the information (within constraints) about their ability levels from the item responses. Thus, examinees will receive few items that are very easy or very hard for them. This tailored item selection can result in reduced standard errors and greater precision with only a handful properly selected items. CAT employs a great deal of a theory called “item response theory”.

2.2.1 Features

- Tests are given on demand and scores are available immediately.
- Neither answer sheet nor trained test administrators are needed. test administrator differences are eliminated as a factor in measurement error
- Tests are individual paced so that an examinee does not have to wait for others to finish before going on the next section. Self-paced administration also offers extra time for examinees that need it, potentially reducing one source of test anxiety.
- Computerized testing offers a number of options for timing and formatting. Therefore, it has the potential to accommodate a wider range of item types.
- CATs can provide accurate scores over a wide range of abilities while traditional tests are usually most accurate for average examinees

2.2.2 Limitations

Despite the above advantages, computer adaptive tests have numerous limitations, and several technical and procedural issues:

- CATs are not applicable to all subjects and skills. Most CATs are based on an item-response theory model, yet item response is not applicable to all skill and item types.
- Hardware limitations may restrict the types of item that can be administered by computers. Items involving detailed art work and graphs or

extensive reading passages, for example may be hard to present.

- CATs required careful calibration, the item parameters used in pencil and paper testing may not hold with the computer adaptive test.
- CATs are only manageable if a facility has enough computers for a large number of examinees and the examinees are at least partially computer literate. This can be a big limitation.
- The test administration procedures are different. This may cause problems for some examinees.
- With each examinee receiving a different set of questions, there can be perceived inequalities.
- Examinees are not equally permitted to go back and change answers. A clever examinee could intentionally miss initial questions. The CAT program could then assume low ability and select a series of easy questions. The examinee could then go back and change the answers getting them all right. The result could be a 100% correct answer which could result in the examinee estimated ability being the highest ability level.

2.3 Cambridge Neuropsychological Test Automated Battery (CANTAB)

Sahakian et al., (2008) wrote that the Cambridge Neuropsychological Test Automated Battery (CANTAB), originally developed at the University of Cambridge in the 1980s but now provided in a commercial capacity by Cambridge Cognition, is a computer-based cognitive assessment system consisting of a battery of neuropsychological tests, administered to subjects using a touch screen computer. The CANTAB tests were co-invented by Professor Trevor Robbins and Professor Barbara Sahakian. The 25 tests in CANTAB examine various areas of cognitive function, including:

- general memory and learning,
- working memory and executive function,
- visual memory,
- and reaction time (RT),
- semantic/verbal memory,
- decision making and response control.

The CANTAB combines the accuracy and rigour of computerised psychological testing whilst retaining the wide range of ability measures demanded of a neuropsychological battery. It is suitable for young and old subjects, and aims to be culture and language independent through the use of non-verbal stimuli in the majority of the tests.

The CANTAB PAL touchscreen test, which assesses visual memory and new learning, received the highest rating of world-leading 4* grade from the Research Excellence Framework (REF) 2014. CANTAB and CANTAB PAL were highlighted in the Medical Schools Council 'Health of the Nation' 2015 publication.

2.4 Computerized Classification Test

Thompson (2007) wrote that a computerized classification test (CCT) is a test that is administered by computer for the purpose of classifying examinees. The most common CCT is a mastery test where the test classifies examinees as "Pass" or "Fail," but the term also includes tests that classify examinees into more than two categories. While the term may generally be considered to refer to all computer-administered tests for classification, it is usually used to refer to tests that are interactively administered or of variable-length, similar to computerized adaptive testing (CAT). Like CAT, variable-length CCTs can accomplish the goal of the test (accurate classification) with a fraction of the number of items used in a conventional fixed-form test.

A CCT requires several components:

- An item bank calibrated with a psychometric model selected by the test designer
- A starting point
- An item selection algorithm
- A termination criterion and scoring procedure

The starting point is not a topic of contention; research on CCT primarily investigates the application of different methods for the other three components. Note: The termination criterion and scoring procedure are separate in CAT, but the same in CCT because the test is terminated when a classification is made. Therefore, there are five components that must be specified to design a CAT.

2.5 Findings

The study shows that handicapped students will perform better if voice were added to the examination softwares. Hence this project will make a huge difference to what has been in existence and thereby add to the body of knowledge. Furthermore, Experience has shown that examination malpractices have been the bane of Nigeria's education system as both parents and teachers assist students in the task of this crime. This ugly state of affairs has continually robbed-off on both the standard and out-come of education in the country leading to a widespread call for a total overhaul and sanitization of the entire educational system. As a result, the call for the adoption of the electronic/computer-based tests is a right step in the right direction. However, the process requires an appreciable

level of strategies to enable students/candidates meet the challenges posed by CBT. Nonetheless, no human activity goes without its teething problems but consistency brings about success. Best practice experiences revealed some level of success after initial challenges. However, Nigeria would find the utilization of CBT worthwhile. This will not only reduce malpractices but would ensure prompt or timely release of examination results. It will also ensure that students take their studies seriously and discard the idea of planning for malpractices.

3 THE PROPOSED SYSTEM

3.1 Analysis of The Proposed System

The system will take several inputs that form part of the data. The inputs include answers to question options, registration number, customization preferences, etc. For this purpose, a distributed database engine was created with Microsoft SQL Server to ensure a reliable storage of data that will be processed by the system. The controls on the interface of the system is designed with Microsoft visual studio with visual basic programming language. The system has many forms and modules with make up the entire CBT system. The system uses colours to differentiate between answered and unanswered question. Numbers answered by the candidates turn green while those numbers not yet answered remain gray. Buttons labels and text fields are placed properly in order to make the system user friendly.

The proposed system is a computer based system that helps students to adequately make choice inputs during JAMB CBT. As usual, the candidates arrive at the CBT center and get seated. The candidate will next enter JAMB registration number. If the number is valid, the system will launch the CBT window, if not, the system will remain in the login window. Once the candidate's registration number is accepted by the system, the student will see the instruction page that will guide the student on how to proceed. At this point, the student can wear a microphone headset for speech and listening. The next page is the question page. Here the candidate can navigate through the four subjects available for the examination.

Once a question is displayed, the candidate can click on read or even say read so that the system will read the question. The candidate can select the desired option by saying the letter that corresponds to the option. The student can make changes in selection by just saying another letter. The proposed system 'JAMB CBT with voice command' allows the students not only to hear the question directly from the computer, but to also use voice to answer the questions. The system allows the candidate to jump to one subject to another using voice. The student can navigate to any number just by calling the number. The system employs voice

command to relieve students who are new to computer usage their fears or worries. Voice command is the facility of a device, a computer software or system to be controlled by means of the human voice instead of using the mouse or the keyboard. By removing the need to use buttons, dials and switches, students can easily take the exams with their hands full or handicapped.

The system has a multi-user functionality; hence it can be installed in secondary schools where computer laboratories are available. This will help the prospective JAMB candidates to fully prepare and rehearse the voice command before the actual day of examination. The preparation module uses questions from past years to simulate the process. This helps the student to track his progress in a glance. When using the multi-user facility, the entire candidate participating in the examination saves answers to one central computer on the network with a database. If network fails in the course the examination, the system freezes in order that the student cannot cheat the time by using the computer and the time will pause such that the students will not be cheated neither. This ensures enough fairness in examination timing. The system may be delivered via a software product installed on a single computer, through a corporate or educational intranet, or over the Internet as Web-based training. It can be used to conduct mostly any exam that is not really theoretical, but it

is especially popular for computer-related exams. Computer-based testing is a simple and better way to offer the test. It allows testing centers to offer a more consistent test delivery, faster scoring and reporting, and enhanced test security.

This solves the problems noted in the analysis of the existing system. We are going to outline some of the features of the proposed system and some of the advantages it has over the present system.

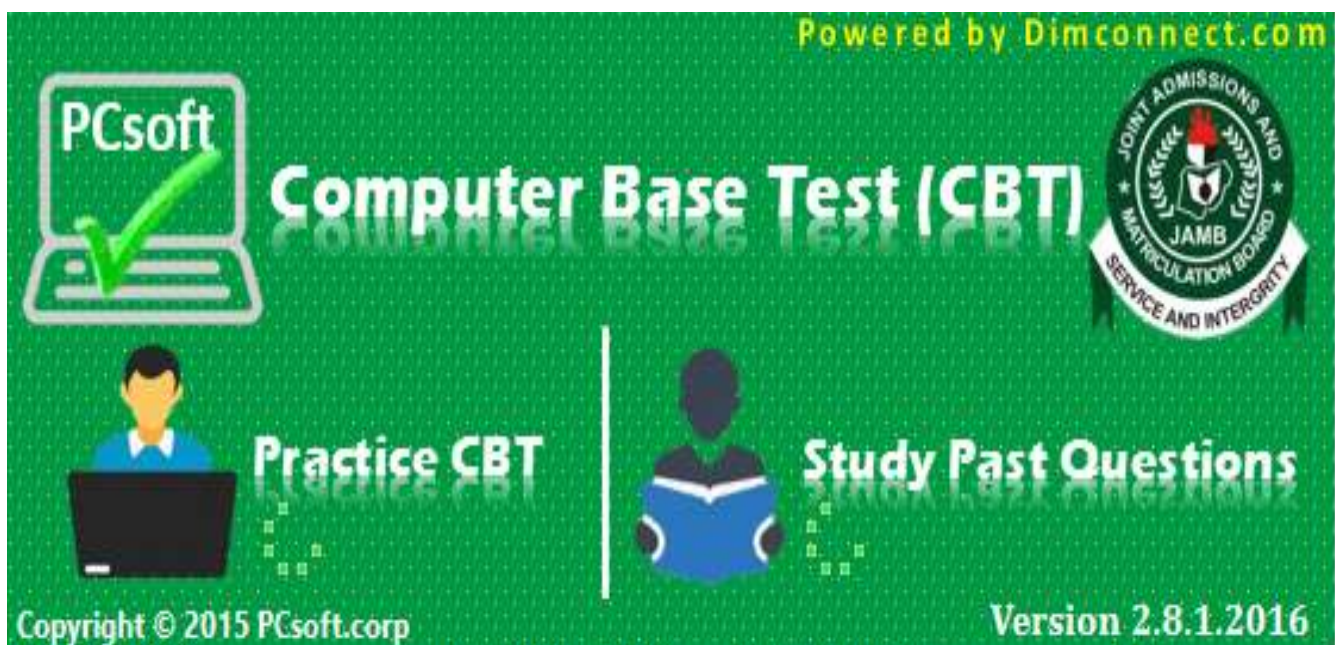
3.2 Features of the Proposed System

Among the features of the proposed system are:

1. It has a question reader for candidates with poor vision
2. It allows voice command for handicapped candidates
3. The system time pauses as a compensation whenever the computer freezes
4. It has exam manager for monitoring exams
5. It has customization module for adjustment of settings

3.3 Sample Outputs of the Proposed System

Splash Screen



Welcome Screen

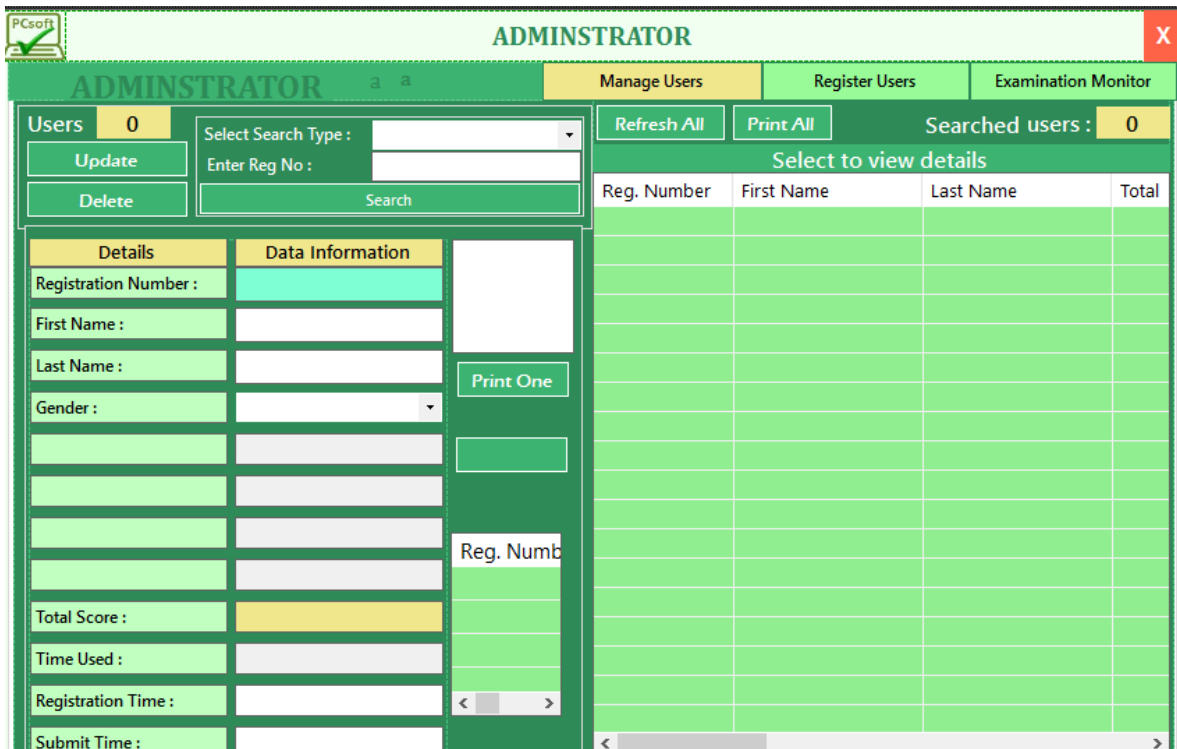
The screenshot displays the main interface of the CBT TRAINING SOFTWARE. At the top, there is a header with the PCsoft logo, the text "CBT TRAINING SOFTWARE", an "UPGRADE" button, and a window control bar with a close button (X). The main content area is divided into several sections:

- Left Sidebar:** Contains two menu items: "Computer Base Test" with a laptop icon and "Ezenwegbu Nnamdi (2013 516 002)" with a person reading icon.
- Center:** Features a "Pratice Computer Based Test" heading, a "Available Subjects Question:" dropdown menu, and a grid of subject buttons with checkmarks: English, Mathematics, Physics, Chemistry, Biology, Geography, Government, Economics, Account, C.R.S, Literature, Agric Science, and Commerce.
- Yellow Note:** A yellow banner with the text: "Note: This software is for student and teachers preparing for exams."
- Navigation:** Four buttons labeled "Admin", "Settings", "About", and "Help" with corresponding icons.
- Bottom Section:** Titled "MANAGE SCHOOL MOCK EXAM", it includes a teacher icon, a text box stating "Did you know is easy to manage student mock exam with PCsoft CBT and get instant result sheet for the students.", and a "Click to know how to" link with a right-pointing arrow.

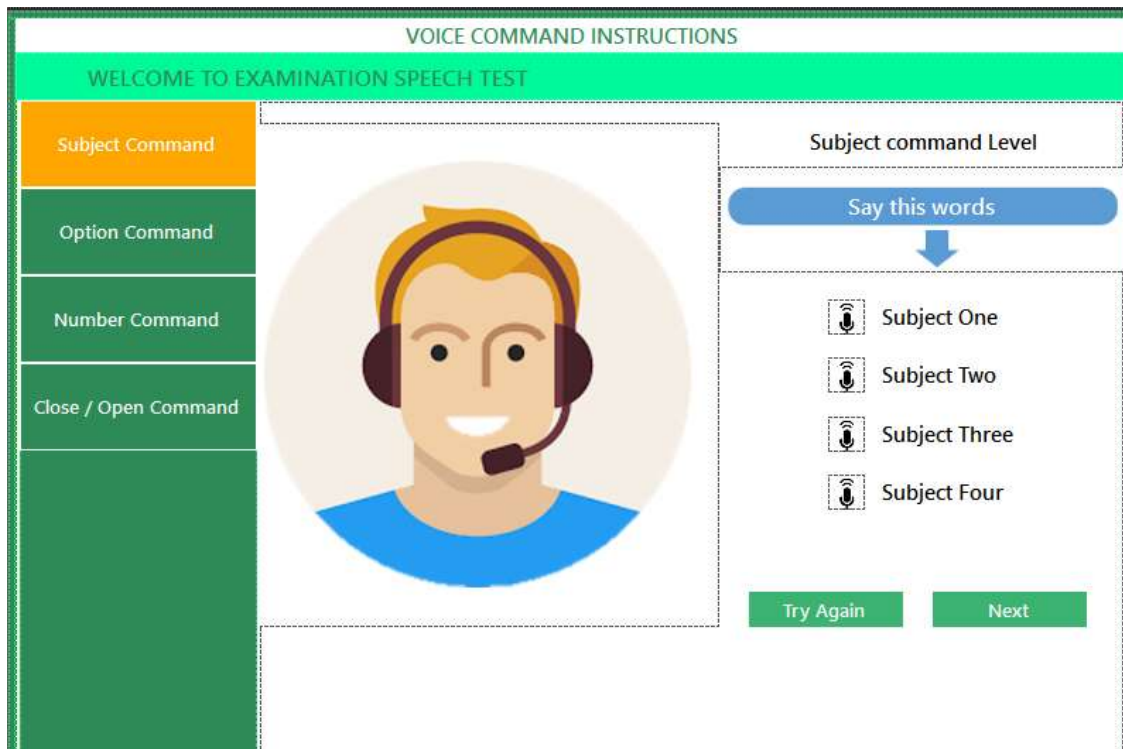
Registration Number Entry Page

The screenshot shows the "Administrator Side" registration page. It features a green background with a white central form area. At the top of the form, there is a PCsoft logo and the JAMB logo. The text reads: "Welcome to computer Based Testing (CBT) Training Software. Please type in your Registration number and click submit to login to your exam area." Below this is a text input field labeled "REGISTRATION NO:" and a large green "SUBMIT" button. At the bottom of the form, there is a copyright notice: "Copyright © 2015 PCsoft Corp." Below the form, there is a navigation bar with four buttons: "Register", "Home", "View Result", and "Time Settings".

Administrator Side



Instruction page



CBT Interface



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