Development of an Examination Based System for the Visually Impaired Persons

E.E. Chukwuemeka[1], C. Ituma[2], N.C. Oyiga[3], N.C. Samson[4], U.C. Ebere[5]
[1, 2] *Department of Computer Science, Ebonyi State University, Abakaliki, Nigeria*
[3,4]*Enugu State Polytechnic Iwollo, Enugu, Nigeria*
[5]*Destinet Smart Technologies, New layout, Enugu, Nigeria*

Abstract: **This work presented the development of an examination based system for visually impaired persons. This was achieved to eliminate the challenges and disenfranchisements of visually impaired person's right to quality education. This was achieved using voice synthesizer, photonic analyzer, and filters techniques. These were designed using universal modeling diagrams and then implemented with MYSQL and visual studio tool. The system was tested but background noise limited the performance, however ear and mouth piece was used to eliminate the back ground noise and good performance was achieved. The result showed the student was able to partake in the exam successfully and then received the overall score after the exam.**

Keywords: **Blind, Examination, Visual Studio, MYSQL, Results, Disenfranchisement**

I. INTRODUCTION

Blindness is a state where one is unable to see with the eye. It is a plight which is pathetic and very worrisome. This inability to see can be due to various reasons like sickness, accident, or even natural causes from birth. This set of individual struggles a lot to associate with the general public state of affairs, but are been limited by their inability to see, and as a result it has been difficult for all of them. Sometimes this people are been marginalized, neglected, and even abandoned by the society due to the lack of tools to help facilitate their integration with the public. To help solve this problem special centers like school churches, daycare, technologies, among others have been established to help provide good standard and also acquit the blind into the society, however this centers cannot function properly without advance tools and technologies. One of such is schools. Today education is believed to be the key to unlock all potentials from individuals irrespective of the person physical condition. According to George Weah "it is the right for everyone" and this right is not limited to the blind. However one of the main challenge faced by the blind today in their schools is the need for a system which can help them partake in public examinations.

In the conventional system one of the popular approaches is the use of Braille system [1]. This system is today generally use worldwide for blind people examinations, however despite the success it suffers from many limitations such as time wasting, cumbersome, required visual person assistance, high cost, takes time to process and provide results and lots more challenges to mention a few. As a result, this has made planning and carrying out examination process for the blind very difficult. To solve this problem, there is need for an intelligent system which will guide the blind just like a visual person using voice command and at the end the results will be made available to them. This will be achieved in this paper using the necessary modeling diagrams, MYSQL dataset and then implemented in visual studio.

II. LITERATURE REVIEW

[1] Developed a computer based text translator for the blind. This system was able to translate text to Braille used for blind education. However despite the success, the system requires human vision assistance for operation. [2] Presented a short introduction of text to speech system synthesis system. This is a system which converts text to speech sound. This approach will be used in this paper to communicate the blind person on how to proceed with the exam via audio. [3] presented a voice interactive software system or speech enabled learning. This will be used in collaboration with [2] as a guide to solve the exam challenge proposed in this paper. [4] Presented a voice recognition based system to assist partially handicapped persons on online exam. The limitation is that the systems do not compute results after the exam and hence due to the delay, the result can be manipulated. [5] Analyzed various exam platforms provided for the blind and revealed that autonomy is lacking in all and recommended the need for an exam based system which the blink can operate with comfortably and independent of full third party supervision. [6] Presented a paper on assisting speech impaired person using text to speech synthesis. This approach will be adopted to interact with the case study blind in this research, but the limitation of [6] is no real time result computation. [7], [8] presented a voice based online examination for physically challenges like the blind. But their approach lack autonomy and also result computation ability. [9] Also presented a voice operated tool for the blind but just like the rest of the papers reviewed lacks autonomy and also real time result computation.

Challenges Identified in the Review

The limitations with the reviewed literatures is that they all depend on external human supervision for operational successes (i.e lacking autonomy), and hence cannot be reliable for large scale exam as the cost to employ supervisors for each

person is expensive. Secondly they lack real time result computation ability and hence can lead to manipulation of results due to delay. Finally they all lack intelligence interaction ability to guide the blind student on what to do and as a result the supervisor must be present all through the exam to guide the student, which is a tedious job to do.

III. METHODS

The methods are the exam registration, admin registration, training, speech synthesizer, results.

Student platform: this is a platform where the students apply for the examinations. This is made up of a system for bio data and then another for exam registration. The bio data request for the student information to create the profile while the exam registration system provides the student with the platform to register for courses they intent to sit for as exam. This student platform assigned registration number to all students as a primary key and will be used for login during te exam.

Admin System: this platform is provided for the exam administrative bodies to provide necessary informations such as the exam questions, objective answers, and score allocated for each. This exam questions provided and objective options will be communicated to the students when they are logged in via audio sound.

Training: this process was used to convert the texted input data provided by the admin into speech and then voiced out to the student when logged in as audio using speech synthesizer.

Speech synthesizer: this is a process of reproducing text to speech sound. This was used to communicate the questions and answer options via audio to the student and then direct on what to do.

Speech Recognition: this is a process where the system listens to the response of the student using phonetic analysis and then gives feedback via voice. The phonetic analyzer collects and represents speech commands from the student into text as in [11] [12]. This is a tool with which one can interact with computer system via voice command and was used in this research to command the system to perform specific intelligence action via voice command.

Results: this is the final stage of the exam process. It is activated after the student have confirmed and answered all questions; the system internally computed by the system and then gives output score to notify the student of his or her performance via audio.

IV. SYSTEM DESIGN

This section presented the design of the various methods in the previous section. The design was done using universal modeling diagrams as shown below, with figure 1 and 2 presenting the class diagram for the exam registration and admin management platform with class diagrams.

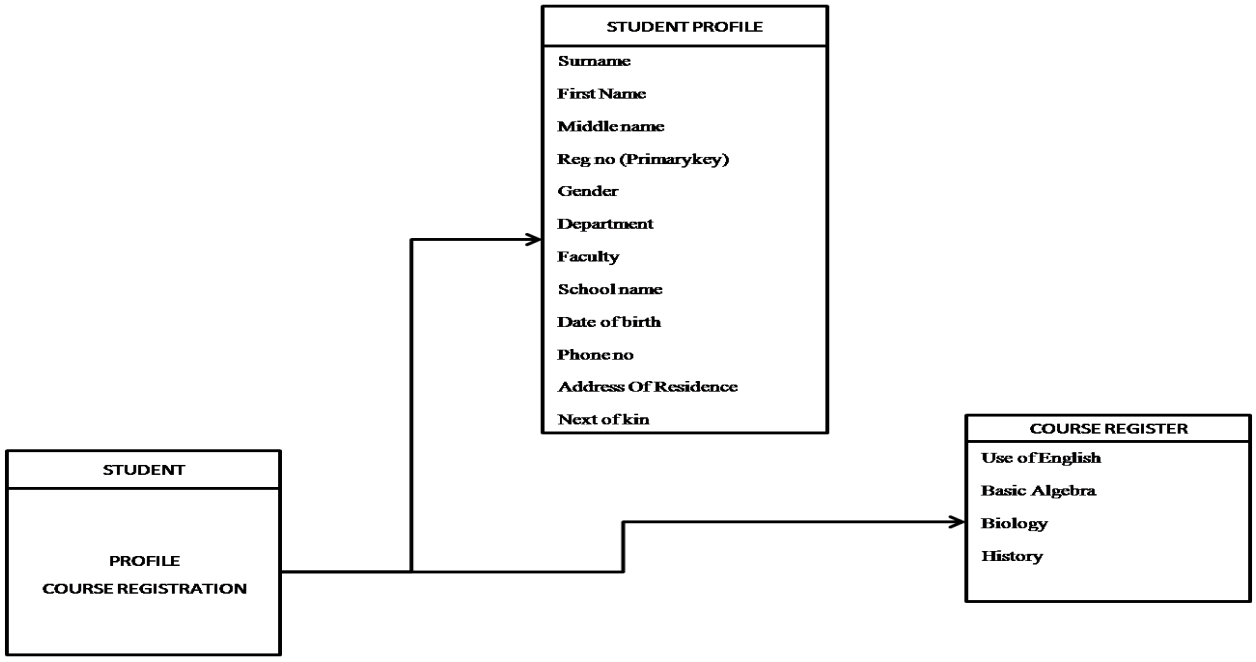

Figure 1: Class diagram for the student registration

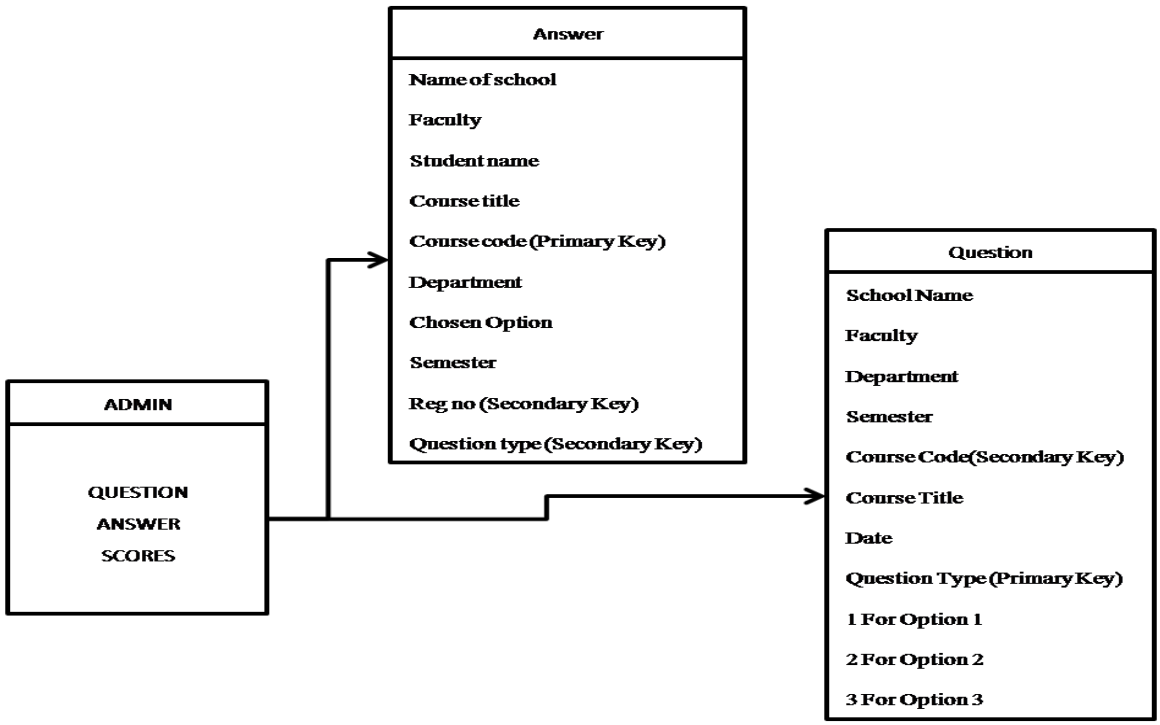

Figure 2: class diagram for the admin management system

The figure 1 and 2 presented the class diagram for the student registration and admin management system. The student registration has two classes which are the class or the student profile registration and the other class for the course registration where the student specifies the courses he or she intends to take the exam on. These two classes are related using the student registration number. The other class diagram in figure 2.1 presented the admin management system where the examiners provide the exam informations via two classes which are the answer and question class.

The system when initializes welcomes the student and asks for their registration number via voice synthesizer software and voice audio asking for the "login registration number" and the voice command which is based on phonetic analysis is activated to collected the response (reg. number) from the student and then log it. With the voice synthesizer the student is prompt via audio to select question number and then simultaneously activate the voice recognition system to listen and then activate the voice command which in this case will be the question number to be read and the objectives options associated with it. The block model of the voice synthesizer is presented a shown in figure 3;

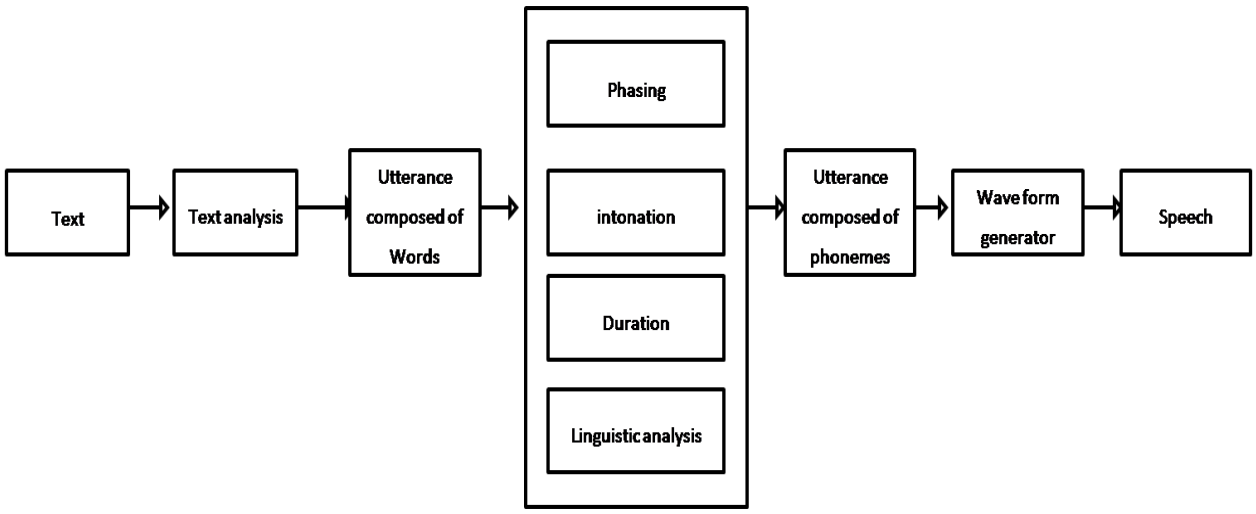

Figure 3: voice synthesizer block model

This figure 3 presented how the voice synthezier convertes the text file from the dataset which are the exam questions, answer options into speech and vocie out to the student while triggering the voice recognition system as shown using the activity diagram in figure 4 below;

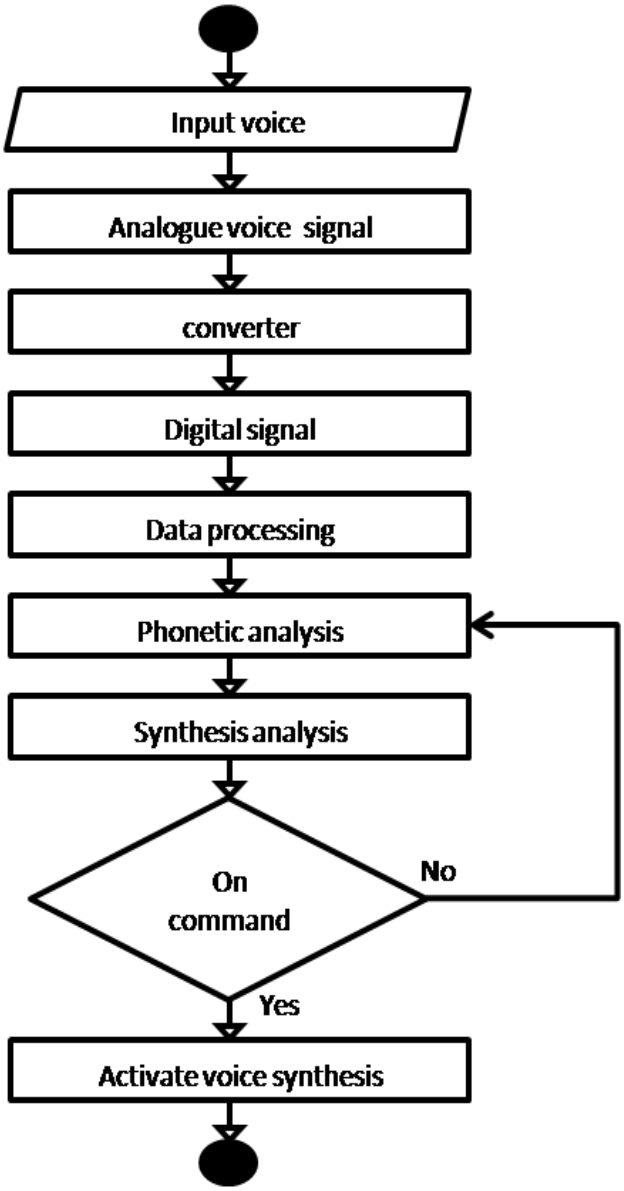

Figure 4: Activity model of the voice recognizer

The figure 4 presented the data flow in the voice recognizer which collects voice data from the student and activated phonetic analysis in [12] to recognize audio command and perform the desired action requested. The data collected from the student is converted from analogue to digital and then processed using the filters in [13] and feed to the phonetic analyzer to transcript the signal to phonetic alphabets and then activate the voice synthesizer in response to the student commend via audio speech. The figure 5 presented the inter relationship between the voice recognition and voice synthesizer tool which works hand in hand for voice command and phonetic analysis.

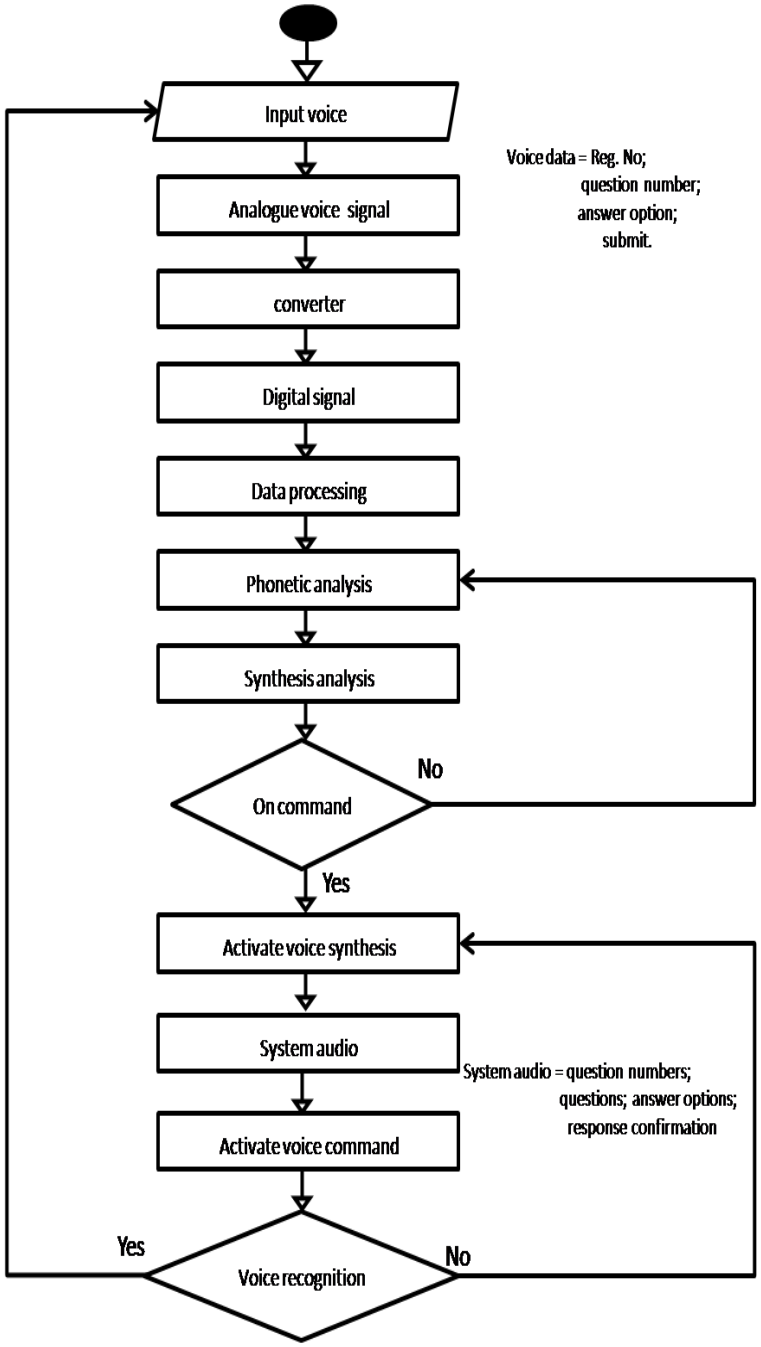

Figure 6: Activity relationship between the voice recognizer and voice synthesizer

The activity model in figure 6 presented the relationship between the voice recognizer and synthesizer as they work hand in hand to for voice command or to listen to voice command from the student. The overall system activity diagram is presented in figure 7 as shown below;

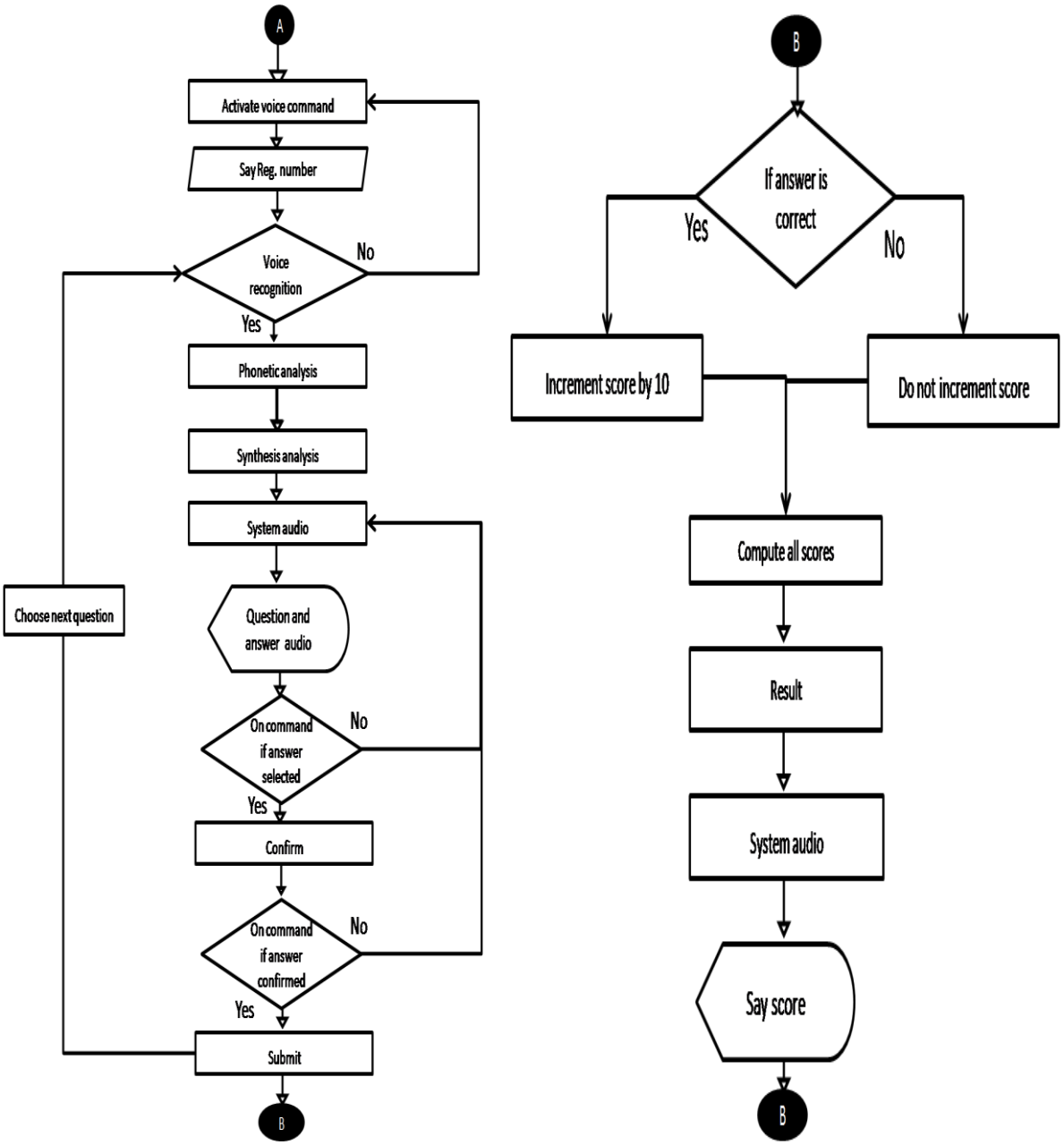

Figure 7: complete system activity diagram

In the system above, when the software is initiated, the voice command prompts the student to login with voice command Reg. number while the phonetic analyzer is activated to convert the speech to text and then trigger the voice synthesizer to perform the response by voice command of "select question number" and then activated the phonetic analyzer to listen for voice command. The student on command reply by selecting question number via voice and the phonetic analyzer recognized the voice and activate the voice synthesizer to read the equations and answer, triggering the phonetic analyzer again to listen for the selection answer option and then prompt the student to confirm the answer and then submit. If the answer submitted is true then the score is incremented by 10, else the score remains the same. When the last question is submitted, then the system computes all results and then activates the voice synthesizer to say the result scored via audio.

V. SYSTEM IMPLEMENTATION

The system was implemented using the models developed in the previous section. The data model in figure 1 and 2 was implemented with MYSQL dataset. The voice recognition and command as modeled in figure 3 and 4 was implemented with voice synthesizer and photonic analyzer tool using visual

studio. The implementation results are presented in figure 8 – figure 11 below;

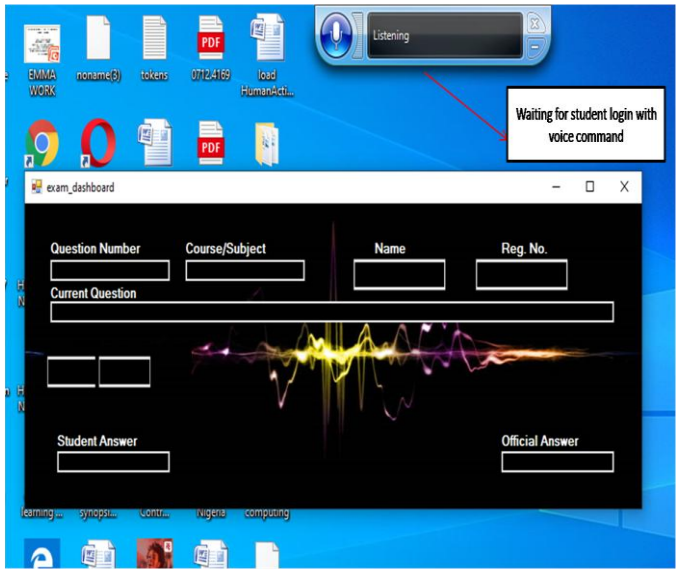

Figure 8: loaded system listening for student login voice command

The figure 8 presented the system setup before the exam. Here the system was loaded and waiting for any registered student login data (Reg. no) for authentication access and examination process using the photonic analyzer modeled in figure 5.

In the next result as shown below, a student with registration number "94319" voiced the login details and was recognized as "justice" by the photonic analyzer, then access was granted to begin exam, while the voice synthesizer modeled in figure 4 was activated to ask the student to "select question number".

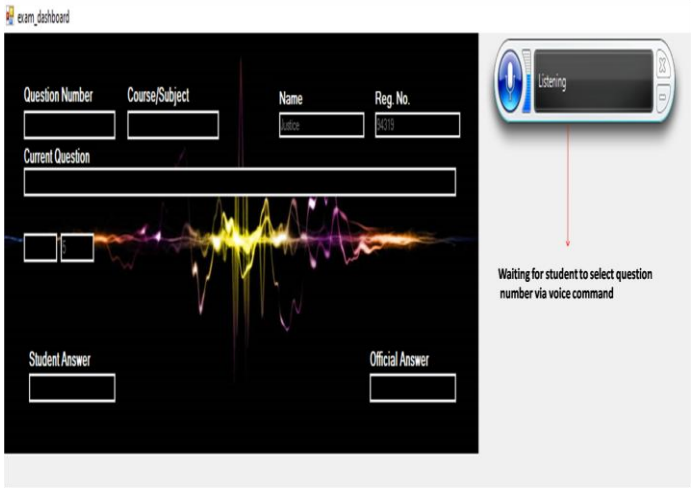

Figure 9: student login successfully and waiting for student vice common to read question

The figure 9 presented where the photonic analyzer was listening for the student to select question number. This was done and then the voice synthesizer read the question for the student to select answers. The figure 10 presented the question and answer section and also the photonic tool waiting for the student to reconfirm answer before submission.

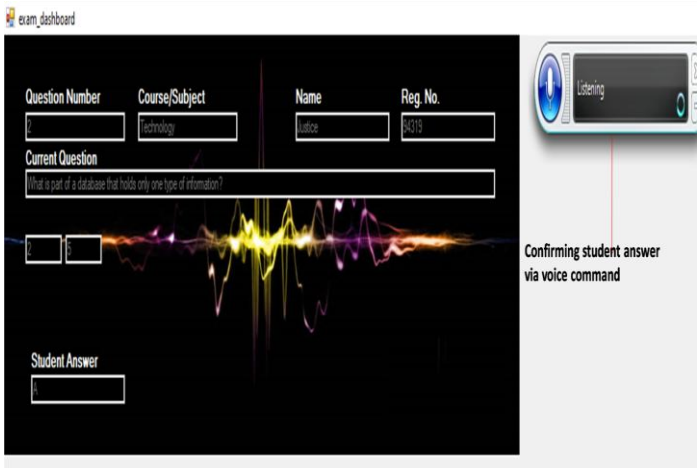

Figure 10: question and answer completed and submitted

The figure 10 was used to achieve the question and answering process until exam is completed, then the result is automatically computed as shown in the flow model in figure 7 to present the result database as in figure 11.

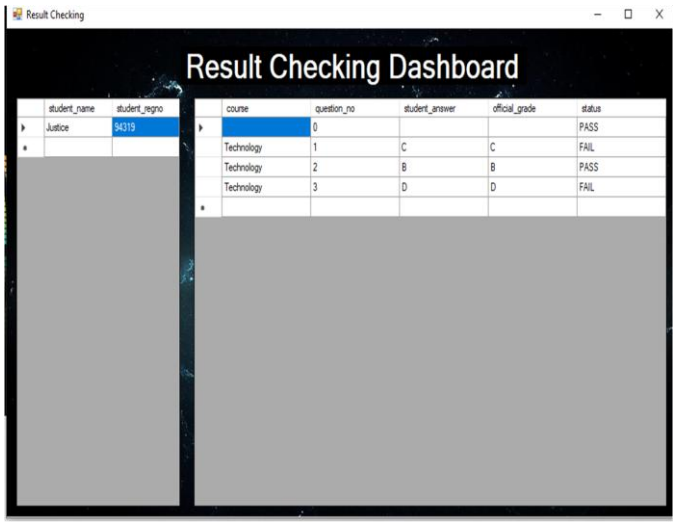

Figure 11: Result dashboard

VI. CONCLUSION

This paper has successfully developed examination software for the blind. This was embarked on to address the challenges faced by these categories of persons due to their inability to see. This was achieved using voice synthesizer, photonic analyzer, and filters and then implemented with MYQSL and visual studio software. The system was tested and the result showed that the student was able to successfully partake in exam and get result with high level of accuracy. However background noise was a limiting factor despite the filter used but this was minimized using ear phone and good operational performance was achieved.

VII. RECOMMENDATION

Having successfully completed this research, the following are recommended

i. This software can be reproduced online to enhance application for public exams
ii. Earpiece is required to eliminate background noise
iii. The sample size used or the exam can be improved to accommodate more student, questions and answers

REFERENCES

[1] Adriano et al (2006) "Personal computer based text translator for the blind. International Journal of Computer Applications" Volume 142 No.14. Retrieved from https //www. Ijcaonline.org

[2] Dutoit T (2016) "A short Introduction to Text-to-Speech Synthesis. TTS Research Team, TCTS Lab". Retrived from. http//tcts.fpms.ac.be/synthesis/intorttsold.html

[3] García, V. et al (2010) "Voice interactive classroom, a service-oriented software architecture for speech-enabled learning". Journal of Network and Computer Applications, 33(5), 603–610.

[4] Jamunkar, V. (2014) "Voice Recognition and its Application in Online Exam for PH People" International Journal of Research in Advent Technology, 2(2).

[5] Junying, A et al. (2012) "The application and efficiency analysis of exam platform for people with visual impairments". In Robotics and Applications (ISRA), 2012 IEEE Symposium on (pp. 1–4). IEEE

[6] Kabari et al. (2015) "Assisting the Speech Impaired People Using Text-to-Speech synthesis"; International Journal of Emerging Engineering Research and Technology

[7] Sania, K et al (2015) "Voice Based Online Examination for Physically Challenged" International Journal of Computer Science and International Journal of Contemporary Applied Researches Vol. 6, No. 2, February 2019 (ISSN: 2308-1365) www.ijcar.net 45 Information technology

[8] Shunmuga, S et al. (2014) "Online Examination System for Blinds" International Journal of Technology Enhancements and Emerging Engineering Research, 2(5)

[9] Vats, A et al (2016) "Voice Operated Tool-examination portal for blind persons". International Journal of Computer Applications, 142(14)

[10] Van S, Jan P., Sproat R. Olive p., Hirschberg J. (1997) "Process in speech Synthesis" ISSN 978-0-387-94701-3

[11] Laver J. (1994)"principles of phonetics" Cambridge p. 550; ISBN 0- 521-45655

[12] Ball M., Rahilly J (1999)" Phonetic the science of speech. Arnold pp 142-3 ; ISBN 0-340-70010-6

[13] Julius O.S (2020) "Introduction to digital filters with audio application" CCRMA; Stanford University.