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Efficient Examination Method for Blind People using MATLAB and Embedded System

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***Abstract*—Examinations are the basic building blocks for academic progress. A person gets promoted to a higher level or completes a course once they pass certain tests. In India, 80% of competitive examinations are of the objective type, typically consisting of multiple-choice questions with 4 or 5 options. Reading questions during examinations can be extremely challenging for blind or visually impaired individuals due to their limited visibility. As software engineers, we have a responsibility to assist these individuals.We propose to develop a comprehensive system that addresses these challenges in real time by reading out the questions and answers during examinations. The system will use audio output, which can be listened to through headphones. We employed the MATLAB tool to convert text to audio. The system will be rigorously tested for its efficiency in real-time conditions. For future enhancements, we have plans to incorporate voice command functionalities such as "read again," "next page," "end," etc. We hope that our system will provide blind and visually impaired individuals with the efficiency and capability to tackle their examination-related problems in real time.**

***Keywords*— Text to speech (TTS), Speech Recognition (SR),Automatic Speech Recognition (ASR), Computer Speech Recognition (CSR), Speech to Text (STT).**

I. INTRODUCTION

The growth of the Internet, and in particular the Web, is already influencing the way science is taught and will undoubtedly continue to do so to a greater extent in the future. In education, the Internet offers a medium with the potential to be more responsive to students' needs by providing a flexible and accessible learning environment. One significant application of this potential is the web-based examination system, which can be used via the Internet or intranet to manage student examinations.

In the future, blind individuals will be able to take online exams like sighted individuals if tests can be administered using simple user interfaces, such as a computer, a fingerprint device for login, a keyboard, and a minimal condition of just a web browser. In our project, questions and choices are delivered through voice in real-time, making it accessible for visually impaired students. The system also automates the marking process, providing instantaneous results and relieving faculty from these time-consuming duties.

Globally, there are an estimated 30 million blind persons, with 6 million in India alone. In Karnataka, the prevalence of blindness is 4 per 1,000 population. Recent advancements in computer technology have made it possible for blind individuals to take examinations independently, eliminating the need to rely on others for assistance during exams.

The development of such a system requires the integration of two key technologies: Text to Speech (TTS) and Speech to Text (STT). Text to Speech, also known as speech synthesis, should be capable of reading any text aloud, providing an artificial production of human speech. The computer system used for this purpose is referred to as a speech computer or speech synthesizer. This technology can be implemented in both hardware and software.

In recent years, speech recognition has emerged as a powerful tool for translating spoken words into text. This technology is not only used as an assistive tool for the blind but also for individuals with partial vision and other impairments. Implementing this tool as a mobile or web application in the future could further enhance its accessibility and usability.

The accuracy of the tool depends on the quality of the hardware used, as different microphones have varying frequencies and input characteristics. Additionally, the system currently recognizes only UK English and requires a peaceful environment free from extraneous noise to function effectively.

By leveraging these technologies, we can create a more inclusive and accessible examination system that empowers visually impaired individuals to take their exams independently, thereby fostering greater equality and inclusivity in education.

II. EXISTING METHODS

First,The examination system for blind individuals currently relies on volunteers to write exams on behalf of blind candidates. Finding a responsible person to write for them in the examination hall is a significant source of stress for blind students, comparable to the challenges posed by their disability. The scarcity of suitable writers is particularly problematic for blind students pursuing advanced degrees in universities.

Proposed System:Given these challenges, the proposed system leverages internet-based examination technology using keypad input. Questions are randomly presented to the candidate. A microcontroller sends the text to a voice board, which converts the text to speech. The blind candidates hear the questions through headphones. After listening to the question, they can input their answers using a keypad. This system can reduce the

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anxiety of blind individuals while answering questions. They can easily respond to questions by pressing keys without confusion or mismatching words.

A. Literature Survey:

B. Shanmuga Sundari, Essaki Durai K., Srinivasa S. proposed a web-based examination system where tests can be taken using a personal computer, with fingerprint authentication for login. Questions and options are provided through speech synthesis, and answers are input using limited keys on the keyboard. Results are also delivered via voice. The major drawback is the limited input method, supporting only multiple-choice questions [1].

Ajinkya Tandel, Manjiri Pathak, et al. proposed an online examination system using Natural Language Processing. This system allows organizations or institutions to conduct and manage examinations online through the internet or a Local Area Network. Candidates answer examination papers on the computer and submit their responses, with immediate results upon completion. However, it does not support long answers, only multiple-choice questions [2].

Akriti Vats, Apoorv Tandon, Deepan Varshney, Amit Sinha proposed a system where users are provided with headphones and a microphone. Authentication is done via thumb impression recognition. The system offers options like NEXT and FINISH. Test results are saved in the user's database and announced via voice. The drawback is that it is designed only for aptitude-type questions [3].

J. Kanimozhi, A. Karkuzhali, K. Suresh Kumar proposed an online examination system using the Internet of Things (IOT). Textual content is converted to voice using a voice board and headphones. Blind individuals use a keypad to input answers. The disadvantage is that answers can only be given using limited keys on the keypad [4].

Pawan Bharadwaj, Tirumala Balaji G., et al. proposed an examination portal for visually impaired individuals using an embedded system and machine learning. The drawback of this system is that it only reads the text present on the screen through voice commands [5].

Sania Khan, Sanskriti Verma, et al. proposed an examination portal for physically challenged people using .NET. Voice commands from the user are stored in a database. The disadvantage is that it supports only yes/no questions and multiple-choice questions [6].

J.Deepika, D. Jayashree, D. Yamuna Thangam proposed a system for visually impaired students to take tests. Information presented on the screen is delivered through voice, and blind individuals select their answers using keyboard keys. The drawback is that a third person is required to monitor and assist the blind candidates [7]..

III. BLOCK DIAGRAM AND EXPLANATION

BeforeThe system is designed to facilitate the examination process for blind individuals. When a user inputs a response via the keypad, the microcontroller processes this input and communicates it to the data acquisition unit. The data is then sent to the data processing unit, where MATLAB software extracts features and classifies the response. The result is relayed back through the speaker, providing immediate auditory feedback to the user. This real-time processing and response system ensures a seamless and efficient examination experience for blind individuals, allowing them to participate independently and confidently in exams.

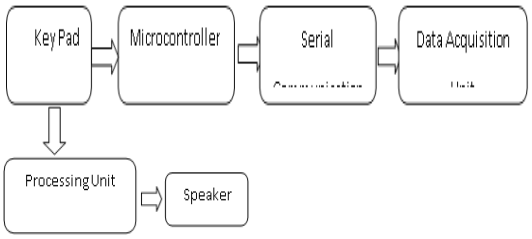

Fig. 1. shows the block diagram of the proposed system. It contains a keypad, microcontroller, serial communication module, data acquisition module, data processing unit, and speaker.

A. Keypad

The keypad serves as the interface between the user and the computer. It has limited keys, with only the essential options: A, B, C, D for multiple-choice questions and additional keys for functions such as forward, reverse, and skip. This simplifies input for blind users, ensuring ease of use and minimizing errors.

B. 8051 Microcontroller

The 8051 microcontroller is a widely used general-purpose microcontroller, programmed using 8051 assembly language. It is an 8-bit microcontroller known for its integration capabilities, making it ideal for embedded systems. It controls the input from the keypad and communicates with other modules to process and relay information.

C. Power Supply

A power supply provides the necessary electrical energy to power the entire system. Its primary function is to convert one form of electrical energy into another, acting as an electric power converter. In this system, the power supply ensures stable and reliable operation of all components, from the microcontroller to the speaker.

D. Serial Communication

Serial communication is employed to send data sequentially, one bit at a time, over a communication channel or computer bus. This method is used for efficient and reliable data transfer between the microcontroller and other modules, such as the data acquisition and processing units.

E. Data Acquisition Unit

The data acquisition unit is responsible for storing data. It samples signals that measure real-world physical conditions and converts these samples into digital numeric values that the computer can manipulate. This unit ensures that all input data is accurately captured and ready for processing.

F. Data Processing Unit

This unit receives data from the acquisition unit. Using MATLAB software, it performs feature extraction and

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develops classification algorithms. MATLAB provides a robust environment for processing the data, analyzing patterns, and making decisions based on the input, thus facilitating accurate voice synthesis and response.

G. Speaker

The speaker, an electro-acoustic transducer, converts electrical audio signals into corresponding sound. It delivers the questions and options to the user audibly, ensuring that blind users can hear the information clearly through headphones. This auditory feedback is crucial for enabling blind individuals to navigate and respond to the exam efficiently.

IV. METHODOLOGY

The methodology outlined below describes the process by which blind individuals can take exams using a specialized kit provided to them. Additionally, it explains the flowchart for recognizing key presses on the keypad and the use of MATLAB for controlling the exam process.

Providing Exam Kit:Blind individuals are provided with an exam kit comprising an earphone and a keyboard set connected to a computer. This kit serves as the interface between the user and the exam portal.

Starting the Exam:The invigilator initiates the exam by clicking the start button on the exam portal. This action triggers the commencement of the exam process.

Question Presentation:Questions and multiple-choice options are audibly presented to the student through the earphone. The student listens to the questions and options and prepares to respond.

Answering Questions:The student answers each question by pressing the corresponding button on the keypad. As each button is pressed, the answer is heard through the earphone, confirming the input.

Navigation and Submission:The student utilizes buttons such as Next, Previous, and Submit on the keypad to navigate through the exam and submit their responses. These actions facilitate the movement between questions and finalizing the exam.

Result Storage and Transmission:Upon completion, the exam results are stored locally on the computer and may also be transmitted online, depending on the system's configuration. This ensures that the results are securely recorded and accessible for further processing.

Flowchart for Keypress Recognition:

Figure 2 depicts the flowchart for recognizing key presses on the provided keypad. The system scans each row and column of the keypad sequentially to determine which key has been pressed by the user. This process ensures accurate detection of user inputs during the exam.

Utilization of MATLAB:MATLAB, a versatile numerical computing environment and programming language, is employed to control the entire exam process. MATLAB allows for matrix manipulations, plotting of functions and data, implementation of algorithms, and creation of user interfaces.The project utilizes MATLAB's Image Processing Toolbox to perform various image processing techniques, enhancing the functionality and efficiency of the exam system.individuals. MATLAB's capabilities are harnessed to streamline the exam process and ensure its smooth execution from start to finish.

Flowchart of Working System:

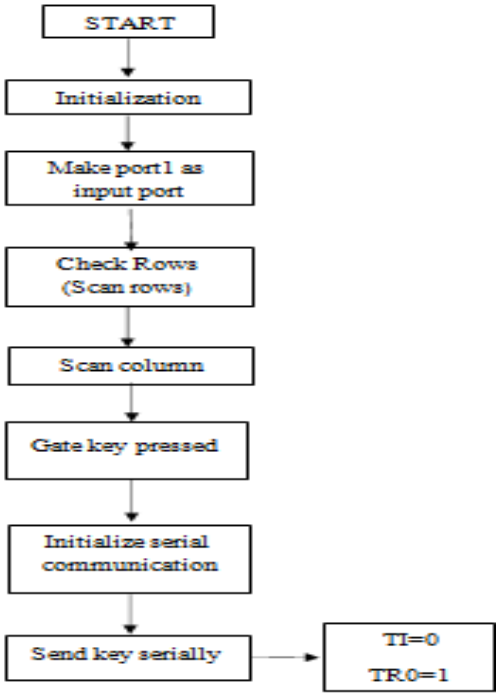

Fig. 2. flow chart to recognize the key pressed

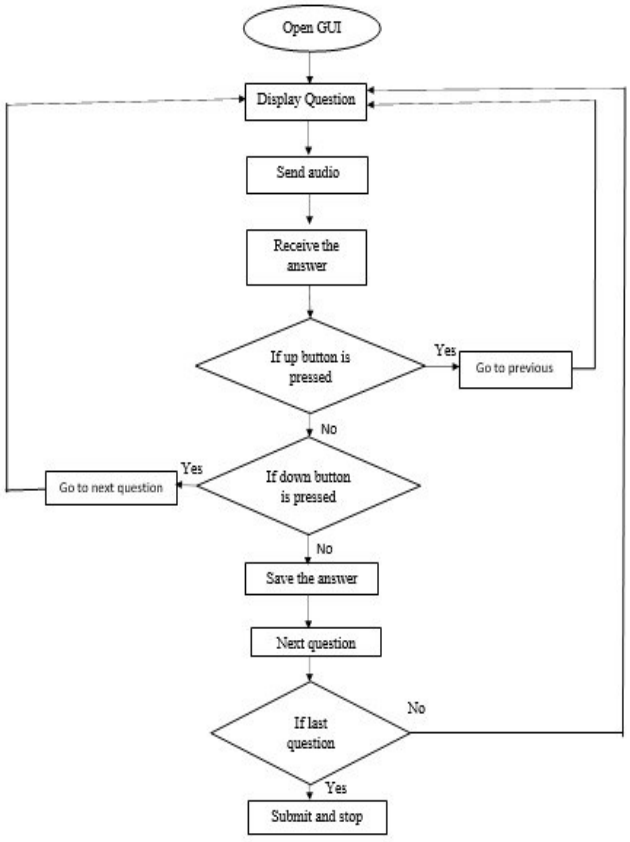

Fig. 3. flowchart of working system

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Figure 3 illustrates the flowchart of the exam system's operation, demonstrating the sequential steps involved in conducting exams for blind

V.CONCLUSION

the methodology outlined presents a groundbreaking approach to facilitate the participation of blind individuals in examinations without the need for volunteers. The proposed system leverages embedded technology to provide auditory question delivery and communication of responses to the computer seamlessly. By integrating an embedded system into the exam process, blind individuals can engage in exams with the same autonomy and dignity as their sighted peers.Furthermore, the proposed system offers notable advantages in terms of accessibility and affordability. By utilizing readily available technology such as embedded systems, the system becomes more accessible to a wider demographic of blind students. Moreover, the cost-effectiveness of the system is significantly enhanced, particularly as many examinations are transitioning to online formats. The utilization of standard peripherals such as a regular keypad and wireless connections further reduces costs, making the system economically viable for widespread implementation. By eliminating the reliance on volunteers and streamlining the examination process, the proposed system empowers blind individuals to participate in exams independently and confidently. This not only promotes inclusivity and equal opportunities in education but also fosters a sense of autonomy and self-reliance among blind students.Looking ahead, there are opportunities for further refinement and expansion of the proposed system. Future iterations could explore the integration of additional features to enhance user experience and functionality. Additionally, collaboration with educational institutions and organizations dedicated to supporting individuals with disabilities could facilitate the adoption and implementation of the system on a larger scale the proposed system represents a significant step forward in promoting inclusivity and accessibility in education for blind individuals. By harnessing the power of technology, we can create a more equitable and supportive learning environment, where all individuals, regardless of their abilities, can thrive and succeed.

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