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Blind o Techmate: A technology for the vision-impaired

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Abstract- We use and experience technology every day, every moment. Computers and the internet have shaped the way 21st-century will be remembered in the pages of history. Unfortunately, many of us are still unable to access technology independently due to vision impairment. Devices have become more sophisticated and require a proper vision for independent operation. Individuals with vision impairment require help from others to operate devices, which deprives them of privacy and makes them completely dependent. We present this paper with the vision of eliminating the barrier between technology and blind individuals. We have developed an idea of modifying the already existing computers and making them specially built for blind individuals so that they can independently use and explore technology in their way. We intend to present an idea that will bring technology closer to them and enable them to interact with the technology independently. We believe that technology must be accessible to everyone irrespective of any disability.

Keywords-Blind; Computer; Internet; Technology

I. INTRODUCTION

In this computer age, human lives have become increasingly dependent on technology. Computers of varying dimensions and features are shaping our world, be it a smartphone or a supercomputer. With time these devices have evolved from mechanical to electronic devices, keys replaced by touch screens. Thus, vision has become a crucial factor in operating these devices. Computers these days do not only perform arithmetic calculations but several other complex operations. Browsing the internet is something that has shaped the 21st-century world. The internet has become an integral part of modern life. From connecting with the world to daily life activities, the internet is the sole medium. Butthis revolutionary technology is far from the reach of a necessitous section of our society. Browsing the internet and experiencing technology is still an untrodden path for about 49.1 million (as of 2020) [1] humans around the Earth, who suffer from visual impairments of varying intensities. Many of them are born with such a disability, some develop it over time and some have lost it due to illnesses or accidents, but is it a sufficient reason for them to be deprived of the right to interact with technology and experience it on their own? Web browsing requires the user to be able to operate devices, but a lack of proper vision renders the user impotent for independent handling. Blind o Techmate aims to be the interface between these people and the internet. We aim to build a machine that supports its user in its operation. Our device aims to provide a self-reliant environment for its user to operate by facilitating easier input and output interface. We aim to bridge the gap between computers and visually impaired individuals and help them experience technology like anyone else.

A. Objective

1. The aim is to bridge the gap between the internet and people with visual impairments.
2. To make modern revolutionary technologies accessible for everyone.
3. With the help of Blind o Techmate we can:
   A. Put a full stop to the dependency on others for basic activities, such as messaging, e-mail, and calls.
   B. Give independent space to people with visual impairment to explore the technology and web in their way.

II. PROPOSED METHODOLOGY

Our device must have specialized input and output devices for effectual use by the user. We aim to eliminate the requirement for correct vision to operate the machine and create an interface that can boost efficiency. Blind o Techmate will operate similarly to any other computer except for its input and output. We

intend to achieve it by modifying the input and output devices.

1. 1. For input devices:

a. A. Keys of the keypad will have Braille alphabets engraved on them instead of regular English alphabets.

b. B. An efficient voice command instead of a mouse will be implemented in the device.

2. Output devices must serve the auditory sense of the user to relay information back. For output devices:

a. A. Screen reading program implementation to read the information displayed on the screen.

b. B. An efficient Artificial Intelligence (AI) to assist the user.

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A. Working principle

At input module:

a. The keys of the keypad will have the corresponding Braille alphabet engraved on them, allowing the user to identify and input the desired alphabet to the machine. The user will input the Braille alphabet using the keypad, and the corresponding English alphabet will be input to the device, bridging the gap between it and the user. It will ensure privacy, as the user can independently type anything of choice.

b. Implementation of an effective voice command program is crucial. The users can give a voice command to the machine to open any window or start any application. It will eliminate the need for vision to read the screen to open up any application. The voice command module will turn on automatically whenever the device is switched on. The user can give commands to open any particular application, for example, MS Word and instruct about the font, font size, and margin and the voice command program will ensure that the instructions are implemented efficiently without any error. It will also notify the user if it encounters any error in the voice command received or if the voice command is invalid.

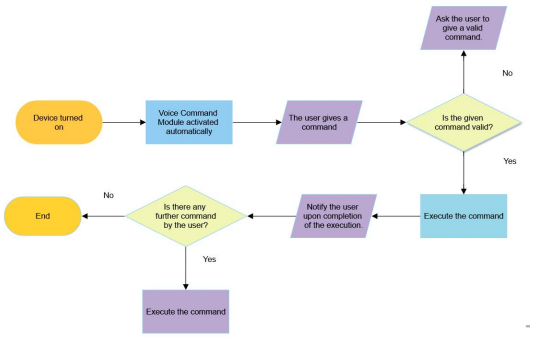

Fig1: Flowchart showing the functioning of the voice command module.

At the output module:

a. An in-built screen reading application will make the user aware of the output on the screen, which will also eliminate the threat of security breaches by third-party applications. With further implementation of AI and ML, efficient description of pictures and other visual data is possible. Whenever the user types any text and commands the screen reader to read out the text, it will simultaneously check for any grammatical, spelling or formatting errors. If present, it will notify the user of it and suggest a solution to it. If again asked by the user to correct it, the screen reader will automatically do it and read out the corrected sentence for the user to approve it. The screen reader when called will also read out any sort of texts, blogs, messages or e-mails for the user.

b. Pre-installed AI will notify the user of any message and notification. The user can command the AI to send a text or e-mail after the user has typed it. The AI can also help the user with daily schedules, news and other updates. It will also notify the user of issues with the device if any. In other words, the AI will assist the user with the operation of the machine. This AI would be similar to present-day market available AIs but there will be certain distinguishing factors as well. This AI will be programmed in accordance with the needs of vision-impaired people, the voice command will be made efficient enough for the user to give commands through voice and eliminate the need to type the command. It will not only become the interface between the device and the user but will also help the user to become aware of what is on the screen. For example, if there is a

picture, on command it will describe the picture to the user. This way it will facilitate smoother operation.

The device will carry on its internal functions similar to any other computer it will have all necessary software installed and provision for installing new software.

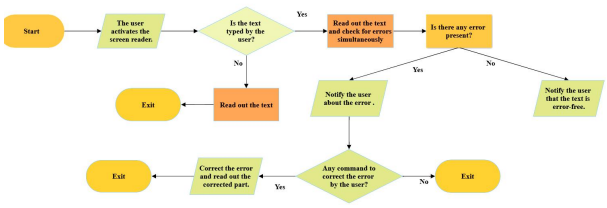

Fig2: Flowchart showing the functioning of the Screen reader module

III. ADVANTAGE AND DISADVANTAGE

A. Advantage

a. A. This device aims at becoming the interface between technology and people with visual impairment of varying intensities.

b. B. It focuses on providing technological independence to its users.

c. C. It ensures privacy and safeguards the information of its user, which would otherwise be vulnerable.

B. Limitation:

a. A. The device can become bulkier due to its design, hence less portable.

b. B. High cost due to use of different technologies.

IV. FUTURE SCOPE

We have identified that the cost of the device will be on the higher side, making it unfeasible for the majority of the population. To address this issue, we can consider cutting costs while keeping the device effective and durable. Whenever a user gives a voice command there is always a scope for error, to resolve this issue and for smoother communication between the user and the device, we consider implementing a Brain-Computer Interface (BCI) in the future.

A. Brain-computer interface (BCI)

Brain-computer interface (BCI) is basically a computer-based system that collects brain signals and then analyses these signals and after that these signals are converted into commands that are connected to an output device to carry out the desired action. To control a *BCI system* generally different brain signals are used. The brain signals are electrical signals from the brain or the activity measured by using the electrodes on the scalp. The purpose of a *BCI* is to detect and quantify features of brain signals that indicate the user's intentions and to translate these features in real time into device commands that accomplish the user's intent. To achieve this, a *BCI system* consists of 4 sequential components:

(1) Signal acquisition.
(2) Feature extraction,
(3) Feature translation, and
(4) Device output.

These 4 components are controlled by an operating protocol that defines the onset and timing of operation, the details of signal processing, the nature of the device commands, and the oversight of performance. An effective operating protocol allows a BCI system to be flexible and to serve the specific needs of each user.

At present, the striking achievements of BCI research and development remain confined almost entirely to the laboratory, and the bulk of work to date comprises data gathered from able-bodied humans or animals. Studies in the ultimate target population of people with severe disabilities have been largely confined to a few limited trials closely overseen by research personnel. The translation of the exciting laboratory progress to clinical use, to BCI systems that actually improve the daily lives of people with disabilities, has barely begun.

Brain-computer interface research and development generates tremendous excitement in scientists, engineers, clinicians, and the general public. This excitement reflects the rich promise of BCIs. They may eventually be used routinely to replace or restore useful function for people severely disabled by neuromuscular disorders; they might also improve rehabilitation for people with strokes, head trauma, and other disorders.

The future of BCIs depends on progress in 3 critical areas: development of comfortable, convenient and stable signal-acquisition hardware; BCI validation and dissemination; and proven BCI reliability and value for many different user populations [2].

BCI when fully developed into functional portable units can be incorporated into Blind o Techmate for aiding people with visual impairment connect easily with technology.

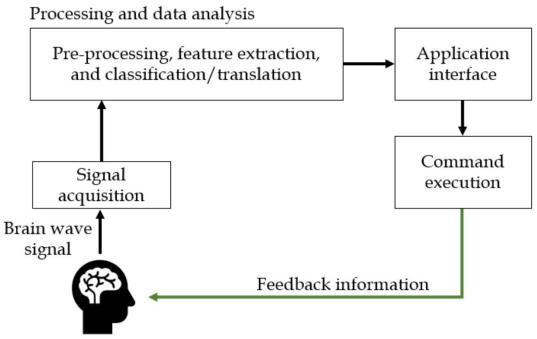

Fig 3: Chart describing the working of BCI technology [3]

V. CONCLUSION

This paper presented an idea to make technology accessible to people who have visual impairments. We have devised several modifications as well as new implementations to create a device similar to the present-day computer but specially built for those who are unable to operate regular computers due to impaired vision. This device will become an interface between blind individuals and the technology; it will introduce them to the world of the internet and will assist them in independent exploration. We believe there is a huge scope for further improvements and up gradation of the device. We envisage overcoming the limitations to improve the efficiency, durability, portability and cost-effectiveness of the device.

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VIII. BIOGRAPHIES

Sumana Saha was born in Kolkata, India, on 12th May, 2001. She completed her secondary and higher secondary education from Kendriya Vidyalaya Aizawl in 2017 and 2019 respectively. She is currently pursuing her undergraduate degree in electronics and communication engineering at Guru Nanak Institute of Technology, Sodepur, Kolkata.

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