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A NOVEL VOICE RECOGNITION SYSTEM FOR DUMB PEOPLE

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ABSTRACT

Information Communication Technology (ICT) can support people with physical disabilities by enabling them to access the information along with others. Physical challenge either temporary or of permanent nature put limitations in learning process of an individual as it can limit accessibility, can hamper understanding thus making it difficult for such persons to be at par with others. Learning activity such as following a lecture, reading a book, accessing resources, websites, appearing in the exams (written or oral) becomes an uphill task for physically challenged persons. A wide range of software and peripherals are now available as alternatives to using the traditional keyboard and mouse, which can suit learners with varying physical disabilities. A person can choose a technology based on his or her ability and ease in using a technology This paper analysis how ICT can meet requirements of education and employment of physically challenged people. This paper is basically aims in making mobile phones that can be easily accessible by the dumb, who are not deaf. The primary aim lies in capturing the lip movements of the dumb and converting these into vibrations and consequently into sound signals which are later transmitted to the receiver as such. Basically a device needs to be fitted in their mouth to sense the lip movements and consequently convert them into vibration. Then the process of recognizing the speech from vibrations takes place. The recognized speech is sent to receiver. Thus this product will prove effective for conversing with dumb people, thereby bringing a great impact in improving their communication with others and for understanding and sharing their thought and feelings. This product will be "SERVICE TO HUMANITY".

Keywords: *Dump people, Lip movement, Speech recognition, Sound detection, Transceiver.*

1. INTRODUCTION

People do suffer with disabilities due to weak or no capacity[1] to utilize a sensory organ such as eye ear or control over their body parts , mental weakness etc . The problem can be by birth, due to aging process , accident etc . Disability has its effect on quality of human life irrespective of its origin and reason. Different type of disabilities requires support related to handle that problem.

Problems of people[2] with Multiple disorders becomes more complicated as solution for a particular type of disability may not work for them, therefore additional efforts are needed to provide devices and technological support to make their life simpler . Some of the disability factors[3] and their requirements are presented here:

Visual impairment:

People with visual disabilities are individuals who are blind, have low vision, or have color blindness. People who are blind need text equivalents for the images used on the Web page, because neither they nor the assistive screen reader technology can obtain information from an image. A person [4]who has a visual disability will not find the mouse useful because it requires hand and eye coordination. People with color blindness or those with low vision need good contrasting colors to be used in design

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or an alternate attribute of information being presented.

Mobility impairment

People with mobility disabilities have physical impairments that substantially limit movement and fine motor controls, such as lifting, walking, and typing. Mobility [5] impaired individuals experience difficulties in using the computer's input devices and in handling storage media. Such people need devices for mobility, control and manipulation and alternate input devices on Computers.

Hearing impairment

People who are deaf or hard of hearing require visual representations of auditory information that a Web can site provides. Solutions[6] for these disabilities include closed captioning, blinking error messages, and transcripts of the spoken audio. The primary concern is to ensure that audio output information is provided in a redundant equivalent visual form.

Learning disability

People with cognitive or learning disabilities, such as dyslexia and short-term memory deficit, need more general solutions,[7] which include providing a consistent design and using simplified language. For example, by using a template, a Web developer can reuse the same layout and design for each page, so a person with a cognitive disability can more easily navigate through a Web site. People with cognitive or learning[8][9] disabilities can also benefit from redundant input, such as providing both an audio file and a transcript of a video. By simultaneously viewing the text and hearing it read aloud, they can take advantage of both auditory and visual skills to comprehend the material better.

Speech is the most natural way of communication. It also provides an efficient means of man-machine communication. Generally, transfer of information between human and machine is accomplished via keyboard, mouse etc. But human can speak more quickly instead of typing. Speech interfacing provides the ways to these issues. Speech interfacing involves speech synthesis and speech recognition. Speech Recognition is a technology that allows the computer to identify and understand words spoken by a person using a microphone. Speech recognition allows a computer to interpret any sound input (through either a microphone or audio file) to be transcribed or used to interact with the computer. Whereas, Speech synthesizer takes the text as input and converts it into the speech output i.e. it act as text to speech converter. Speech recognizer converts the spoken word into text.

The fastest way [10] to warn the citizens of disasters is the mobile phone network. All mobiles phones communicate through electromagnetic audio waves. They have a low power transceiver that transmits [11] voice, that is sound signals in the form of vibrations (longitudinal waves) or electromagnetic radio waves are transmitted to the towers nearby. But in the case of dumb, voice (sound) never comes into picture. Here we refer to the dumb who are not deaf. Hence the mechanism is proceeded as :

Lip movements of dumb -> capture using a device fitted in mobile -> convert movements into vibrations -> recognition of vibrations into speech -> to receiver.

The goal of this research is to incorporate Lip movement recognition and speech synthesis technology, thus provides a solution to communication between two dump persons or between a dump and a normal person, especially who are not deaf. The innovation lies in making mobiles usable to dumb who are not deaf.

2. LITERATURE REVIEW

In the past decade, much works have been done in the field of speech recognition and speech synthesis for communication. One promising study [12] at California State University at Northridge explored the performance of learning disabled college students using voice recognition technology to complete the university's written proficiency exam. With the use of this innovation, the learning disabled students achieved the same distribution of scores on the exam as their non disabled peers. Another exploratory study [13] focused on a single subject-a sixth grade student with learning disabilities. Wetzel was interested in whether middle school students could learn to use a voice recognition system, in this case IBM Voice Type, and whether this system would enhance their communication skills. Wetzel found that the student was able to learn to use the software, but that difficulties with the system's recognition accuracy and the complexity of editing compromised this student's success. The authors

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[14] describe four methods that persons who are blind or visually impaired use to access information: enhanced image, braille, synthetic speech and optical character recognition. These devices can be used separately or in combination to access consumer products, personal computers and printed information. Microsoft also developed a standard by which applications could effectively communicate with assistive technologies. This standard, called Microsoft® Active Accessibility® (MSAA) has been available since Windows 95. Windows Vista has built on this to improve accessibility into two other areas: 1) an Ease of Access center to assist users in finding ways to make using their computer easier; and 2) new technologies, such as better speech recognition and magnification [15]. Apple has now built accessibility into its Carbon application programming interface (API), which allows Mac OS X applications to more effectively communicate with assistive technologies. the Linux developer community has produced a basic core set of accessibility features, as well as a combined screen reader/screen magnification application, Braille output software, and an onscreen keyboard. Each of these products was developed for the popular GNOME desktop, a graphic interface environment that runs on both Linux and Unix.
Microsoft commissioned Forrester Research to measure the market for accessible technology in the United States and to better understand how accessible technology is being used. Research advances can lead to a unique product coming to the market, such as the Xbox Kinect. The science behind Kinect came from multiple research areas, including depth sensing, speech recognition, gestural interface, computer vision, and sound processing [16]. Microsoft Research has a group in Redmond and another in Beijing working together to improve spoken language technologies. Our main goal is to build applications that make computers available everywhere, and work with 'Microsoft Tell me' 'to make this vision a reality. The research paper outlined how speech recognition is being used today to enhance the educational process for students and teachers alike. Dragon Naturally Speaking software offered speech output capabilities so that students can have text read aloud to them. The system worked with most popular screen readers, such as JAWS, helping visually impaired students to work more effectively [17].

Marshall H. Raskind, a learning disabilities researcher at the Frostig Center in Pasadena, Calif., found that voice recognition software could make a significant difference for many people with dyslexia. It is concluded that speech recognition not only allows dyslexics to communicate more efficiently, but may even help them overcome their condition [18] J-Say is designed to make it possible for blind people to work with speech recognition software. It acted as an interface between Dragon Naturally Speaking and "JAWS" screen reading program. This combination of programs has made it possible for a totally blind person to dictate and compose documents hands-free. This solution requires technical aptitude, commitment and a significant amount of training [19].

3. PRINCIPAL OF SOUND DETECTION

Sound causes objects [20] to vibrate, which is used to detect and process the sound. The ear and a microphone are common detectors of sound, although there are also some clever devices to detect sound at a distance. Laser can be used to detect conversation. From a distance outside, they would shine a small, invisible laser spot on a window of a building where secret conversations were being held. The reflected light off the window would be distorted due to the subtle vibrations [21] of the glass from the conversations inside the room. The device would detect the reflected light and convert it into electrical signals.

4. DEVICES INVOLVED

4.1 Envelope detector

It is an electronic circuit [22][23] that take a high frequency signal as input and provide an output which is the "envelope" of the original signal. The capacitor in the circuit stores up charge on the rising edge and releases it slowly through the resistor when the signal falls. The diode in series ensures current does not flow backward to the input to the circuit. Most practical envelope detectors use either half-wave or full-wave rectification of the signal to convert the AC audio input into a pulsed DC signal. Filtering is then used to smooth the final result.

4.2 Transducer

It is a device that converts one type of energy or signal into another. For example[24][25] a microphone is a transducer that converts sound

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waves into electric impulses, an electric motor is a transducer that converts electricity into mechanical energy.

4.3 Light-emitting diode (LED)

It is a semiconductor diode that emits incoherent narrow-spectrum light when electrically biased in the forward direction of the p-n junction. This effect is a form[26] of electroluminescence. Microphones transform acoustical movements (the vibrations of air created by the sound waves) into electrical vibrations. The conversation is relatively direct and the electrical vibration can then be amplified, recorded, or transmitted.

5. AUDIO & AMPLITUDE MODULATED PHOTO DATA COLLECTION FOR SPEECH RECOGNITION

A speech recognition[27] data collection arrangement in which audio sounds spoken by the user are supplemented with lip and mouth movement information obtained from a combination of a light emitting diode and photodiode disposed immediately before the user's face is disclosed. The lip and mouth movement photo information is obtained in the form of an AC coupled amplitude modulated carrier waveform which results from energizing the light emitting diode from a pulsating or alternating current component inclusive source of electrical energy. The lip and mouth movement amplitude[28] modulated carrier waveform is processed with filtering and envelope direction and communicated to a programmed digital computer for the purpose of dual-channel audio and photo based accomplishment of human speech recognition.

6.APPARATUSCONSTRUCTION DETAILS

Dual-channel, optical energy [29] and sound energy, human speech recognition data collection apparatus comprises of the following combinations.

- A user's head-carried headset apparatus including a boom end received speech actuated microphone transducer member located close to lip and mouth cavity facial regions of user.
- Light emitting diode means, disposed adjacent said microphone transducer member at the boom end for illuminating the lip and mouth cavity regions of the user visible spectrum optical energy.
- Pulse modulated electrical energy source, of fixed predetermined operating frequency, connected with said light emitting diode for pulsed electrical emerging of said light emitting diode and for pulsed optical energy generation therein.
- Microphone transducer member for generating a user's lip movement responsive amplitude modulated electrical signal having a carrier component of said predetermined frequency and having signal correlation with a voice generated electrical signal, microphone transducer member.
- Dual-channel electrical conduction for communicating electrical signals from said microphone transducer member and the photodiode electrical transducer to a spoken sound and lip movement correlation speech recognition electrical signal processor.
- The apparatus of electrical photodiode transducer includes an electrical photodiode member and further including electrical circuit for operating the photodiode member in a photovoltaic, current source mode of operation.
- The apparatus of electrical circuit includes an operational amplifier circuit and an electrical current output signal of the photodiode member is connected with a summing node electrical input terminal of the operational amplifier.
- The apparatus of electrical energy source of predetermined operating frequency is displaced in spectral location from fundamental and harmonic frequencies of a sixty Hertz power line frequency.
- The apparatus of electrical energy source has the predetermined operating frequency of two hundred seventy nine Hertz.

7. PROCEDURE

- Dispose an audio sound to electrical signal transuding microphone adjacent a lip and mouth cavity facial area of a user subject, with the microphone generating electrical signals representative of user speech sounds.

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- and lip facial portion of the user with visible spectrum light energy originating in a light emitting diode electrical energy to optical energy transducer energizing the light diode with pulsating electrical energy of predetermined pulsation frequency.

- Collect user's lip-reflected illumination energy in a photodiode optical signal to electrical signal transducer, and the collected energy is used in generating a lip movement modulated electrical signal of the predetermined pulsation frequency, carrier frequency and lip movement responsive carrier amplitude modulation at output terminals of the photodiode transducer.

- Locate the photodiode optical signal to electrical signal transducer, microphone and the light emitting diode and proximate a predetermined portion of the user's lips and mouth cavity

- Communicate the microphone electrical signals and the photodiode electrical signals via separate communication paths to a correlated dual-channel human speech recognition processor which includes signal processing in a hardware and software implemented speech recognition algorithm. This step includes electrical signal transmission via a two-path flexible electrical tether cord.

Thus the method of disposing, illuminating, and locating steps each comprise mounting

- Illuminate a predetermined mouth microphone, light emitting diode, and photodiode transducers on a distal end of a headset carried microphone[30] boom arm. The pulsating electrical energy pulsation frequency is above one hundred twenty Hertz.

The apparatus diagram is shown in Fig.1 and the control system diagram is shown in Fig.2

8. FLUENCY COACH SOFTWARE

Fluency Coach software uses altered auditory, feedback technology to simulate the effect of choral speech (speaking simultaneously with another person),known for years to promote fluency in individuals afflicted by various types of non-fluencies and has been particularly successful in treating stuttering. Among the several types[31] of Altered Auditory Feedback, the most effective, for treating the people impaired with stutter are Delayed Auditory Feedback (DAF) and Frequency-Shifted Auditory Feed BFAF) both implemented in fluency coach. The effect of DAF basically amounts to hearing your voice with a slight delay after speaking like an echo, FAF, on the other hand, changes the pitch of your voice lower or higher, enhancing the impression of another voice speaking along with you . Both DAF and FAF, each reduce stuttering approximately 70% and have been demonstrated to produce significant carry-over fluency.

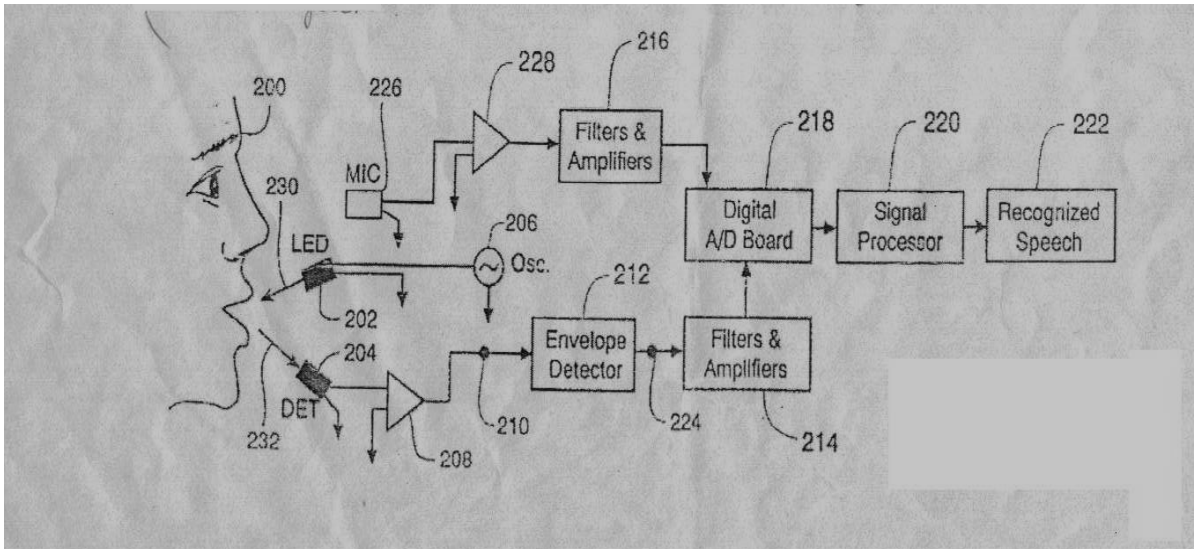

Fig 1. The Apparatus Arrangements

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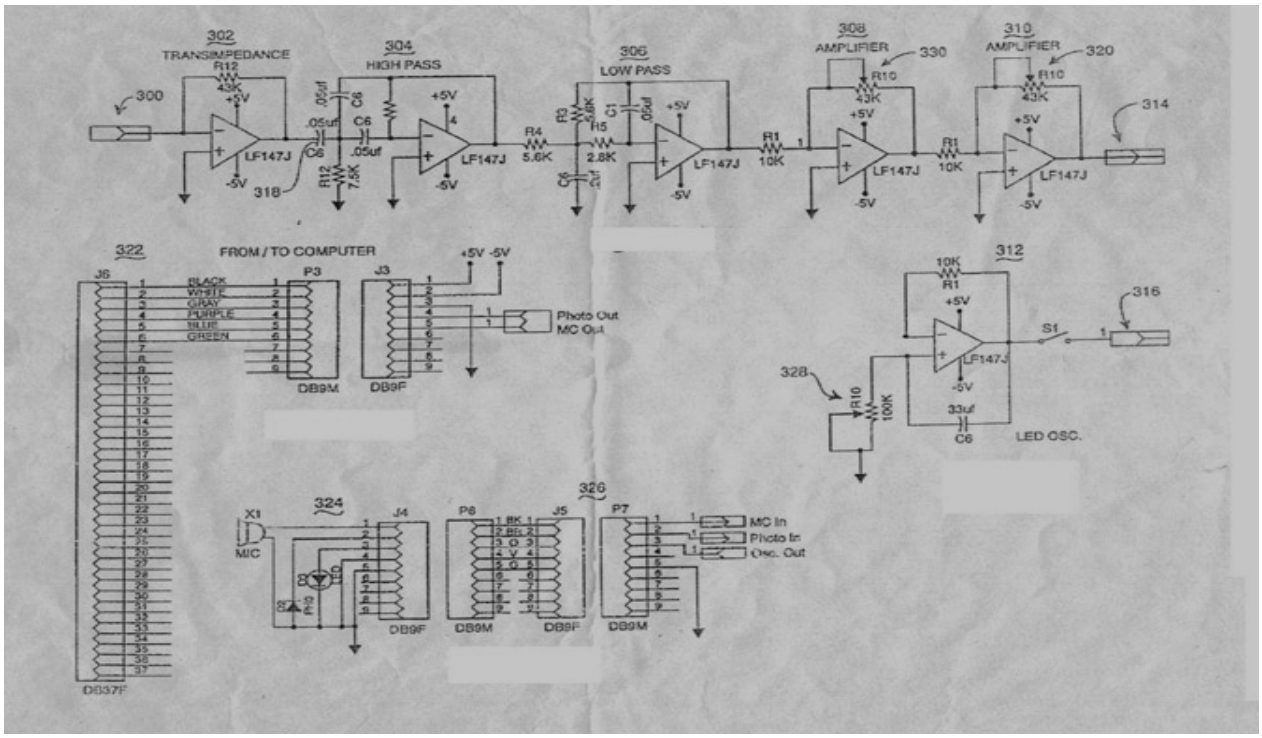

Fig 2. The Control System Arrangements

Combining DAF and FAF changing delay and Pitch simultaneously) reduces stuttering over 80%.

8.1 The method of using fluency coach

Fluency Coach can be used in two ways. First, it can be used as a speech aid to improve influence immediately, without training, mental effort or abnormally sounding speech reducing stuttering by approximately 70% on the average and producing significant rates of carryover fluency – permanent reduction of stuttering. For immediate improvement the delay can be set between 50 and 100 milliseconds and pitch shift between – 0.5 and 0.5. With these settings enabled, fluency coach can be used while doing basic reading exercises (a list of the "problem" words and sounds, a poem, character's part from favorite play, or any other text), making phone call to friends or family members or doing so via applications like Google Talk[32], Instant Messenger or Microsoft Live Messengers, all of which are compatible with and can be used parallel to Fluency Coach' Experiments with different Delay and pitch settings can be carried out to find the optimal settings that yield best improvement in your speech. Fluency Coach can also be used in conjunction with any of several prominent shuttering therapies employing altered auditory feedback to support the fluency shaping target of slow speech with stretched vowels., For this purpose the delay[33] is usually set at 100 milliseconds and then reduced to shorter delays (as short as 75 milliseconds) over the course of the therapy program.

9. THREAPY GUIDES

The delayed auditory feedback feature of fluency Coach gives an ongoing instantaneous feedback of our efforts and performance, whereby allowing us to adjust the speech pattern to achieve desired results. The auditory processing abnormality which can be treated with the help of an altered auditory feedback software or device, has been identified as a major factor causing onset and development of stuttering. No speech therapy is known to correct this abnormality . Many people stuttering by treating the other factors. But using an altered auditory feedback device or software in conjunction with other therapies may make the other therapies easier, faster, and more effective.

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9.1 Effects and uses of delayed auditory feedback

Delayed Auditory, Feedback (DAF)[34] can be used in two different ways. The delay can be set between 50 and 70 milliseconds to reduce stuttering about 70% at a normal speaking rate, without training, mental effort, or abnormal sounding speech. DAF can also be used to support the fluency shaping target of slow speech with stretched vowels. For this purpose the delay is usually set at 200 milliseconds and then reduced to shorter delays (as short as 75 milliseconds) over the course of the therapy program. DAF therapy has two goals. To increase the length and complexity of the utterance and increase the stress of the speaking situation, while using the DAF device to support on-target fluent speech. To reduce the need of the DAF device, until the person with stutters no longer needs to device. Before three months of DAF use, the subjects stuttered on 37% of words. On average when they put on the DAF device their stuttering dropped to 10% i.e., the device improved their speech about 70% Three months later the subjects stuttered on 17% of words, when not using the DAF device when wearing the DAF device they stuttered on 13% of words. This shows that, when not wearing the devices, the subjects' stuttering diminished from 17% of words to 17% of words or a 55% improvement. This is "carryover fluency" put another way, the devices trained the users to need the devices less.

9.2 Effects and uses of frequency- shifted auditory feedback

Frequency-shifted auditory feedback (FAF) shifts the pitch of the voice. A quarter octave pitch shift reduces stuttering about 35%. A half-octave pitch shift reduces stuttering about 65-70%. A full-octave pitch shift reduces stuttering about 70-75% The differences between the two studies is the "carryover fluency" or the subjects' speech without the devices. The DAF users had more than 50% carryover fluency. The FAF users had no statistically significant carryover fluency.

10. CONCLUSION

Many companies are producing a variety of applications or packages which incorporated speech synthesis and recognition separately as assistive technology for physically disabled persons to increase their access to the current technology. However, few seemed to incorporate both. The art of instructing the deaf and dumb is yet comparatively new[35], and it is not to be supposed that we have already reached its last limit of perfection. As we advance along the path of progress, there must be some ***u*** undiscovered country" still before us. Some higher ground which neither [36] [37] ourselves nor our predecessors have as yet ascended. In this Speech Recognition & Synthesis Tool, we designed a Novel and sophisticated mobile which will help the dump people to communicate with the other people during contingency situations and to help them become more self adaptive. Further work [38] is carried out by designing a DSP based speech processor for converting the lip movements into a proper vocal code [39]. Also With certain improvement in the future, the communication between two different physical disability persons can communicate with ease like normal persons as our design can be designed for the communication through Ethernet/LAN/Internet/Wireless in future for large distance. It can be designed to one to many communications for educational purposes. It can also be designed for communicating with persons, who are speaking different languages.

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