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Intelligent and Smart Hearing Aid Using GSM and Microcontroller

Dharani Kumar S V¹, Durga Devi G M², Mahalakshmi A G R³, Nagashree M S⁴

Assistant Professor, Department of Biomedical Engineering, GRTIET, Tiruttani, Tamil Nadu, India^[1]

Student, Department of Biomedical Engineering, GRTIET, Tiruttani, Tamil Nadu, India^[2,3,4]

ABSTRACT: The GSM based Sound Bite hearing system allows people with to hear the sounds via bone conduction to wear an intraoral device and a small microphone in the deaf ear to regain lost hearing. This device consists of GSM modem PIC16F877A controller and audio amplifier unit. GSM modem will receive incoming calls and automatically answer the call via AT Commands. Then incoming voice signal is converted into low frequency vibration signal that fed through the teeth to cochlea. Unlike implantable bone conduction hearing aids, Sound Bite requires no surgery. Rather, it is the world's first removable and non-surgical hearing solution to use the well-established principle of bone conduction to imperceptibly transmit sound via the teeth. Custom made for each person, Sound Bite is simple, removable, and totally non-invasive.

KEYWORDS: Hearing aids, Internet of Things (IoT), System on-Chip(SoC), Microcontroller

I. INTRODUCTION

Virtual Reality is seen as the high-end of human-computer interactions and it has the potential to target a widerange of applications. Wall mounted buttons which are used as physical UI for elevators, room rights and so on. However, changing installation locations of wall mounted buttons is not easy. In addition, changing button labels and types is not easy, too. If we can change installation locations, labels and types of wall mounted buttons easily, their UX is improved. Redirected walking algorithms require the prediction of human motion in order to effectively steer users away from the boundaries of the physical space. While a virtual trajectory may be represented using straight lines connecting waypoints of interest, this simple model does not accurately represent typical user behavior. We implemented the model within a framework that can be used for redirect walking within different virtual and physical environments. It is useful for the evaluation of redirected of parameters under varying conditions. The proposed system gets user's height and change buttons' vertical position. In addition, users can change a button label and type. As a result of the user-test, the proposed system improves the problems of wall mounted buttons and has a possibility that it improves product and system UX. On the other hand, user-test shows necessity to improve buttons visibility. The proposed system projects virtual wall mounted buttons on a wall by a projector. The Proposed system gets user's height and change buttons vertical position. Hearing aids offer a partial solution to the problem faced, it is a device worn in or around the ear which amplifies the sound in the wearer's surrounding. There is not much of advancement in the traditional hearing aids past a decade, the hearing aids amplify the background noise and speech is most likely to happen when the user is on a phone call or connected to a laptop or television.

II. PURPOSE

This hearing device is designed to use the natural amplification of your ear. Any sound in that coming from GSM Modem. It uses a digital processor (PIC16F877A) to transmit to the sound to a piezoelectric actuator which needs very little power to generate the vibrations that travel through bone, which in turn sends those sound vibrations into your cochlea through your teeth. This way, the sound is transported from your impaired ear directly to your hearing ear. This hearing device will be fitted to the upper left or right teeth in the back of your mouth. This doesn't require any of your teeth to be altered, and the device can be inserted and removed easily. This hearing device is a flat piece (in Real-Time Product) that contains a sealed rechargeable battery, and electronics and wireless capabilities that can pick up sound transmissions from the behind-the-ear microphone



III. EXISTING METHOD

Several hearing devices were found for outer drum problem only. Inner drum problem is usually a permanent condition which impairs one's ability to tell the direction a sound is coming from. It can also be responsible for difficulty understanding speech or conversations on the deaf ear side, particularly in a noisy environment. Some medical treatments has been proposed but that needs surgery. Due to that surgery it may leads to additional problems

3.1. DRAWBACK OF EXISTING SYSTEM

The UI is remapping able as well, according to the user they can change the UI and UX of the virtual switches. This system is completely safe to use in the industries, as there is no current leakage. The projected switch is activated when our hand blocks the light, and calculates the shadow of the light using image processing. The pc compares with the image and operates the relay using the wireless ZigBee and the Arduino microcontroller. An LCD displays the relay to be operated, for verification to the operator at the industry and change the load accordingly. Therefore, without any live switches virtual switches are proposed highly electric industry.

IV. PROPOSED SYSTEM

Industrial safety is important as it safeguards human life, especially in high risk areas such as nuclear, aircraft, chemical, oil and gases, and mining industries, where a fatal mistake can be catastrophic. For providing this industrial safety they are introducing a large interactive display with virtual touch buttons and sliders on a pale colored flat wall. Our easy-to-install system consists of a front projector and a single commodity camera. A button touch is detected based on the area of the shadow cast by the user's hand this shadow becomes very small when the button is touched. The shadow area is segmented by a brief change of the button to a different color when a large foreground (i.e., the hand and its shadow) covers the button region. Therefore, no time-consuming operations, such as morphing or shape analysis, are required. Background subtraction is used to extract therefore ground region.

4.1. BENEFIT OF PROPOSED SYSTEM

The benefit of proposed system that overcomes the drawback of the existing system is that it supports multiple functionalities such as editing and searching. It also adds benefit by providing heterogeneous characters recognition.

4.2. ARCHITECTURE OF THE PROPOSED SYSTEM

The Architecture of the optical character recognition system on a grid infrastructure consists of the three main components. They are:-

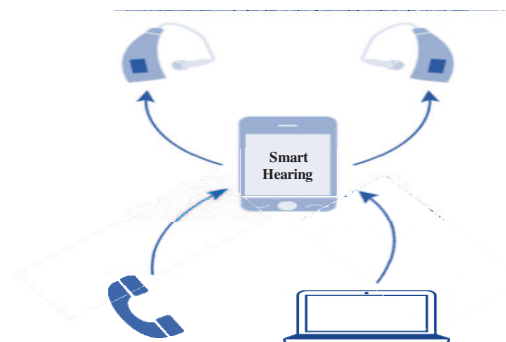
- PIC16F877A
- SIM800A GSM Module
- UART Cable
- Voice Module
- Speaker
- Relay
- Motor

4.2. A AMENABLY PROJECTED VR SYSTEM OF WALLMOUNTED BUTTONS

Industrial safety is important as it safeguards human life, especially in high risk areas such as nuclear aircraft chemical oil and gases and mining industries where a fatal mistake can be catastrophic. Industrial safety reduces risks to people and processes. Process control and safety systems are usually merged. Maintaining a safe and healthy working environment is not only an important human resources issue, it's the law. Whether they're entry-level workers, seasoned veterans, supervisors, or plant managers, the employees need to understand health and safety risks, the steps they need to take to minimize those risks, and common safety standards and compliance procedures. Should we give special care to one of these two areas? Yes. In this project we are going to provide a solution for these risks through virtual reality. VR (also known as virtual reality) can be found in fields as diverse as entertainment, marketing, education, medicine, construction and road safety training and many others. They provide numerous possibilities for users to explore virtual realities for various purposes. In this project we use large interactive display with virtual touch buttons and sliders on a pale-colored flat wall. Our easy-to-install



system consists of a front projector and a single commodity camera. A button touch is detected based on the area of the shadow cast by the user's hand; this shadow becomes very small when the button is touched. The shadow area is segmented by a brief change of the button to a different color when a large foreground (i.e., the hand and its shadow) covers the button region. Therefore, no time consuming operations, such as morphing or shape analysis, are required. Background subtraction is used to extract therefore ground region. The reference image for the background is continuously adjusted to match the ambient light. Our virtual slider is based on this touch-button mechanism. When tested, our scheme proved robust to differences in illumination. The response time for touch detection was about 150ms. Our virtual slider has a quick response and proved suitable as a controller for a Breakout-style game.



V. INPUT LAYER

The input layer to the neural network is the conduct through which the external environment presents a pattern to the neural network. Once a pattern is presented to the input layer of the neural network the output layer will produce another pattern. In essence this is all the neural network does. The input layer should represent the condition for which we are training the neural network for. Every input neuron should represent some independent variable that has an influence over. It is important to remember that the inputs to the neural network are floating point numbers. These values are expressed as the primitive Java data type "double". This is not to say that you can only process numeric data with the neural network. If you wish to process a form of data that is non-numeric you must develop a process that normalizes this data to a numeric representation.

VI. OUTPUT LAYER

The output layer of the neural network is what actually presents a pattern to the external environment. Whatever pattern is presented by the output layer can be directly traced back to the input layer. The number of output neurons should be directly related to the type of work that the neural network is performing. For a specific example of how to choose the numbers of input and output neurons consider a program that is used for optical character recognition or OCR. To determine the number of neurons used for the OCR example. The number of input neurons that we will use is the number of pixels that might represent any given character. Characters processed by this program are normalized to universal size that is represented by a 5x7 grid. A 5x7 grid contains a total of 35 pixels. The optical character recognition program therefore has 35 neurons. The number of output neurons used by the OCR program will vary depending on how many characters the program has been trained for. The default training file that is provided with the optical character recognition program is trained to recognize 26 characters. As a result using this file the neural network would have 26 output neurons. Presenting a pattern to the input neurons will fire the appropriate output neuron that corresponds to the letter that the input pattern corresponds to.

6.1. VISION BASED ASSISTIVE SYSTEM FOR LABEL DETECTION WITH VOICE OUTPUT

A camera based assistive text reading framework to help blind persons read text labels and product packaging from hand-held object in their daily resides is proposed. To isolate the object from cluttered backgrounds or other surrounding objects in the camera view, we propose an efficient and effective motion based method to



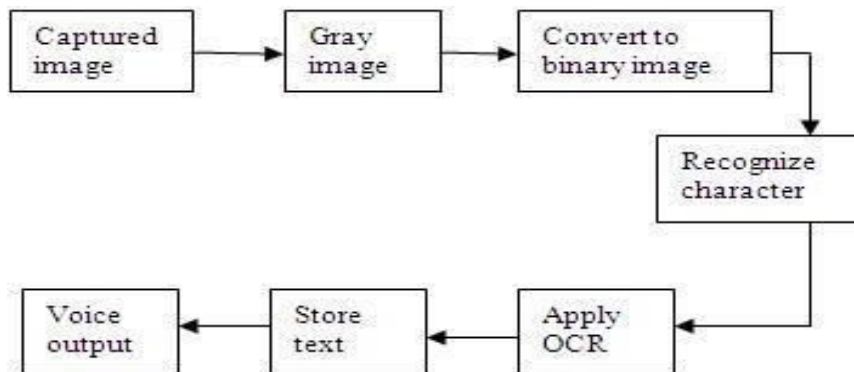
define a region of interest (ROI) in the video by asking. In the extracted ROI, text localization and recognition are conducted to acquire text information. To automatically localize the text regions from the object ROI, we propose a novel text localization algorithm by learning gradient features of stroke orientations and distributions of edge pixels in an Adaboost model. Text characters in the localized text regions are then binarized and recognized by off-the-shelf optical character recognition software. The recognized text codes are output to blind users in speech.

6.2. INTRODUCTION

Of the 314 million visually impaired people worldwide, 45 million are blind. Recent developments in computer vision, digital cameras and portable computers make it feasible to assist these individuals by developing camera based products that combine computer vision technology with other existing commercial products such optical character recognition (OCR) systems. Reading is obviously essential in today’s society. Printed text is everywhere in the form of reports, receipts, bank statements, restaurant menus, classroom handouts, product packages, instructions on medicine bottles, etc. The ability of people who are blind or have significant visual impairments to read printed labels and product packages will enhance independent living and foster economic and self-sufficiency. Selectively extract the image of the object held by the blind user from the cluttered background or other neutral objects in the camera view; and 2) text localization to obtain image regions containing text, and text recognition to transform image-based text information into readable codes. We use a mini laptop as the processing device in our current prototype system. The audio output component is to inform the blind user of recognized text codes.

VII. IMAGE CAPTURING AND PRE-PROCESSING

The video is captured by using web-cam and the frames from the video is segregated and undergone to the pre-processing. First, get the objects continuously from the camera and adapted to process. Once the object of interest is extracted from the camera image and it converted into gray image. Use cascade classifier for recognizing the character from the object. The work with a cascade classifier includes two major stages: training and detection. For training need a set of samples. There are two types of samples: positive and negative.



To extract the hand-held object of interest from other objects in the camera view, ask users to shake the hand-held objects containing the text they wish to identify and then employ a motion-based method to localize objects from cluttered background.

VIII. AUTOMATIC TEXT EXTRACTION

In order to handle complex backgrounds, two novel feature maps to extracts text features based on stroke orientations and edge distributions, respectively. Here, stroke is defined as a uniform region with bounded width and significant extent. These feature maps are combined to build an Adaboost based text classifier.

IX. TEXT REGION LOCALIZATION

Text localization is then performed on the camera based image. The Cascade-Adaboost classifier confirms the existence of text information in an image patch but it cannot the whole images, so heuristic layout analysis is performed to extract candidate image patches prepared for text classification. Text information in the



image usually appears in the form of horizontal text strings containing no less than three character members.

X. TEXT RECOGNITION AND AUDIO OUTPUT

Text recognition is performed by off-the-shelf OCR prior to output of informative words from the localized text regions. A text region labels the minimum rectangular area for the accommodation of characters inside it, so the border of the text region contacts the edge boundary of the text characters. However, this experiment shows that OCR generates better performance text regions are first assigned proper margin areas and binaries to segments text characters. Then, employ the Microsoft Speech Software Development Kit to load these files and display the audio output of text information. Blind users can adjust speech rate, volume and tone according to their preferences. They are designed to easily interface with dedicated computer systems by using the same USB technology that is found on most computers. Static random-access memory (SRAM) is a type of a semiconductor memory that uses bi-stable latching circuitry to store each bit. ARM11 features are, Supports 4-64k cache sizes, Powerful ARMV6 instruction set architecture, SIMD (Single Instruction Multiple Data) media processing extensions deliver up to 2x performance for video processing, and High-performance 64-bit memory system speeds data access for media processing

and networking applications. LAN9512/LAN9512i contains an integrated USB 2.0 hub, two integrated downstream USB 2.0 PHYs, an integrated upstream USB 2.0 PHY, a 10/100 Ethernet PHY, a 10/100 Ethernet Controller, a TAP Controller EEPROM. Flash memory is an electronic non-volatile compute storage medium that can be an electrically erased and reprogrammed. Earphones either have wires for connection to a signal source such as an audio amplifier, radio, CD player, portable media player or have a wireless receiver, which is used to pick up signal without using a cable. The proposed system ensures to read printed text on hand-held objects for assisting blind persons. In order to solve the common aiming problem for blind users, a motion-based method to detect the object of interest is projected, while the blind user simply shakes the object for a couple of seconds. This method can effectively distinguish the object of interest from background or other objects in the camera view. An Adaboost learning model is employed to localize text in camera-based images. Off the shelf OCR is used to perform word recognition on the localized text regions and transform into audio output for blind users.

XI. LITERATURE SURVEY

[1]. Load control using projected VR system of wall mounted buttons. The existing system is the conventional switches and there is no safety in the system as it does not withstand high temperature and it is not convenient in big industries and has many disadvantages as well.

[2]. The UX and UI is also a major problem that it might not be changed according to our convenience. The other buttons in the industry were push buttons, lever switches, limit switches, magnetic switch, membrane switches, pressure switches, toggle switches, rotary switches and pull chain switches

[3]. In all these switches, it is easy to get current leakage and damage in the industry. The LCD is the system that is currently in use, which cannot be used in all the places as it causes huge damage.

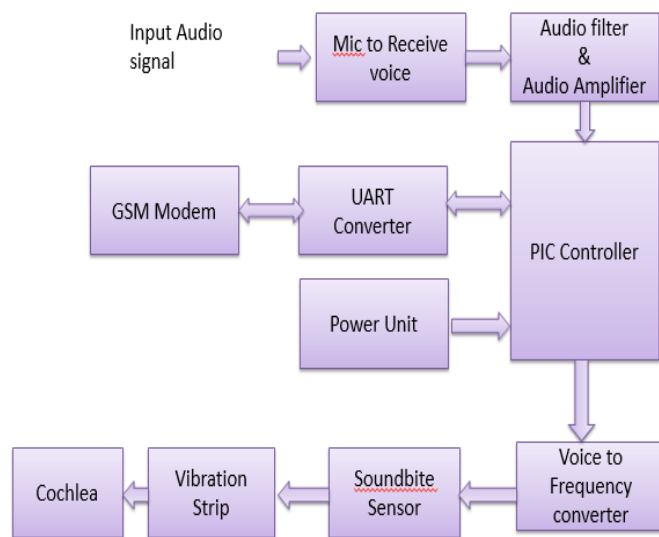
XI.1. PROPOSED SYSTEM

The proposed system is virtual switches with the help of projector to project the switch, the UI is remapping able as well, according to the user they can change the UI and UX of the virtual switches. This system is completely safe to use in the industries, as there is no current leakage. The projected switch is activated when our hand blocks the light, and calculates the shadow of the light using image processing. The pc compares with the image and operates the relay using the wireless ZigBee and the Arduino microcontroller. An LCD displays the relay to be operated, for verification to the operator at the industry. and change the load accordingly. Therefore, without any live switches or devices, the virtual switches are proposed in the highly electric industry. Security is the main aspect in all industries, especially in industries like gas, nuclear, mining and chemical industries, where a small mistake takes away lives and damages huge properties. Also User Interface (UI) and User Experience (UX) is an important factor nowadays. Changing the location, design of switches is a difficult task and its cost increases on each activity. The proposed system provides strict safety on electrical leakage of switches, the user interface and user experience can be improved and modified according to our needs. It uses a virtual reality projector, wireless transmitter. The virtual button is operated by the area of the shadow of the user and sends the



signal to the microcontroller through the wireless device. It activates the respective load through the relay, on which the user objects the projection of virtual switches (i.e.) It calculates the hand’s shadow that objects the projection). As there is no morphing of image and other processes, time for the operation is minimized as much as possible. In addition to that, the buttons visibility, UI and UX can also be changed according to our needs. Virtual Reality is seen as the ultimate storage of human and computer communications and has the ability to target a wide variety of applications. [3] Wall switches are mostly used in and conformity of style throughout a applications. It is difficult to change the wall mounted buttons to different locations as such, Also, changing the design and style of the buttons is not possible. And the switches cannot be fixed on all the environments[. The crucial thing is User experience (UX). Building products and programs is done. UX is referenced in one's feelings and opinions through a specific product and program . Concerns you need to upgrade UX , an alternate is required by various electrical appliances or web services. UX features details construction, accessibility, collaborative model, visual design, user interface (UI), usability. The UX is related to human’s character as well as mental functioning. Therefore, special information related to the above is necessary for developing UX. That is, the UI is the method of interaction of humans and switches in the middle of the information, because the shape of the UI is important and the major impact on the sense of use. The “affordance” focus is crucial that engineers design an attractive UI. The action in using an object or nature is called as affordance[1]. Lets take a Push-plate as an example, which is visible, the force that one can push to open up. The handle’s in the door should be visible and smooth to open the door . The revenue of the object is dependent on the ability of the people, goals, and their experience’s. Even personal computer and smart phones has an affordance to develop and experience it. In digital UI we use buttons in the middle [3]. People using the button in front of them and the ability to press it, that is visible. That's right the look is applied to the “click” UI on the computer screen, where users press the location or there is no depth of penetration. Whether they are high-level, experienced and experienced staff, managers, or plant managers, staff are required to understand the health and safety risks, the steps they need to take to reduce those risks, and general safety standards and compliance procedures[8][9]. Should we take special care in one of these two places? Yes. In this project we are going to provide a solution to these risks using real reality. VR (also known as true) can be found in courses such as entertainment, marketing, education, medical, construction and training of road safety and many others[4]. See provide many opportunities for users to visualize facts for various purposes. In this project we use a large virtual display interface touch buttons and slides on the colored wall of the ceiling [10]. An easy-to-install program contains a projector and a screen. Touch a button is obtained from the shadow that hides the particular label and shows all other. The shadow becomes very small at the touch of a button. The shadow area separated by a short button changes to a different color when the front is large and (e.g., hand and its shadow) covers the location of the button[3][6]. Therefore, there are no chronological activities, physical or postal analysis are required. Background extraction is used for extraction therefore a lower place.

XIII. BLOCK DIAGRAM





Hardware

- PIC16F877A
- SIM800A GSM Module
- UART Cable
- Voice Module
- Speaker
- Relay
- Motor

Software

- MPLAB IDE
- PicKit-3

XIV. CONCLUSION

The proposed smart hearing is a device that can be used by the Hearing impaired to hear the sound being played from the internet-based devices with no interference of multi-sound noise due to background sounds. The components used in creating the prototype are reliable, economic, and efficient compared to the present devices. In the market, this smart device provides high- quality audio to the user, Making them comfortable and gets reliable information from the source rather than the amplified audio from the mixed source.

XV. FUTURE WORK

Future work will be focused on enhancing the performance of the system and reducing the load on the user by developing the amplification of the sound waves in real time to design a channelizer offering eleven frequency sub bands centered at the standard frequencies with high side low attenuation and low ripple. To design a automatic gain control (AGC) system which provides accurate control of the steady state and dynamic behavior of dynamic range compression.

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