Developing Prosthetic Vocal Cord Incorporating AI, ML and Sixth Sense Technology

Dr. BASEERA
Assistant Professor (SR)
VIT Bhopal university ,
kothri kalan, Sehore,Bhopal ,M.P.

Dr. Manikandan K
Associate Professor
VIT Bhopal University,
kothri kalan, Sehore,Bhopal,M.P.

Lavish Garg
UG STUDENT
VIT Bhopal university
kothri kalan, Sehore,Bhopal,M.P.

Siddharth Verma
UG STUDENT
VIT Bhopal University
kothri kalan, Sehore,Bhopal ,M.P.

Ayushi Tripathi
UG Student
VIT Bhopal University
kothri kalan, Sehore,Bhopal,M.P.

Vineet Khola
UG STUDENT
VIT Bhopal University
kothri kalan, Sehore,Bhopal,M.P.

Yogita Bhardwaj
UG STUDENT
VIT Bhopal University.
kothri kalan, Sehore,Bhopal ,M.P.

Kartic Malhan
UG Student
VIT Bhopal University
kothri kalan, Sehore,Bhopal ,M.P

Abstract Communication is the basic need for any living thing in this world for survival. Without that it is very difficult to do the work or get the work done. In our day to day life communication plays an important role. It is the greatest gift of the god that one can speak and hear only then the concept of understand comes into existence. We met people in life who cannot speak and hear. Keeping them in mind, this project we have developed. In this project we are trying to prosthetic the vocal cord by which one can speak. Here the technology we used is making a band which will be embedded with AI and ML technology. It will be used to project a virtual keyboard which will be portable, and can be projected on any surface. Using wireless technology, a speaker or a small audio device will be connected near neck area for speaking or pronouncing the words. On the projected keyboard a person can type anything he want the speaker to throw as an output in any language. Which will work as most helpful device for them. There will be a inbuilt battery which supports the power supply, to work the band which is rechargeable on the other hand it is cost consuming also. Hope this will be beneficial to the particular community. **Keywords**: Vocal Cord, Prosthetic, Machine Learning, Artificial Intelligence, Sixth Sense.

Introduction Basically this research work is developed keeping in mind the people with issues in speaking or unable to speak by birth or the issues faced later stages due to dangerous viruses or fevers. In this part the technologies used and their description is discussed in details. Sixth sense technology, It is a wearable gesture that augments the physical world around us with the signals given by the hands using different color bands or else. All the hardware components are coupled in a pendent. This technology is introduced by Pranav Mistry in 2012 [1]. Wireless Bluetooth Technology: It is a wireless technology for transferring data between the devices over short distance using short- wavelength UHF radio waves from 2.4 to 2.85 GHz. Bluetooth is managed by Bluetooth Special Interest Group (SIG) [2]. AI and ML technology: Artificial Intelligence is a set of instructions which helps the machine to do things by its own and think like humans. It can also take decisions for different problems on its own. It includes memorization, calculations, reasoning and logic etc. Machine learning can be said as the application of (AI) and used for ability to automatically learn and improve from experience without being explicitly programmed [3]. Bluetooth audio device: Bluetooth is known for its high-speed and short-range communication protocol. It is used for transmitting high- quality audio signals to the audio devices. Like headphones, earphones etc. [4]. Text to Speech conversion: Is a form of speech synthesis that's converts the text to speech. Text to speech systems are developed to aid visually impaired by offering computer generated speech [5].

Literature Survey

This research has introduced an innovative, effective, physical, easy to handle, cost effective way that enables people who stutter, mumble, babble, gibber, slur, riddles or are totally speechless (dumb), to speak by using the proposed device consisting two parts:

I.   Physical wrist band incorporated with small visual projector can display a keyboard on our hand incorporated with touch system.

II. And a neck band incorporated with VOICE BOX which is connected with the band can speak out whatever written by the user on real time visually projected keyboard on the hand of a person.

Wrist Band: These are encircled strips worn on the wrist or lower forearm and used for many reasons. Now-a-days wrist bands are capable to show time, to record audio and video, to count steps-covered etc.[6]

Visual Projector: A video projector takes visual signals as input and show the corresponding image on the flat screen using lens systems. All video projectors use very bright ultra-high-pressure mercury lamp [7].

Touch System (Implementation): The Virtual keyboard will be projected on the hand surface through the visual projector present inside the wrist band using infrared sensor [8].

Neck band: This device will be on the neck. Bluetooth audio device will be embedded inside this. So that it will become handier and portable for many purposes.

Voice Box: It can speak out whatever written by the user on real time visually projected keyboard on an his/her hand. This will be inside the neck band [9].

Optical Alphabet Recognition (OAR): This technology is used for the electronic or mechanical conversion of the images typed or handwritten [10].

Text to Speech (TTS): Is a form of speech synthesis that's converts the text to spoken speech format. Text to speech systems are developed to aid visually impaired by offering computer generated speech [11].

Arduino Nano: It lacks only DC power jack, but Mini-B USB is provided for the functionality unlike other models of Arduino. It is small and can be used in small projects [12].

Tools and Technology Used to Implementation

Accelerometer sensor: The accelerometer sensor can be used to measure the acceleration exerted upon the sensor. Usually the acceleration is given in two or three axis-vector components that make up the sum/net acceleration. Accelerometers have quite a few uses. You can probably think of a few already—glass breakage detector, video game remote controls, or even electronic bubble levels for when you are trying to hang a picture frame on the wall [13]. These accelerometers typically give us two types of data:

1.   Static force applied on the sensor due to gravity → tilt/orientation detection

2. Force/acceleration exerted upon the sensor → movement/force detection.

Memory card + **ROM:** Memory cartridge is an electronic data storage device used for storing digital information, typically using flash memory. These are commonly used in portable electronic devices.

**Processor:** Here we are using Arduino Nano(microcontroller) as a processor.
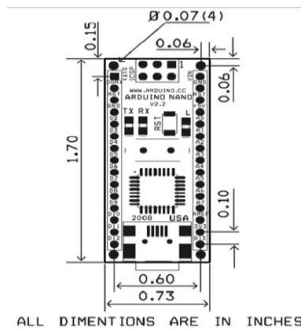
Vibrator: Vibrator is used to gives the sensation of pressing the alphabet keys of the virtually projected keyboard [14].

Micro USB port: Micro USB connectors exist or have existed in three forms: micro A, micro B and micro USB 3. USB 3 micro is much like micro B, but with an additional pin group on the side for twice the wires, enabling USB 3's greater speed. Like standard USB, the micro versions are plug-and-play and hot- swappable. Which can easily provide support to the device [15].

Battery: A lithium ion battery is used to give the power supply to the device which is easily chargeable.
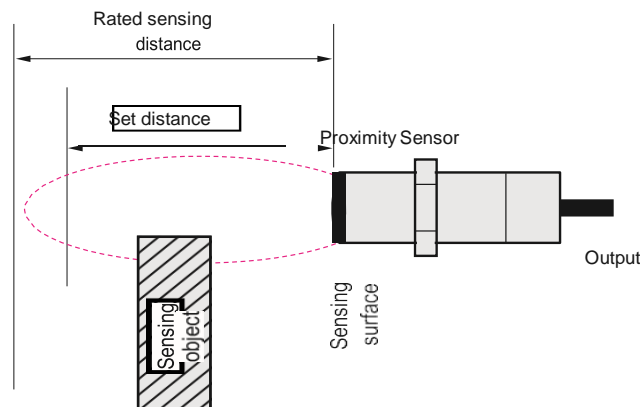
Standard Sensing Object: A sensing object that serves as a reference for measuring basic performance, and that is made of specified materials and has a specified shape and dimensions [16].


Proximity Sensor
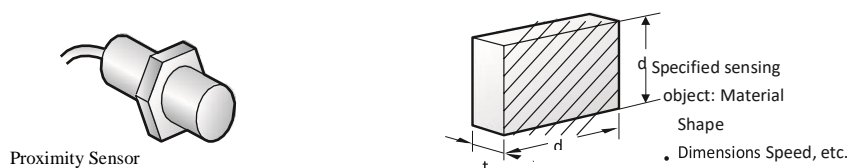
Sensing Distance: The distance from the reference position (reference surface) to the measured operation (reset) when the standard sensing object is moved by the specified method.

3
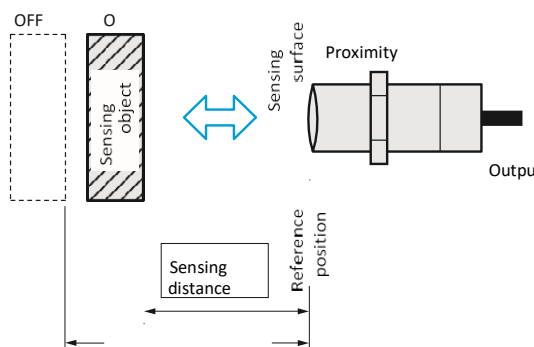
Set Distance: The distance from the reference surface that allows stable use, including the effects of temperature and voltage, to the (standard) sensing object transit position. This is approximately 70% to 80% of the normal (rated) sensing distance.


Hysteresis (Differential Travel): With respect to the distance between the standard sensing object and the Sensor, the difference between the distance at which the Sensor operates and the distance at which the Sensor resets.
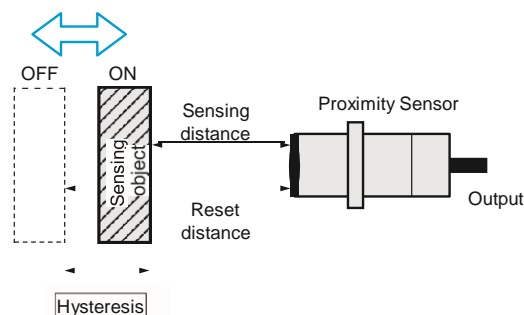

Response Time:
1. t1: The interval from the point when the standard sensing object moves into the sensing area and the Sensor activates, to the point when the output turns ON.
2. t2: The interval from the point when the standard sensing object moves out of the Sensor sensing area to the point when the Sensor output turns OFF.

4
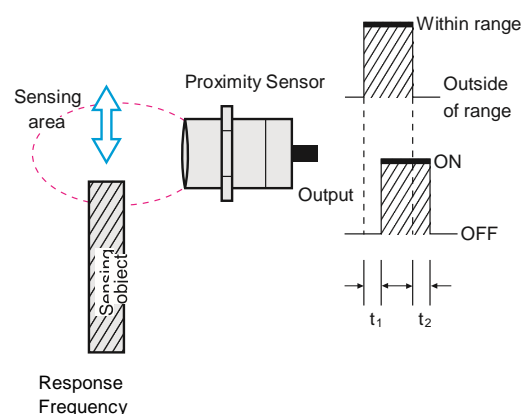
The number of detection repetitions that can be output per second when the standard sensing object is repeatedly brought into proximity. See the accompanying diagram for the measuring method .

Shielded: With a Shielded Sensor, magnetic flux is concentrated in front of the Sensor and the sides of the Sensor coil are covered with metal. The Sensor can be mounted by embedding it into metal.
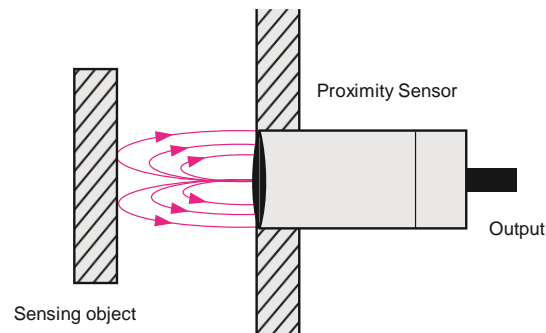
Unshielded: With an Unshielded Sensor, magnetic flux is spread widely in front of the Sensor and the sides of the Sensor coil are not covered with metal. This model is easily affected by surrounding metal objects (magnetic objects), so care must be taken in selecting the mounting location.

Expressing the Sensing Distance
When measuring the sensing distance of a Proximity Sensor, the reference position and the direction of approach of the sensing object are determined as follows:

Cylindrical/Rectangular Sensors	
Perpendicular sensing distance	**Horizontal sensing distance and sensing area diagram**
Expressed as the measured distance from the reference surface when the standard sensing object approaches from the radial direction (perpendicular to the sensing surface).	Expressed as the measured distance from the reference axis when the standard sensing object is moved parallel to the reference surface (sensing surface). This distance depends on the transit position (distance from the reference surface), so it can be expressed as an operating point track. (Sensing Area Diagram)

Output Configuration		
NPN transistor output	**PNP transistor output**	**Non-polarity/non-contact output**
A general-use transistor can be directly connected to a Programmable Controller or Counter.	Primarily built into machines exported to Europe and other overseas destinations.	A 2-wire AC output that can be used for both AC and DC Sensors. Eliminates the need to be concerned about reversing the polarity.

Leakage current: A maximum current of 0.8 mA flows to the load current even when the output is OFF. Check that the load will not operate with this current.

Output residual voltage: When the output is ON, voltage remains in the Sensor, and the voltage applied to the load decreases.

Output Configuration		
NO (normally open)	**NC (normally closed)**	**NO/NC switchable**
NO	NC	NO/NC switching
When there is an object in the sensing area, the output switching element is turned ON.	When there is no object in the sensing area, the output switching element is turned ON.	NO or NC operation can be selected for the output switching element by a switch or other means.

**Pico Projector:** Here we are making our own mini projector which will feel light on the wrist band.

Bluetooth module: It is used to connect the band with the voice box (near the neck area) via Bluetooth.

Working and Methodology

Keyboard Projection Band:-

These are some of the modules inside the projection band are explained below-

Pattern projector: This will project the keyboard design as coded in Arduino on the wrist. "QWERTY" type keyboard will be projected on the hand. The sensor inside the wrist band will detect the position of the finger, though the touch will be detected according to the key touched. The projector will have a wide-angle lens so that the large pattern can be projected from relatively low height. Here the projector itself takes the input, providing dual functionally [17].

Laser Projection Keyboard
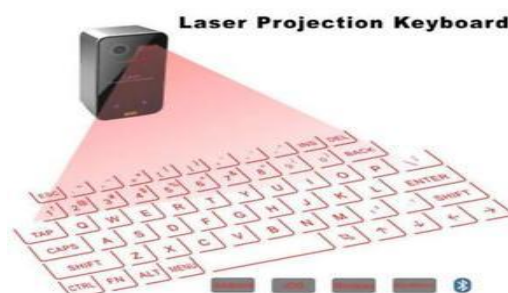
Sensors: Sensors are used in band to read where the person finger touches on the surface like if a person touches the letter 'k' on surface or hand then sensors should detect the position of the finger in 3D space and send the data via USB or Bluetooth.

IR light: Using this technology, we are sending the message to the processor about the data sent to the sensors by the infrared beam light to scan the image and send it to sensor module for converting the given data and position into an understandable text.
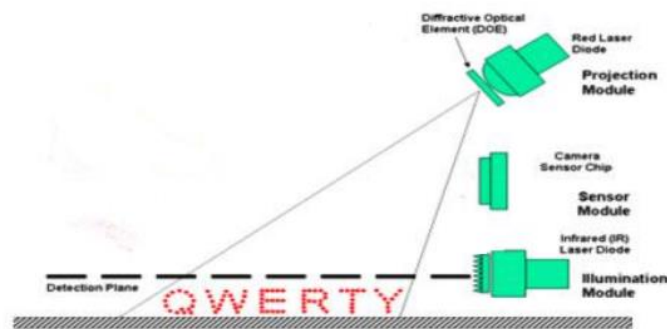
Reference plane illuminations: The infrared plane will be generated above the surface of virtual keyboard. The infra-red plane will be situated just above and parallel to the virtual keyboard. As it is infra-red so invisible for the user and will be a few millimeters above the hand. When a key position in touched on the IR surface, the light is reflected from the plane in the vicinity of the key and directed towards the sensor module.

Final Product

Conclusion

This virtual keyboard will provide convenience of the compactness with advantage of "QWERTY" type keyboard. Thus, on day-to-day use it will become more handier and of course portable.

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