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Sign Language Recognition using Smart Glove

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Abstract: ***Gesture-based communication Recognition through innovation has been ignored idea even though an enormous local area can profit from it. There are more than 3% total population of the world who even can't speak or hear properly. Using hand Gesture-based communication, Every especially impaired people to communicate with each other or rest of world population. It is a way of correspondence for the rest of the world population who are neither speaking and hearing incompetency. Normal people even don't become intimate or close with sign language based communications. It's a reason become a gap between the especially impaired people & ordinary person. The previous systems of the project used to involve the concepts of image generation and emoji symbols. But the previous frameworks of a project are not affordable and not portable for the impaired person.The Main propaganda of a project has always been to interpret Indian Sign Language Standards and American Sign Language Standards and Convert gestures into voice and text, also assist the impaired person can interact with the other person from the remote location. This hand smart glove has been made with the set up with Gyroscope, Flex Sensor, ESP32 Microcontrollers/Micro bit, Accelerometer,25 LED Matrix Actuators/Output &, flex sensor, vibrator etc.***

Keywords: Sign Language Recognition, Flex sensor, Indian Sign Language, American Sign Language, ESP32 bit Microcontroller Embedded System, Networking, Cloud Computing, and Machine Learning/Artificial Intelligence

I. INTRODUCTION

Communication is a medium of transferring information and conveying data to each other. Over the centuries, Communication is a way of exchanging data, information, thought and feelings with each other. Indian Sign Language is a standardized and commonly used sign language over worldwide. The people can communicate by using their hand by performing some action with the help of fingers of both the hands, in that no grammar is considered and it can take only common words. In this communication omitted the Articles such as 'a', 'an', 'the' and tense also. For ex, in the English language the sentence is –"I am not a good person", or in sign, language grammar is removed and it's said "Not a good person". advances in a field of Machine Learning, Cloud Computing and other domains make it easy to identify and clarify the pattern of a hand gesture. Smart gloves classify and identify the action of a hand and motions of fingers on a person to person basis. The data of sensors are in form of digital signals, which are combined with a particular value for the identify the word or alphabets, These alphabets use to form a phrase. in that, flex sensors are used to identify the position of the fingers and hands. In a conclusion, by using smart glove speech or hearing person can convey the other world peoples easily. the main purpose of the glove is, to make the impaired people life kind of speech or hearing-impaired folks straightforward

II. LITERATURE SURVEY

[1] Cao Dong, Ming C. Leu, Zhao Zheng Yin 2015 according to the analysis done that, one out of every five people is having speech or hearing incompetency on this planet is an Indian. In India about more than 1.5 million with hearing-impaired utilize Sign Language as a method of correspondence.[2] Nguyen Dang Binh, Toshiaki Ejima 2006"A new Approach Dedicated to Hand Gesture Recognition "Normal parents of special incompetency or vice versa use a gesture-based conversation with others. However, due to this type of complication an automatic Sign-to-Speech/text language interpretation framework could assist to make more details accessible to the hearing impaired. [3] Kirsten Ellis and Jan Carlo Barca 2012 Neural networks were used to implement an adaptive interface, called Glove Talk II, which contains hand gestures to control the parameters of a parallel formant speech synthesizer to allow a user to speak with his hands. It is used to implement an artificial vocal tract [4] Nicholas Born. 2010, "Senior Project Sign Language Glove Talk II"is a system that translates hand gestures to speech through an adaptive interface. Hand gestures are mapped continuously to 10 control parameters of a parallel format speech synthesizer. The mapping allows the hand to act as an artificial vocal tract that produces speech in real-time. This gives an unlimited vocabulary, multiple languages in addition to direct control of fundamental frequency and volume. Currently, the best version of Glove Talk II uses several input devices (including a Cyber glove, a contact glove, a Polhemus sensor, and a foot pedal), a parallel formant speech synthesizer, and three neural networks. The gesture to speech task is divided into vowel and a consonant neural network. The

gating network and the consonant network are trained with examples from the user. [5] SIGN LANGUAGE RECOGNITION USING MACHINE LEARNING S.Saravana Kumar1 , Vedant L. Iyangar2 1 Professor, Department of Computer Science and Engineering Karpagam College of Engineering, Coimbatore. 2Student, Department of Computer Science and Engineering, Karpagam College of Engineering, Coimbatore.2018A modern learning and translation tool for sign language implemented in Machine Learning can significantly affect the ease of Sign Language Communication. This tool will aim to : Obtain a video feed from the camera Classify and display the equivalent English Alphabet for the American Sign Language Alphabet. [6] "Conversation of Sign Language to Speech with Human Gestures", ISBCC'2015 by Rajaganapathy. S, Aravind. B, Keerthana. B, Sivagami.MNeural networks were used to implement an adaptive interface, called Glove Talk II, which contains hand gestures to control the parameters of a parallel formant speech synthesizer to allow a user to speak with his hands. It is used to implement an artificial vocal tract Glove Talk II is a system that translates hand gestures to speech through an adaptive interface. Hand gestures are mapped continuously to 10 control parameters of a parallel format speech synthesizer. [7] Translating Indian Sign Language to text and voice messages using flex sensors", International Journal of Advanced Research in Computer and Communication Engineering 2015 Vol. 4, Issue 5,by Sachin Bhat, Amruthesh's M, Ashik, Chidanand Das, Sujith. The glove is internally equipped with multiple flex sensors that are made up of "bend-sensitive resistance elements", For each specific gesture, internal flex sensors produce a proportional change in resistance of various elements. The processing of this information sends a unique set of signals to the PIC microcontroller and speak jet IC which is pre-programmed to speak desired sentences. [8] Paul D. Rosero-Montalvo1,2, Pamela GodoyTrujillo1, Edison Flores-Bosmediano1, Jorge Carrascal-Garc´ıa3, Santiago Otero-Potosi3, Henry Benitez-Pereira3 and Diego H. PeluffoOrd´ 2018 o˜nez4"Sign Language Recognition Based on Intelligent Glove Using Machine Learning Techniques" published on 978- 1-5386- 59/18/$31.00 ©2018 IEEE. Here in the hardware section of their proposed design has its constituent electronics components as a bend sensor, hall-effect sensor, accelerometer, and machine learning algorithms used for gesture recognition. The bend sensor output is fed to the analog multiplexer (HEF4051 by NXP semiconductors. [9] Abhinandan Das, Lavish Yadav, Mayank Singhal, Raman Sachan, Hemang Goyal, Keshav Taparia RaghavGulati, Ankit Singh, Gaurav Trivedi 2016 "Smart Glove for Sign Language Communications" Indian Institute of Technology Guwahati, Assam 781039, India. Published on 978-1-5090-4291-3/16/$31.00 ©2016IEEE. The mapping allows the hand to act as an artificial vocal tract that produces speech in real-time. This gives an unlimited vocabulary, multiple languages in addition to direct control of fundamental frequency and volume. Currently, the best version of Glove Talk II uses several input devices (including a Cyber glove, a contact glove, a Polhemus sensor, and a foot pedal), a parallel formant speech synthesizer, and three neural networks.

[10] Solanki Kumar 2016, "Indian Sign Language using Flex sensor Glove" International Journal of Engineering Trends and Technology (IJETT)vol.4, n0.6 June 2013. In their paper, they have thoroughly scrutinized the previous attempts over the technologies and also suggested various possible ways to implement the design of a simple smart glove. They tried to develop an electronic speaking glove, designed to facilitate easy communication through synthesized speech for the benefit of speechless patients. Gestures of fingers of a user of this glove will be converted to synthesized speech to convey an audible message to others, for example in critical communication with doctors

III. PROPOSED ARCHITECTURE

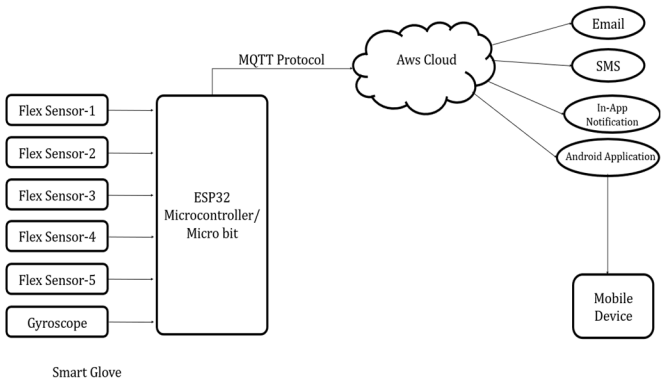

Figure 1 System Architecture

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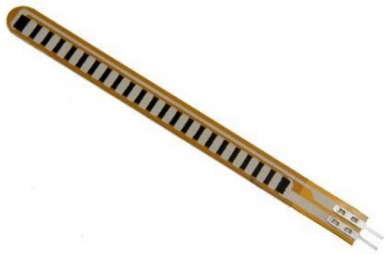
The undertaking work begins from the offers of hand gloves where there are appended flex sensors and at whatever point the sensor encounters bowing the worth of sensors get changed. The changing value of the sensor is depending upon the resistance and applied angle of the bending when we bend the sensor at some angle. we can see the value of the resistance is increased and accordingly the output gets reduced. We are also using a gyroscope to get the exact position of the hand & also implementing a fuzzy logic-based algorithm to predict the word from sensor value. Arduino Nano is applied to capture signals from the connected flex sensors and accelerometer which are placed on the glove. Then that computed output is sent across to display the text message output linked together along with Bluetooth connection to a Computer containing text message to speech combination and output of speech is accomplished. After looking at the changing value of the output, the value gets recorded by the ESP32 controller/Micro-bit and Send on AWS cloud. AWS sends these data to the application in real-time using AWS IoT Core Service with the help of MQTT Protocol.

The Smart Glove is integrated with the following Components:

1) *Flex Sensors:* Flex Sensors measures the total curving and flexing done by the user to communicate with the use of sign language. This sensor works on the bending strip principle. This flex sensor is connected with a 10k resistor. Here the angular displacement is measured using the voltage from the resistor. Every flex sensor is connected with 10k resistors.



2) *ESP32-Micro-Controller/Micro-bit:* ESP32 microcontroller series is an inexpensive, low-power system that is integrated with the Wi-Fi network and BLE dual mode Bluetooth on a chip microcontroller. And micro bit microcontroller which can be computerized to perform several distinct tasks, it may be your fitness tracker and on other hand gaming consoles &, etc. The device features have 25 built-in LED lights and programmable two buttons.

3) *Gyroscope:* A gyroscope is a sensor that can be used to detect or measure the angular velocity which maintains the orientation of an object .It contains a spinning wheel or the disc in which there is a rotations of axis that is complementary to take that orientation by itself
4) *Bluetooth Module:* Bluetooth modules can transmit and receive data wirelessly by using two devices. The Bluetooth module transmits serial data from the target device and this target device will display the data on the screen. This data is sent in a Bluetooth Module in alphabetical order,numerical values,etc.
5) *AWS Cloud:* Amazon web service (AWS) is a platform that provides flexible, easy to use, reliable, scalable, and cost-effective cloud computing solutions. This platform is provided with a combination of infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS)

IV. CONCLUSION

"Sign Language Recognition using Smart Glove" is to be one of the beneficial methods of easy communication within the hearing incompetent & speech incompetent people, general society. The gloves area unit is portable with the least weight and less power. The system translates the hand actions to the text. With this hearing, incompetent groups will need the gloves to build gestures in holding with signs. Thus, this system plays an important role for especially impaired people. Shortly, this glove is extended by implementing inbuilt sensors like temperature sensor is worked to calculates the body temperature, the pressure sensor is used for used to see the heartbeat of body.

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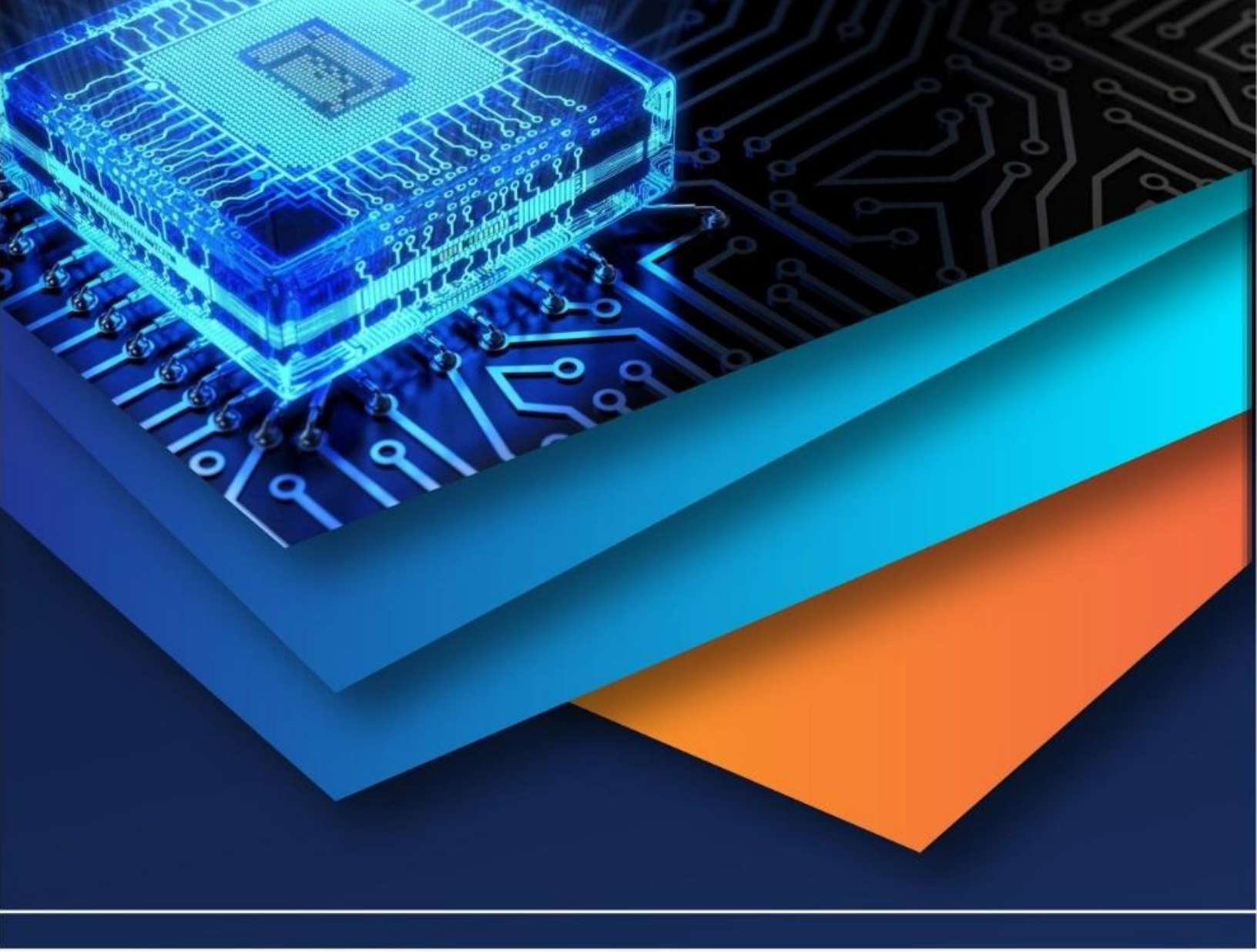

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