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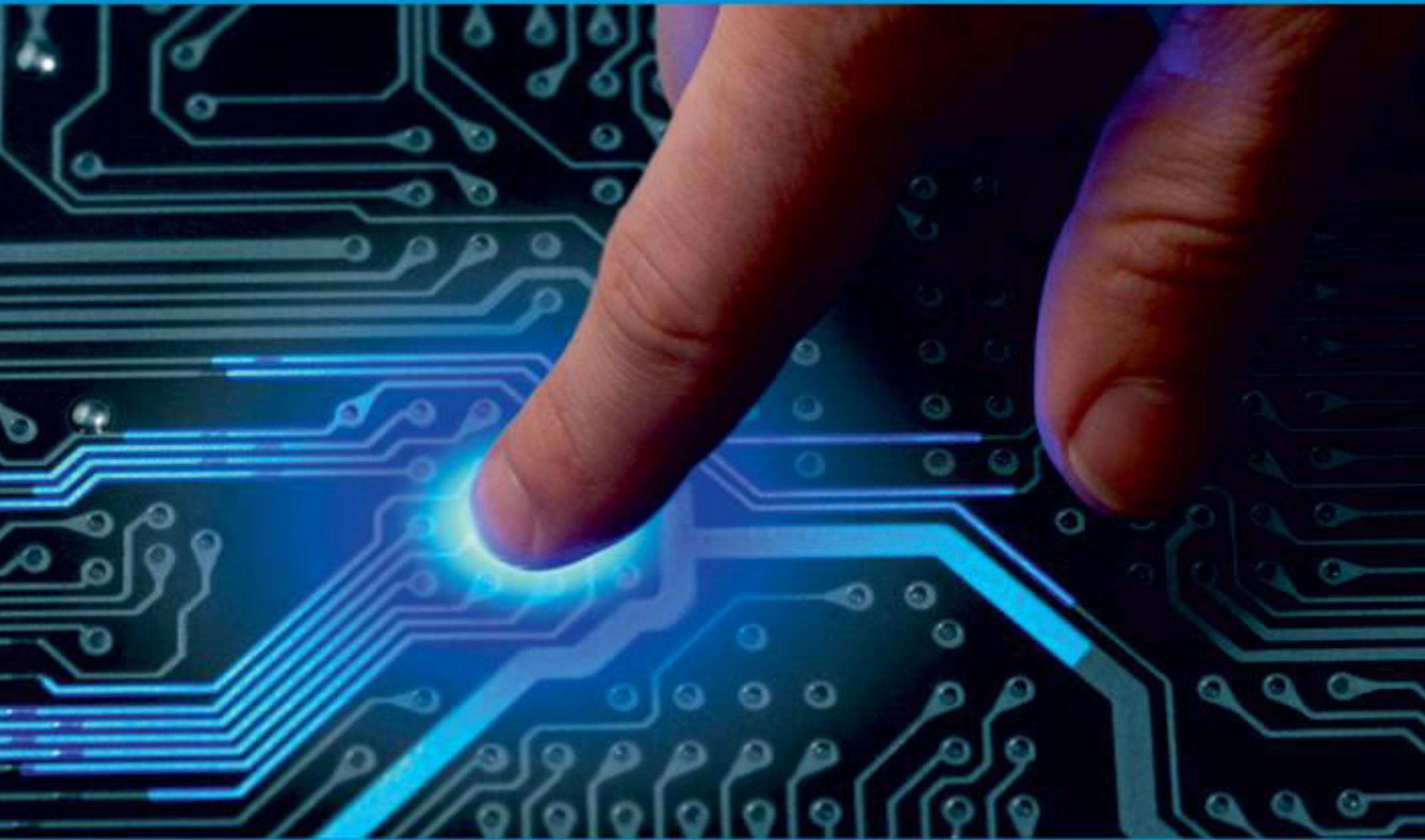

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Survey On Sign Language Converter to Voice and Text Using Gloves, Sensors & Image Processing

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Kommentar [AJ1]: ...

Kommentar [AJ2]: ...

ABSTRACT: These days, communicating with other deaf and dumb individuals as well as with regular people is the biggest challenge faced by the deaf and dumb community. Regular people can pick up new knowledge and information from the spoken language, daily discussions, and sounds around them. People who are deaf or hard of hearing do not have this luxury. This method will benefit those individuals by offering a communication channel. The phrase "assistive technology" refers to devices that are adaptive, rehabilitative, and designed for those with disabilities. The goal of this effort is to create a system that can identify sign language, allowing those who are speech impaired to communicate with those who do not, thus closing the communication gap. In contrast to other methods, hand gestures are significant because they allow users to convey their opinions quickly. In the current effort, a text-to-speech synthesizer is designed to convert the matching speech to text, and an image processing-based gesture recognition module is developed to recognize signs.

KEYWORDS: Gloves; Assistive Technology; Raspberry PI; Image Processing; American Sign Language

I. INTRODUCTION

Individuals who are deaf and dumb frequently find it awkward to bring up their hearing impairment in social situations. These people have the desire to have good hearing like their pals, which makes them think it's best to stick to themselves and avoid social interactions with regular people. Mute persons utilize sign language as a form of communication. Sign languages are used to express ideas using objects, symbols, etc. They also use a blend of gestures and words to communicate. Finger bends and curls create various patterns known as gestures. The greatest way for them to communicate is through gestures. People engage in social interactions with one another to share their experiences, ideas, and views with those around them. But for those who are deaf-mute, this is not the case. People who are deaf-mute can communicate thanks to sign language. A deaf-mute individual can communicate without the use of auditory cues through sign language. The goal of this effort is to create a system that can identify sign language, allowing those who are speech impaired to communicate with those who do not, thus closing the communication gap. In contrast to other methods, hand gestures are significant because they allow users to convey their opinions quickly. In the current effort, a text-to-speech synthesizer is designed to convert the matching speech to text, and an image.

II. RELATED WORK

The purpose of this work is to present an operation armature for a hand glove that uses Bluetooth, GSM-CDMA, and Internet modules to record the gestures performed by individuals who are speech- and hail-bloodied, restate those movements into meaningful text, and shoot the text to distant locales. It features a graphic stoner interface that shows all of the data transferred and entered between two druggies, trans-receiver modules for data transmission and event, an AVR 2560 microcontroller for gesture processing, and five flex, three contact, and one three-axis accelerometer detectors that act as input channels [1]. This exploration proposes a wireless hand gesture discovery glove for real-time Taiwanese sign language restatement. Flex and inertial detectors are integrated into the glove to enable demarcation between colorful hand gestures. These three parameters — cutlet posture, win exposure, and hand stir — are pivotal in

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the Taiwanese Language and must be honored. The suggested system uses the stirring line attained by the gyroscope, the win exposure attained by the G-detector, and the cutlet flexion postures attained by the flex detectors as input signals. The input signals will be recorded and reviewed regularly to determine whether or not they're licit sign language gestures. The tried signal is considered licit if it exceeds a destined number of timepiece cycles. It's also transferred to a mobile device via Bluetooth for voice restatement and gesture demarcation. The delicacy of gesture recognition with the suggested armature and algorithm is relatively good. trials show that it's possible to reach a delicacy rate of over 94 on perceptivity for gesture recognition, which supports the superiority of the suggested design [2]. In this paper, according to how the flex detectors identify a certain bending angle, the exploration composition" stoner- acquainted Cutlet- Gesture Glove Controller with Hand Movement Visualization Using Flex Detectors and Digital Accelerometer" established a control medium employing recorded countries. The countries have a defined range because they're grounded on a destined threshold. With the help of five flex detectors and the Y-axis of a three-axis accelerometer, 64 possible movements were reduced to 256 countries by the current configuration, which doesn't include the fresh contact detector countries. This backed in the creation of textual coequals for all 26 English rudiments [3] This study presents the conception of a smart glove that can restate sign language affairs into voice. Flex detectors and an Inertial Measurement Unit (IMU) are integrated inside the glove to describe the gesture. A brand-new state estimation fashion has been created to track a hand's movement in three confines. The feasibility of rephrasing the Indian subscribed language-to-speech affair using the prototype was examined. Despite being designed to restate sign language to speech, the glove has multiple uses in the gaming, robotics, and medical fields [5]. This exploration aims to produce and dissect a technology that can fete sign language. Flex detectors, accelerometers, and gyroscope signals make up all of the input data used by the Multilayer Perceptron, which does the recognition. A neural network instinctively is estimated with three different parameters changed a) the quantum of neurons in the middle subcaste solely; b) the literacy rate between the middle and input layers; and c) the literacy rate between the middle and affair layers. Following testing, confirmation, and training, the network achieves a megahit rate of roughly 96.1. It's suggested as volition to the accessible results presently available for deaf individuals, offering good delicacy at a lower cost than those formerly on the request [6]. In this work, they created a detector-grounded contrivance that can fete hand gestures used to represent the English ABC. We suggest that a mute person may wear this wearable device — a hand glove — and it would nearly rightly identify the 26 letters. The standard hand movements used by silent people as sign language are enforced by this suggested system. They also pay close attention to the need that the system to take the form of a wearable device with its data collection module that can collude data to the applicable sign and also restate that sign into the ABC each in one go. This task is completed without the need for a large CPU running MATLAB software or a fresh processing unit. A mute existent can hold a single, specially designed device that houses our entire system [6]. In this paper, the thing is to produce a system that's affordable, reliable, and movable. Because of this, the system is affordable and can be bought by anyone because it makes use of readily available, locally-produced electronics. Detector gloves, the foundation of the technology, restate sign language into speech. The gloves included an accelerometer and flex detectors to describe the movement and exposure of both hands. Bluetooth is used to dissect and multiplex all of the detector data wirelessly. When the gestures' detector values match, the audio module plays the corresponding sound train. The system can go into its resting mode and save energy when no sign is entered. The system armature avoids complicated calculations by using a straightforward system that directly maps movements via a lookup procedure [7]. This paper will enable silent persons to fete colorful hand gestures while wearing gloves, and these gestures will be restated into applicable addresses for non-silent people. Flexible detectors are pivotal in this situation. Along with the accelerometer value of the hand's slant position relative to the ground, the resistance value change that results from the detectors' degree of curve is also covered. Through Bluetooth communication, this collected data is further handled by a microcontroller module and transferred to any stoner of a smartphone. An operation that has been developed can also be used to convert the data into text grounded on the hand shape that's honoured and will induce a voice signa l[8]. This article presents the framework that was created to support them and make it easier for them to communicate their message. Such a device requires expertise in both computer engineering and electronics. Flex sensors, an Arduino, a Bluetooth module, an accelerometer, a glove, and an Android app to show the outcomes are all included. The framework aims to lower the communication gap that exists between a normal person and a deaf or dumb person. The objective is also to identify the choices and gaps in this field to enhance the framework even more [9]. The study focuses on the indications of the Dzongkha alphabet, which is Bhutan's original tongue. This study builds a system that senses bend, orientation, and contact using an assemblage of flex sensors, a gyroscope, an accelerometer, and contact sensors. Each sign has a purpose, and the design conveys that purpose to the audience using audio that clarifies the meaning of that specific sign [10]. The development of a glove translator capable of translating American Sign Language motions into text and speech is the aim of this research. Using flex sensors and an accelerometer, the prototype can translate the alphabet, numerals one through ten, and fifty common words and phrases in three seconds. The translation's result can be viewed using an Android application. For wireless operation,

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the glove translator will be connected via Bluetooth. The accuracy rating of the prototype is 95%. The purpose of this research is to facilitate communication between the deaf-mute community and non-sign language users [11]. This study presents a revolutionary way to use hand gestures to connect with computers and other digital devices. The technique relies on using a glove that has been specially designed and fitted with flex sensors, which can detect finger movements and wirelessly transfer them to the device that has to be controlled. The flex sensors on the glove must be coated with polydimethylsiloxane (PDMS) to enable precise and dependable hand gesture detection. PDMS helps to dampen and cancel out any vibration caused by the user's movements. Several tests were conducted using a variety of hand gestures from users to assess the method's efficacy. The results demonstrate that cross-correlation approaches may distinguish between diverse hand motions even when some of them are intentionally designed to look similar to one another. Additionally, the method's resistance to noise and other forms of interference made it suitable for usage in real-world scenarios [12].

III. IMPLEMENTATION ANALYSIS

According to the research and above analysis, new experiments utilizing gloves, sensors, and microcontrollers can be implemented. Use this, which translates sign language into voice and text, if you're normal or deaf. In addition, machine learning can be used in assistive systems to help the deaf and dumb population. This will recognize a picture taken using a computer's webcam and, following preprocessing, convert the associated text and voice. The block diagram in Figure 1 illustrates the idea of putting this into practice.

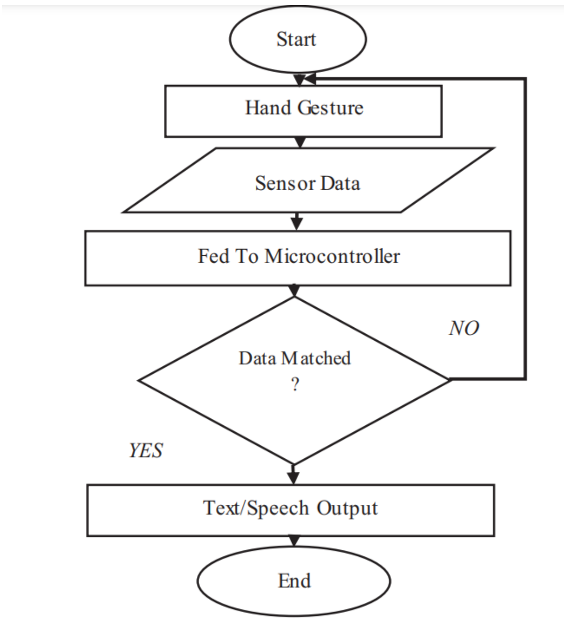

Fig 1: Blocked Diagram for Sign Language Converter with Gloves and Sensors

Combining five more flex sensors with a wrist-mounted flex sensor allows for the production of letters like G, H, J, P, and Z. Six flex sensors and three contact sensors work together to generate letters like M N P R S T U. All 26 alphabets and corresponding recognition with accuracy is shown in Table 1 as below. Sign language representation by hand for each letter is given in Fig 2. A to Z hand gestures were used to test the smart gloves. A few letters, such as M, N, O, R, S, T, V, and X, cannot be proven because of their comparable gesticulations to other letters. To gather the

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smart glove's accuracy from this test, each hand gesture was made five times. These systems checked the analysis for sentences as shown in Table 2. The system's accuracy shown in this research was 92% on average. Table 2 displays several sentences' correctness and response time about their indicators. The response time fell between one and one and a half seconds. Smaller sentences converted more quickly than somewhat longer ones, which took slightly longer. The correctness of the 14 statements provided in Table 2 is displayed in Figure 4.

Hand Gesture	Recognized Wrongly As	Accuracy (%)
A		100
B		100
C	E,D	60
D	C	80
E	C	80
F		100
G	L,Q	60
H		100
I		100
J		100
K	P	80
L	G,Q	60
P	K	80
Q	G,L	60
U		100
W		100
Y		100
Z		100

Table 1: Accuracy for 26 Alphabet letters

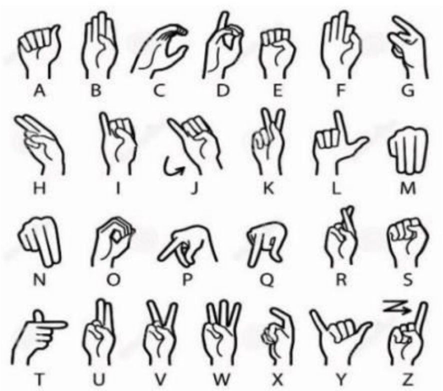

Fig 2: Sign Language representation by hand for 26 letters

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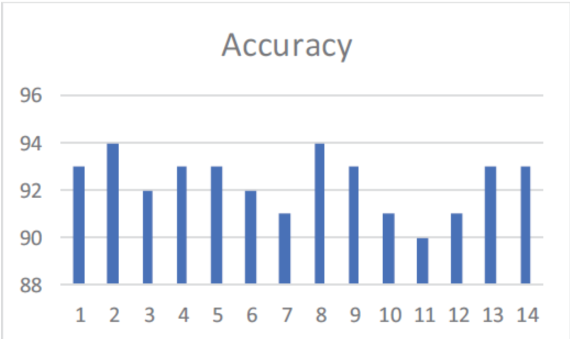

Fig 4: Bar Chart showing accuracy

	Sentence	Response Time (s)	Accuracy (%)
1.	Hello	1 s	93%
2.	How are you?	1.3 s	94%
3.	Listen up!	1.1 s	92%
4.	I need water.	1.1 s	93%
5.	Please help.	1 s	93%
6.	Do you have a pen?	1.5 s	92%
7.	I need food.	1.2 s	91%
8.	I can do it.	1.2 s	94%
9.	Thank you.	1 s	93%
10.	Switch off the lights.	1.5 s	91%
11.	I am tired.	1.1 s	90%
12.	Feeling accomplished.	1.1 s	91%
13.	Where is the restroom?	1.3 s	93%
14.	Let’s go.	1 s	93%

Table 2: Accuracy And Response Time Of Sentences

Dumb and Deaf assistive systems can be implemented with image processing, machine learning, and a Raspberry Pi device. Here we CNN to train the machine and OpenCV to capture images, producing text as the output. An artificial neural network that is specifically made for handling grid-like input, such as photos and movies, is called a convolutional neural network (CNN). It uses specialized layers to automatically and hierarchically extract patterns and characteristics from the input data, such as convolutional, pooling, and fully connected layers. CNNs are particularly good at tasks like object detection, image classification, and image recognition because they are great at identifying spatial patterns in the data. They scan and extract local patterns using convolution processes, which makes it possible to extract features from complex visual data with effectiveness and power. While several other initiatives have provided techniques for identifying signs in part, this project aims to fully embrace American Sign Language, which consists of 26 letters. A webcam is utilized to record video, which is then sent through a CNN model that has already been trained to identify hand motions. A few ASL letters are dynamic, while the bulk are static. Therefore, the objective of this project was to identify static and dynamic gestures by extracting features from finger and hand motions. This project

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has potential applications in the areas of assistive technologies, communication aids, and educational materials for the deaf and hard-of-hearing community. Fig 3 depicts the working of a CNN.

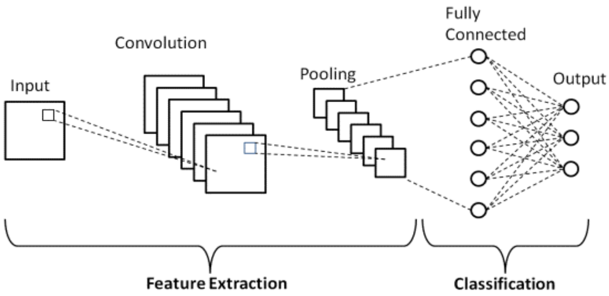

Fig 2: CNN Architecture

Viola-Jones Face Detection Algorithm for Pattern and Face recognition in Dumb and Deaf Assistive approach.
Given a picture (this algorithm operates on grayscale images), it examines numerous smaller subregions and searches each one for particular traits in an attempt to locate a face. An image may have multiple faces of varying sizes, therefore it must verify a wide range of positions and scales. In this technique, Viola and Jones used Haar-like properties to detect faces.

The Viola-Jones algorithm has four main steps

- Selecting Haar-like features
- Creating an integral image
- Running AdaBoost training
- Creating classifier cascades

To determine which section is lighter or darker, simply add up and compare the pixel values of the two areas. The total amount of values for all the pixels in the darker area will be less than the total amount of pixels in the lighter area. If one side is lighter than the other, it could represent the edge of an eyebrow. Occasionally, the middle part might be glossier than the boxes around it, suggesting the shape of a nose. Haar-like features can be used to achieve this, and we can then use them to interpret the various facial traits. Our ability to swiftly complete these complex computations and determine if a feature or set of features meets the requirements is aided by the integral image. The term "integral image" refers to both the data structure and the process that creates it (also called a summed-area table). The sum of the pixel values in an image or the rectangular portion of an image can be quickly and effectively calculated using this method. We employ the AdaBoost machine learning algorithm. About 160,000 features are present in the 24 x 24 detector frame, however, only a small subset of these features are crucial for face identification. To find the top features among the 160,000 features, we apply the AdaBoost algorithm. Therefore, we input AdaBoost information in the form of training data and then train it to learn from the information to forecast when we're training it to detect relevant features. In the end, the algorithm establishes a minimal threshold to decide whether or not something qualifies as a useful feature. The cascade's task is to swiftly eliminate non-faces to save valuable time and computations. Consequently, the speed required for real-time face detection is attained. We separate the face identification process into several steps and put up a cascaded system. Our finest features comprise the classifier in the first stage; to put it another way, the subregion goes through the best features in the first stage, such as the feature that recognizes the nasal bridge or the eye.

IV. CONCLUSION AND FUTURE WORK

Since sign language is a means for Deaf and Dumb individuals to communicate their thoughts, this technology will improve the dependability and utility of that medium. Here, the Gloves will be used by the system to translate the sign

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language into text and speech. We have included the opportunity to add more gestures to the database to enhance and facilitate gesture recognition. It is possible to insert more sensors in this system to detect entire sign language more precisely and flawlessly. Additionally, the system can be built so that it has no limitations on language and can translate words between other languages. Integrating it with a mobile application can add this to any portable device. The assistive system method may be improved to translate from any sign language to voice and text and vice versa.

REFERENCES

1. Dhananjai Bajpai, Uddaish Porov Gaurav Srivastav ,Nitin Sachan,2015 Fifth International Conference on Communication Systems and Network Technologies,2015 Conference Paper,IEEE, DOI: 10.1109/CSNT.2015.121
2. Lih-Jen Kau, Wan-Lin Su ,Pei-Ju Yu ,Sin-Jhan Wei, 2015 IEEE 58th International Midwest Symposium on Circuits and Systems (MWSCAS),Conference Paper IEEE,DOI: 10.1109/MWSCAS.2015.7282137
3. Carlos Emmanuel A.Quiapo, Katrina Nicole M.Ramos, 2016 IEEE Region 10 Conference (TENCON), Conference Paper IEEE, DOI: 10.1109/TENCON.2016.7848321
4. K Abhijith Bhaskaran, Anoop G. Nair,K Deepak Ram ,Krishnan Ananthanarayanan, H.R. Nandi Vardhan ,2016 International Conference on Robotics and Automation for Humanitarian Applications (RAHA), Conference Paper ,IEEE , DOI: 10.1109/RAHA.2016.7931887
5. Brunna Silva, Wesley Calixto , Geovanne Furriel, 2017 CHILEAN Conference on Electrical, Electronics Engineering, Information and Communication Technologies (CHILECON), Conference Paper, IEEE, DOI: 10.1109/CHILECON.2017.8229734
6. Abhishek B. Jani, Nishith A. Kotak , Anil K. Roy 2018 IEEE SENSORS ,Conference Paper,IEEE, DOI: 10.1109/ICSENS.2018.8589574
7. Hina Shaheen, Tariq Mehmood, 2018 IEEE Region Ten Symposium (Tensymp), Conference Paper, IEEE, DOI: 10.1109/TENCONSpring.2018.8692069.
8. Anirbit Sengupta, Tausif Mallick , Abhijit Das, 2019 Devices for Integrated Circuit (DevIC), Conference Paper, IEEE, DOI: 10.1109/DEVIC.2019.8783574
9. Ajay Suri, Sanjay Kumar Singh, Rashi Sharma ,Pragati Sharma ,Naman Garg ,Riya Upadhyaya, 2020 International Conference on Smart Electronics and Communication (ICOSEC), Conference Paper IEEE, DOI: 10.1109/ICOSEC49089.2020.9215392
10. Basudev Subedi, Kelzang Ugyen Dorji ,Pema Wangdi ,Tshering Dorji ,Kazuhiro Muramatsu, 2021 Innovations in Power and Advanced Computing Technologies (i-PACT), Conference Paper, IEEE, DOI: 10.1109/i-PACT52855.2021.9696641
11. Ana Antoniette C. Illahi, Maria Fides M. Betito, Christine Caryl F.Chen, Christian Vittorio A. Navarro ,Irene Victoria L.Or, 2021 IEEE 13th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM), Conference Paper, IEEE, DOI: 10.1109/HNICEM54116.2021.9731835
12. Amir R.Ali, Jessica Magdy, Aya ElNahas, Marina Samir, N. M. Samantha Kamel, Mariam A. Fathy, 2023 International Telecommunications Conference (ITC-Egypt),Conference Paper, IEEE, DOI: 10.1109/ITC-Egypt58155.2023.10206218

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