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Table of Contents

Impact of sensorless neural direct torque control in a fuel cell traction system

Benhamou Aissa, Tedjini Hamza, Guettaf yacine, Nour Mohamed 2725-2732

Determination of the price for a hydro resource with consideration of operating conditions of hydropower plants using complex criteria of profit maxmization

T. V. Myatezh, Y. A. Sekretarev 2733-2742

Reactive power sharing in microgrid using virtual voltage

Eder A. Molina-Viloria, John E. Candelo Becerra, Fredy E. Hoyos Velasco 2743-2751

Solar/wind pumping system with forecasting in Sharjah, United Arab Emirates

Waleed Obaid, Abdul-Kadir Hamid, Chaouki Ghenai 2752-2759

Intelligent control of battery energy storage for microgrid energy management using ANN

Younes Boujoudar, Mohamed Azeroual, Hassan Elmoussaoui, Tijani Lamhamdi 2760-2767

Four-leg active power filter control with SUI-PI controller

Mohamed M. El-sotouhy, Ahmed A. Mansour, Mostafa I. Marei, Aziza M. Zaki, Ahmed A. EL-Sattar 2768-2778

Numerical analysis of the photovoltaic system inspection with active cooling

Ahmed Hasan Mohammed, Ghanim Thiab Hasan, Kamil Jadu Ali 2779-2789

Assessment of voltage stability based on power transfer stability index using computational intelligence models

Ahmed Majeed Ghadban, Ghassan Abdullah Salman, Husham Idan Hussein 2790-2797

An electric circuit model for a lithium-ion battery cell based on automotive drive cycles measurements

Jaouad Khalfi, Najib Boumaaz, Abdallah Soulmani, El Mehdi Laadissi 2798-2810

Wind energy development in Morocco: Evolution and impacts

Touria Haidi, Bouchra Cheddadi, Faissal El Mariami, Zineb El Idrissi, Ali Tarrak 2811-2819

A review of intelligent methods for condition monitoring and fault diagnosis of stator and rotor faults of induction machines

Omar Alshorman, Ahmad Alshorman 2820-2829

Detection of internal and external faults of single-phase induction motor using current signature

Marwan Abdulkhaleq AL-Yoonus, Omar Sharaf Al-deen Alyozbaky 2830-2841

Adaptive backstepping control of induction motor powered by photovoltaic generator

M. Madark, A. Ba-razzouk, E. Abdelmounim, M. El Malah 2842-2855

Adaptive hysteresis band current control of grid connected PV inverter

R. S. Ravi Sankar, A. Venkatesh, Deepika Kollipara 2856-2863

Nonlinear control strategy of single-phase unified power flow controller

Younes Abouelmahjoub, Mohamed Moutchou 2864-2875

Fuzzy logic power management for a PV/Wind microgrid with backup and storage systems

Aysar M. Yasin, Mohammed F. Alsayed 2876-2888

Design and performance evaluation of a solar tracking panel of single axis in Colombia

Hernando González-Acevedo, Yecid Muñoz-Maldonado, Adalberto Ospino-Castro, Julian Serrano, Anthony Atencio, Cristian Jaimes Saavedra 2889-2898

Design new voltage balancing control series connected for HV-IGBT`s

M. I. Fahmi, M. F. Mukmin, H. F. Liew, C. L. Wai, M. A. Aazmi, S. N. M. Arshad ..2899-2906

Implementation of SHE-PWM technique for single-phase inverter based on Arduino

Laith A. Mohammed, Taha A. Husain, Ahmed M. T. Ibraheem 2907-2915

Finite control set model predictive direct current control strategy with constraints applying to drive three-phase induction motor

Anmar Kh. Ali, Riyadh G. Omar 2916-2924

Insights on critical energy efficiency approaches in internet-of-things application

Sharath S. M., Manjunatha P., Shwetha H. R. 2925-2933

Application of BaY2F8:Er3+,Yb3+ and Mg8Ge2O11F2:Mn4+ in improving the lighting quality of phosphor-in-glass based white light-emitting diodes with the dual-convex design

Huu Phuc Dang, Phung Ton That 2934-2940

A simple multi-stable chaotic jerk system with two saddle-foci equilibrium points: analysis, synchronization via backstepping technique and MultiSim circuit design

Aceng Sambas, Sundarapandian Vaidyanathan, Irene M. Moroz, Babatunde Idowu, Mohamad Afendee Mohamed, Mustafa Mamat, W. S. Mada Sanjaya 2941-2952

Compressor based approximate multiplier architectures for media processing applications

Uppugunduru Anil Kumar, Syed Ershad Ahmed 2953-2961

One input voltage and three output voltage universal biquad filters with orthogonal tune of frequency and bandwidth

May Phu Pwint Wai, Amornchai Chaichana, Winai Jaikla, Surapong Siripongdee, Peerawut Suwanjan 2962-2973

A novel 4 dimensional hyperchaotic system with its control, Synchronization and Implementation

Basil H. Jasim, Anwer Hammadi Mjily, Anwer Mossa Jassim AL-Aaragee 2974-2985

A new energy regeneration system for A BLDC motor driven electric vehicle

R. Palanisamy, Rohit Sahasrabuddhe, Mathur Kartik Hiteshkumar, Jay Anil Puranik..2986-2993

A smart fire detection system using iot technology with automatic water sprinkler

Hamood Alqourabah, Amgad Muneer, Suliman Mohamed Fati.....2994-3002

Improved control and monitor two different PLC using LabVIEW and NI-OPC server

Ignatius Deradjad Pranowo, Dian Artanto.....3003-3012

Autonomous vehicles: A study of implementation and security

Firoz Khan, R. Lakshmana Kumar, Seifedine Kadry, Yunyoung Nam, Maytham N. Meqdad 3013-3021

Smart element aware gate controller for intelligent wheeled robot navigation

Nadia Adnan Shiltagh Al-Jamali, Mahmood Z. Abdullah 3022-3031

Lane marking detection using simple encode decode deep learning technique: SegNet

A. Al Mamun, P. P. Em, J. Hossen.....3032-3039

Small intestine bleeding detection using color threshold and morphological operation in WCE images

A. Al Mamun, M. S. Hossain, P. P. Em, A. Tahabilder, R. Sultana, M. A. Islam 3040-3048

Bayesian learning scheme for sparse DOA estimation based on maximum-a-posteriori of hyperparameters

Raghu K., Prameela Kumari N. 3049-3058

Breast cancer diagnosis system using hybrid support vector machine-artificial neural network

Tze Sheng Lim, Kim Gaik Tay, Audrey Huong, Xiang Yang Lim.....3059-3069

Image encryption under spatial domain based on modify 2D LSCM chaotic map via dynamic substitution-permutation network

Rana Saad Mohammed, Khalid Kadhim Jabbar, Hussien Abid Hilal 3070-3083

Purging of silence for robust speaker identification in colossal database

P. Rama Koteswara Rao, Sunitha Ravi, Thotakura Haritha 3084-3092

Device to evaluate cleanliness of fiber optic connectors using image processing and neural networks

Victor Fernandez, Javier Chavez, Guillermo Kemper 3093-3105

Improved LEACH protocol for increasing the lifetime of WSNs

Ikram Daanoune, Abdennaceur Baghdad, Abdelhakim Ballouk 3106-3113

Analysis of cyclic prefix length effect on ISI limitation in OFDM system over a Rayleigh-fading multipath

Sarah Zanafi, Noura Aknin 3114-3122

Location tracking using LoRa

Norlezah Hashim, Fakrulradzi Idris, Tuan Nur Anisa Tuan Ab Aziz, Siti Halma Johari, Rozilawati Mohd Nor, Norfariza Ab Wahab 3123-3128

Case-based reasoning system for prediction of fuel consumption by haulage trucks in open-pit mines

Gomolemo Tadubana, Boyce Sigweni, Raymond Suglo 3129-3136

Smart cities: Understanding policies, standards, applications and case studies

Surender Reddy Salkuti 3137-3144

Optimization of open flow controller placement in software defined networks

Raghda Salam Al mahdawi, Huda M. Salih 3145-3153

A four-element UWB MIMO antenna using SRRs for application in satellite communications

Chafai Abdelhamid, Hedi Sakli, Nizar Sakli 3154-3167

Detecting spam e-mails using stop word TF-IDF and stemming algorithm with Naïve Bayes classifier on the multicore GPU

Manjit Jaiswal, Sukriti Das, Khushboo Khushboo 3168-3175

Aditi Agrawal, Rajeev Paulus 3176-3185

Simulation based comparison of routing protocols in wireless multihop adhoc networks

Ali H. Wheeb, Marwa T. Naser 3186-3192

VANET-Based Traffic Monitoring and Incident Detection System: A Review

Mustafa Maad Hamdi, Lukman Audah, Sami Abduljabbar Rashid, Sameer Alani 3193-3200

The effects of using variable lengths for degraded signal acquisition in GPS receivers

Arif Hussain, Hina Magsi, Arslan Ahmed, Hadi Hussain, Zahid Hussain Khand, Faheem Akhtar

.....3201-3211

Performance evaluation of hierarchical clustering protocols with fuzzy C-means

Hamid Barkouk, El Mokhtar En-Naimi, Aziz Mahboub 3212-3221

An FPGA-based network system with service-uninterrupted remote functional update

Tze Hon Tan, Chia Yee Ooi, Muhammad Nadzir Marsono 3222-3228

Prediction of nodes mobility in 3-D space

Mohammad Al-Hattab, Nuha Hamada 3229-3240

A novel fast time jamming analysis transmission selection technique for radar systems

Kamal Hussein, Mohamed Mabrouk, Bahaaeldin M. F. Elsor, Ahmed Alieldin, Walid M. Saad

.....3241-3254

Collaborative intrusion detection networks with multi-hop clustering for internet of things

Ida Wahidah, Yudha Purwanto, Aditya Kurniawan

PDF 3255-3266

Residential access control system using QR code and the IoT

Pak Satanasaowapak, Witawat Kawseewai, Suchada Promlee, Anuwat Vilamat

PDF 3267-3274

Inter-cell interference mitigation using adaptive reduced power subframes in heterogeneous networks

Mohammed I. Aal-nouman, Osamah Abdullah, Noor Qusay A. Al Shaikhli

PDF 3275-3284

A novel methodology for time-domain characterization of a full anechoic chamber for antennas measurements and exposure evaluation

Chakib Taybi, Mohammed Anisse Moutaouekkil, Bachir Elmagroud, Abdelhak Ziyyat

PDF 3285-3292

Performance analysis of OFDM-IM scheme under STO and CFO

Suyoto Suyoto, Agus Subekti, Arief Suryadi Satyawan, Vita Awalia Mardiana, Nasrullah Armi, Dayat Kurniawan

PDF 3293-3299

IoT based on secure personal healthcare using RFID technology and steganography

Haider Ali Khan, Raed Abdulla, Sathish Kumar Selvaperumal, Ammar Bathich

PDF 3300-3309

Design and development of handover simulator model in 5G cellular network

Abdulkarem Basil Abdulkarem, Lukman Audah

PDF 3310-3318

Comparative analysis of short-term demand predicting models using ARIMA and deep learning

Halima Bousqaoui, Ilham Slimani, Said Achchab

PDF 3319-3328

Characterizing user behavior in online social networks: Analysis of the regular use of Facebook

Jaafar Idrais, Yassine El Moudene, Abderrahim Sabour

PDF 3329-3337

A new technology on translating Indonesian spoken language into Indonesian sign language system

Risky Aswi Ramadhani, I Ketut Gede Dharma Putra, Made Sudarma, Ida Ayu Dwi Giriantari

PDF 3338-3346

Companies' perception toward manufacturing execution systems

Adil Aramja, Oualid Kamach, Rachid Elmeziane

PDF 3347-3355

RescueAlert-an accident detection and rescue mechanism

Uttkarsh Kumar Singh, Sahil Yadav, Sonali Joshi, Stuti Singh, Kayalivizhi Jayavel

PDF 3356-3364

Advances in lane marking detection algorithms for all-weather conditions

Hadhrami Ab Ghani, Rosli Besar, Zamani Md Sani, Mohd Nazeri Kamaruddin, Syabeela Syahali, Atiqullah Mohamed Daud, Aerun Martin

PDF 3365-3373

A fully integrated violence detection system using CNN and LSTM

Sarthak Sharma, B. Sudharsan, Saamaja Naraharisetti, Vimarsh Trehan, Kayalvizhi Jayavel

PDF 3374-3380

Tangible user interface design for learners with different multiple intelligence

Salintip Sudsanguan, Sakchai Tangwannawit, Thippaya Chintakovid

PDF 3381-3392

Comparative analysis of ReliefF-SVM and CFS-SVM for microarray data classification

Mochamad Agusta Naofal Hakim, Adiwijaya Adiwijaya, Widi Astuti

PDF 3393-3402

Potential key challenges for terahertz communication systems

Ahmad A. A. Solyman, Ismail A. Elhaty

PDF 3403-3409

Smart security door system using SMS based energy harvest

Abdullah Hamas, Amgad Muneer, Suliman Mohamed Fati

PDF 3410-3423

The impact of sentiment analysis from user on Facebook to enhanced the service quality

Daniel D. Albesta, Michael L. Jonathan, Muhammad Jawad, Oktovianus Hardiawan, Derwin Suhartono

PDF 3424-3433

An assistive model of obstacle detection based on deep learning: YOLOv3 for visually impaired people

Nachirat Rachburee, Wattana Punlumjeak

PDF 3434-3442

The future of software engineering: Visions of 2025 and beyond

Firoz Khan, R. Lakshmana Kumar, Seifedine Kadry, Yunyoung Nam

PDF 3443-3450

Association rule hiding using integer linear programming

Suma B., Shobha G.

PDF 3451-3458

Audio compression using transforms and high order entropy encoding

Zainab J. Ahmed, Loay E. George, Raad Ahmed Hadi

PDF 3459-3469

IoT-based air quality monitoring systems for smart cities: A systematic mapping study

Danny Munera, Diana P. Tobon V., Johnny Aguirre, Natalia Gaviria Gomez

PDF 3470-3482

Big data traffic management in vehicular ad-hoc network

Tantaoui Mouad, Laanaoui My Driss, Kabil Mustapha

PDF 3483-3491

A transfer learning with deep neural network approach for diabetic retinopathy classification

Mohammed Al-Smadi, Mahmoud Hammad, Qanita Bani Baker, Sa'ad A. Al-Zboon

PDF 3492-3501

Environment humidity and temperature prediction in agriculture using Mamdani inference systems

Julio Barón Velandia, Jonathan Steven Capera Quintana, Sebastian Camilo Vanegas Ayala

PDF 3502-3509

Optimization techniques on fuzzy inference systems to detect Xanthomonas campestris disease

Julio Barón Velandia, Camilo Enrique Rocha Calderón, Daniel David Leal Lara

PDF 3510-3518

Using deep learning models for learning semantic text similarity of Arabic questions

Mahmoud Hammad, Mohammed Al-Smadi, Qanita Bani Baker, Sa'ad A. Al-Zboon

PDF 3519-3528

AlertNet: Deep convolutional-recurrent neural network model for driving alertness detection

P. C. Nissimagoudar, A. V. Nandi, Aakanksha Patil, Gireesha H. M.

PDF 3529-3538

An algorithm for characterizing skin moles using image processing and machine learning

Zaid Sanchez, Alicia Alva, Mirko Zimic, Christian del Carpio

PDF 3539-3550

Time series activity classification using gated recurrent units

Yi-Fei Tan, Xiaoning Guo, Soon-Chang Poh

PDF 3551-3558

Two-step artificial neural network to estimate the solar radiation at Java Island

Adi Kurniawan, Eiji Shintaku

PDF 3559-3566

Oversampling technique in student performance classification from engineering course

Nachirat Rachburee, Wattana Punlumjeak

PDF 3567-3574

Robotic hex-nut sorting system with deep learning

Cristian Almanza, Javier Martínez Baquero, Robinson Jiménez-Moreno

PDF 3575-3583

Online handwriting Arabic recognition system using k-nearest neighbors classifier and DCT features

Mustafa Ali Abuzaraida, Mohammed Elmehrek, Esam Elsomadi

PDF 3584-3592

Real-time cloud system for managing blood units and convalescent plasma for COVID-19 patients

Dhuha Basheer Abdulla, Mohammed Dherar Younus

PDF 3593-3600

Efficiency of the energy contained in modulators in the Arabic vowels recognition

Nesrine Abajaddi, Youssef Elfahm, Badia Mounir, Laila Elmaazouzi, Ilham Mounir, Abdelmajid Farchi

PDF 3601-3608

Cyber physical systems: A smart city perspective

Firoz Khan, R. Lakshmana Kumar, Seifedine Kadry, Yunyoung Nam, Maytham N. Meqdad

PDF 3609-3616

Text classification model for methamphetamine-related tweets in Southeast Asia using dual data preprocessing techniques

Narongsak Chayangkoon, Anongnart Srivihok

PDF 3617-3628

Modified digital space vector pulse width modulation realization on low-cost FPGA platform with optimization for 3-phase voltage source inverter

Shalini Vashishtha, Rekha K. R.

PDF 3629-3638

Antenna design and fabrication for biotelemetry applications

Sourav Sinha, Raja Rashidul Hasan, Ta-Seen Reaz Niloy, Md. Abdur Rahman

PDF 3639-3646

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A new technology on translating Indonesian spoken language into Indonesian sign language system

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ABSTRACT

People with hearing disabilities are those who are unable to hear, resulted in their disability to communicate using spoken language. The solution offered in this research is by creating a one way translation technology to interpret spoken language to Indonesian sign language system (SIBI). The mechanism applied here is by catching the sentences (audio) spoken by common society to be converted to texts, by using speech recognition. The texts are then processed in text processing to select the input texts. The next stage is stemming the texts into prefixes, basic words, and suffixes. Each words are then being indexed and matched to SIBI. Afterwards, the system will arrange the words into SIBI sentences based on the original sentences, so that the people with hearing disabilities can get the information contained within the spoken language. This technology success rate were tested using Confusion Matrix, which resulted in precision value of 76%, accuracy value of 78%, and recall value of 79%. This technology has been tested in SMP-LB Karya Mulya on the 7th grader students with the total of 9 students. From the test, it is obtained that 86% of students stated that this technology runs very well.

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1. INTRODUCTION

Deaf people refers to that who has disabilities in hearing function. This condition might be either temporary or permanent. For those living around people with hearing disabilities, a special communication form is highly needed in order to properly deliver the message in a conversation [1-3]. Indonesian sign language system or *sistem isyarat Bahasa Indonesia (SIBI)* is a sign language system specifically developed for people with hearing disabilities. Indonesian sign language system follows Indonesian grammatical structure, and the morphology is also based on *Bahasa Indonesia* [4-6]. The Indonesian sign language system also includes prefixes, basic words, and suffixes [7].

Within the information technology field, especially in Indonesia, there are still very limited researchers developing technology on translating language specific for people with hearing disabilities. Technologies which have been developed currently for people with hearing disabilities are Indonesian vocabularies dictionary, and Indonesian sign language morphology [8, 9]

Creating special facilities for people with hearing disabilities is a heavy task. In 2001, the Indonesian government had just established the dictionary of Indonesian sign language system, of which during that time there were only a few technology developments on the field. Meanwhile, the hearing disabled people were in high needs of communication tools to be used in receiving information in the form of

audio [10]. The solution of this problem is to develop a one-way translation technology from spoken language to Indonesian sign language system.

In 2018, we developed a data set on Indonesian sign language system according to the morphology in *Bahasa Indonesia*. The data set includes prefixes, basic words, and suffixes. The research was entitled *"Database of Indonesian Sign System"* [11]. This research is the continuation from the preceding research in 2018. In this research a technology would be developed to conduct one way translation from spoken language to Indonesian sign language system [12]. Indonesia novelty of this research is being able to make an interpreter of spoken language into Indonesian sign language, by following the morphology of Indonesian.

Input used in this research consists of sentences delivered orally (audio), which then was recorded using microphones in laptops or mobile phones. The voice would subsequently be converted into texts using speech recognition technology [13-15]. The texts would later enter the processing stage. Text processing is used to select input sentences [16, 17]. Text processing consists of several stages such as case folding, tokenizing, and stemming. Case folding is conducted to homogenize the letters to lower case letters. Tokenizing is used to trim the sentences to words. The last stage is stemming which is used to separate word elements to prefixes, basic words, and suffixes [18, 19].

The words which have been identified into a number of prefixes, basic words, and suffixes would then go through indexing process with the prepared database [20]. Finally, the words would be converted to a word in Indonesian sign language system (Images). In order not to change the information contained in Indonesian sign language system, the pictures will be arranged in the formation based on the input sentences. This translation technology has gone through two stages of tests. The first test was using confusion matrix aimed to identify accuracy, precision, and recall [21, 22]. The second test was conducted to understand to what extent the students of SMP-LB Karya Mulya are able to use this technology.

2. RESEARCH METHOD

This research focuses on technology on translating spoken *Bahasa Indonesia* to Indonesian sign language system. To implement this technology, a long process should be conducted. The process spans from inserting input in the form of sentences which are normally used by Indonesian people in regular conversation to produce output in the form of sign language to be received by people with hearing disabilities. This application was built in website base so that it is accessible in all kinds of platforms [23]. More detailed explanation and scheme are depicted in the following flowchart as shown in Figure 1.

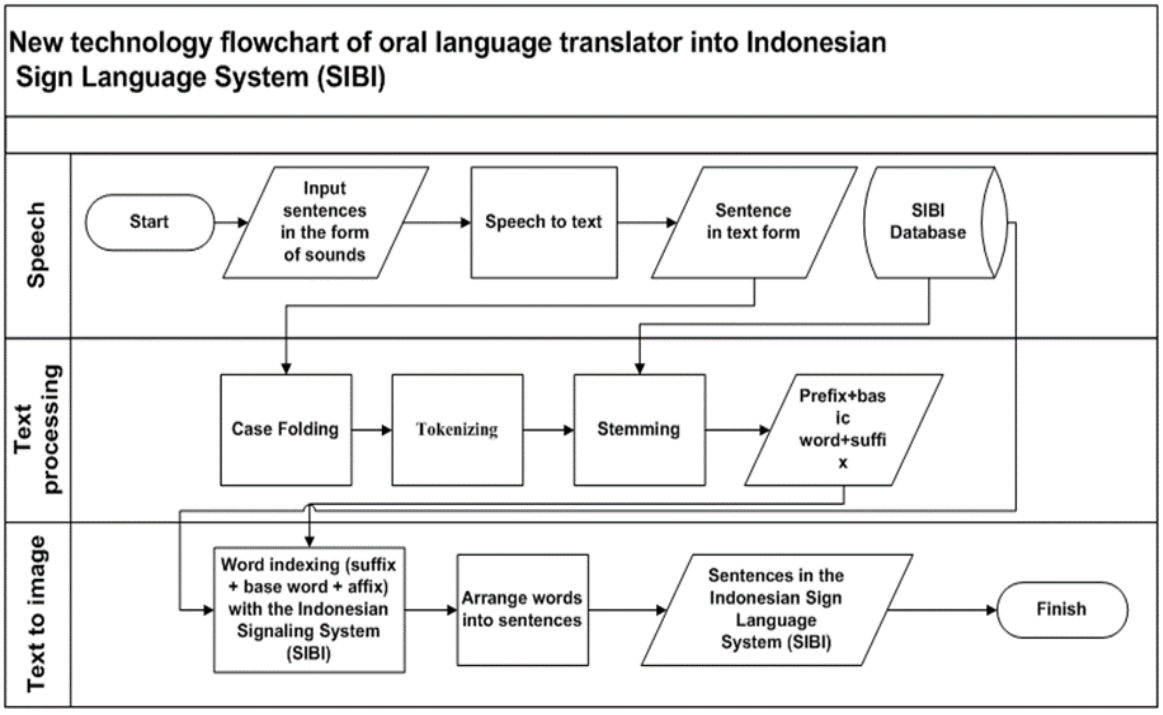

Figure 1. Flowchart of the new technology on translating spoken language to Indonesian sign language system

2.1. Speech recognition

Speech Recognition is the process of converting audio to texts. Audios are sourced from the society who are not familiar with sign language system but are aiming to deliver message towards their hearing-impaired counterparts. Information conveyed by the society is in the form of spoken sentences (audio). Then, the audio input would be converted into texts by using speech recognition [24, 25]. The output produced from speech recognition process are sentences (texts). The Figure 2 is a simplified figure showing the speech recognition process.

Speech recognition is biometric recognition, which is the process of a computer recognizing what someone is saying based on the tone of voice that is converted into digital text. This system is very good if it is used to develop communication applications for the general public with hearing impairers. The process is to convert sound spectrum data into digital form and convert it to text. Speech recognition has several steps that are important for recognizing sounds. The following are the steps that speech recognition uses to recognize sound.

- Receiving input data
- Extraction, i.e. input data storage as well as database creation
- Benchmarking/matching, which is the stage of matching new data with voice data (matching grammar) in the database
- User identity validation
- After the data is validated, the user (general public) can submit information that will be conveyed to the deaf through microphone
- After the sound is saved, the system will convert the data into text.

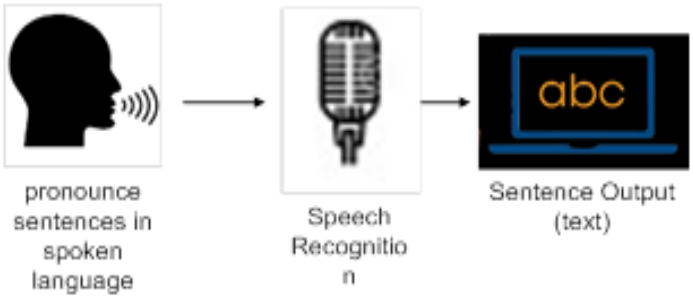

Figure 2. Processing audio to texts

2.2. Text processing

The texts produced in the previous stage were not arranged yet, therefore text processing is needed to arrange and to split the texts based on their syllables [26, 27]. The following are stages in text processing.

2.2.1. Case folding

Case folding is the stage where texts were homogenized to lower cases. Figure 3 is the case folding process figure.

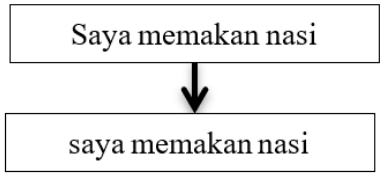

Figure 3. Case folding process

2.2.2. Tokenizing

Tokenizing is splitting the previously homogenized texts into words. The words are recognized by space, enter, and tabulation. The Figure 4 is an illustration of the tokenizing process.

Figure 4. Tokenizing process

2.2.3. Stemming

Furthermore, stemming is the process to separate prefixes, basic words, and suffixes [28, 29] stemming is made from *Bahasa Indonesia* morphology structure, which is depicted as:

$$Prefix + Basic\ Word + Suffix$$

Affixation is the process of adding / affixing or affixing. Affixation consists of:

- prefix (prefix): ber-, be-, PER-, per-, di-, ter-, ke, se
- suffix (suffix): -kan, -an, -i

The use of words in Indonesian usually gets a prefix or suffix, for example the word eats, the word gets a prefix of the word and the word *(makan)* eat basically. The Table 1 is a list of words that get prefix and suffix. Stemming in this research is specifically designed to build translator technology for people with hearing disabilities. The images of sign language system or *sistem bahasa isyarat* (SBI) are sourced from dictionary of sign languages published in 2001 by the Department of Education. The total data of words taken is 3340 words consist of basic words, prefixes, and suffixes. To develop this technology, a data set is needed to store the words/texts. The texts would later be stored in database, and are called as basic words in this research. Texts (SIBI) were stored in repository or specified folder entitled "Image of SIBI". The purpose of separating basic words and images of SIBI is to accelerate the data collection process.

By splitting the prefixes and suffixes, stemming process will identify the basic words. The identified basic words are later traced for its Id. Every word going through this translator technology should pass stemming process, in the Figure 5 show the example of sentence input and the stemming process. The processed basic words were then shown based on their Ids, the Ids were subsequently matched with the images of words (SIBI) stored in the repository.

Table 1. List of sentences to test

Number	Word	Prefix	Basic Word	Suffix
1.	Memakan (eat)	Me-	Makan (eat)	
2.	Membaca (read)	Mem-	Baca (read)	
3.	Bersihkan (cleaning)		Bersih (cleaning)	-kan
4.	Menulis (write)	Me-	Tulis (write)	
5.	Mandikan (bathe)		Mandi (bathe)	-kan

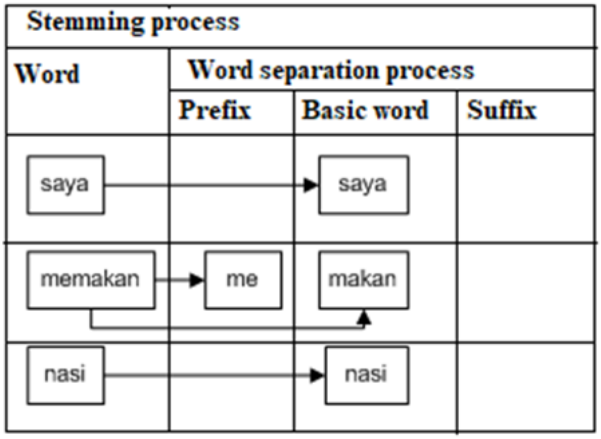

Figure 5. Stemming process

2.2.4. Text to image

The process of converting text to images (SIBI) uses an Id as a link between text and image text (SIBI). Text images (SIBI) are stored in a specific repository, to allow faster access and lighten system performance. Figure 6 is a simple image showing the process of converting text to text image (SIBI). In this research, Indexing is conducted to match the texts with images (SIBI). The following chart illustrates the matching process as shown in Figure 7.

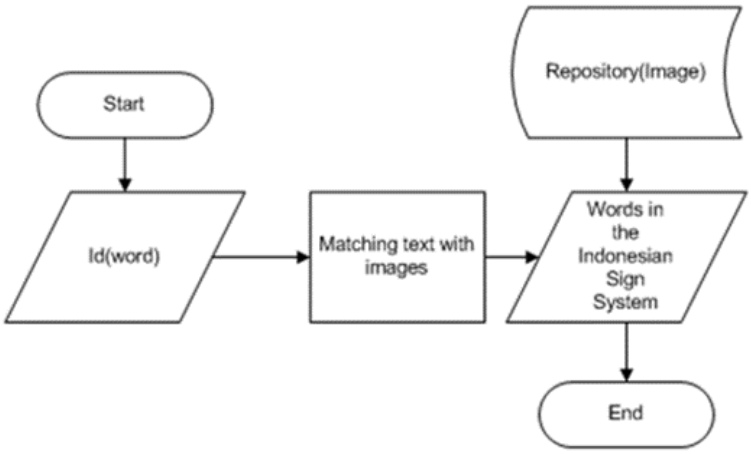

Figure 6. Flowchart of indexing texts with images

Figure 7. Illustration on matching text Id to image Id

2.2.5. Sentences in sign language

Images of words (SIBI) which were previously separated then being arranged in a sentence (SIBI). Images of sentences (SIBI) can be easily seen by the people with hearing disabilities. The display in this output is still in black and white based on its sources in the dictionary which were obtained through image scanning. The Figure 8 is the image of sentence (SIBI) output.

Figure 8. Sentences in the form of Indonesian sign language system (SIBI)

3. RESULTS AND DISCUSSION

3.1. Precision and recall accuracy analysis

Model testing is an essential step, considering the application will be directly related to the people with hearing disability [30-32]. To analyze accuracy, precision, and recall test of this application, confusion matrix is used. Data is used to test 100 sentences (audio) to be converted to images of texts (SIBI). Data in Table 2 is data used in system testing. By using confusion matrix, researcher can assess system success rate, by calculating accuracy, precision, and recall as success parameter. The Figure 9 shows accuracy, precision and recall calculation.

Table 2. List of sentences to test

Number	Sentence
1	*saya membaca buku setiap sore*
2	*stop, apa yang kamu lakukan*
3	*ayo silahkan airnya diminum*

N=100		Prediction Value	
		False	True
True Value	True	True Negative(TN)= 40 Correction of no results	False Positive(FP)=12 unexpected results
	False	False Negative(FN)=10 missing results	True Positive(TP)=38 Correct results

Figure 9. Research result analysis using confusion matrix

The data is obtained from the application testing results. From the data, researcher is allowed to acquire accuracy, precision, and recall values of the application. The detailed calculation is shown in (1)-(3). The calculation has resulted in the values of precision is 76%, accuracy is 78%, and recall is 79%. It can be concluded from the values that this technology run well.

$$Accuracy = \frac{(TP+TN)}{TP+TN+FP+FN} = \frac{(38+40)}{38+40+12+10} = 0{,}78 \quad (1)$$

$$Precision = \frac{TP}{TP+FP} = \frac{38}{38+12} = 0{,}76 \quad (2)$$

$$Recall = \frac{TP}{TP+FN} = \frac{38}{38+10} = 0{,}79 \quad (3)$$

3.2. Testing of translator technology in students of SMP-LB Karya Mulia Surabaya

Testing of translator technology in Surabaya Mulya Junior High School-LB students is needed, considering that this translator technology will be used by deaf people. Translator technology was tested on 1st grade students of SMP-LB Surabaya, these students were aged 12-13 years. The system was tested on 9 students. The Figure 10 is a photo of the trial activities carried out at SMP-LB Karya Mulya Surabaya. Instrument is needed to measure the success of translator technology, in the pilot phase a questionnaire is used. To analyze the number of students from SMP-LB Karya Mulya Surabaya who rate this application it is good to use (4).

$$\text{Index formula } \% = \frac{\text{total score}}{\text{Y}} * 100 \quad (4)$$

From (4), it is found that the percentage of students who gave excellent grades, can be seen more clearly in the Table 3.

Figure 10. Trial translator system translating Indonesian spoken language into Indonesian sign language system (SIBI)

Table 3. Results of the assessment by questionnaire

Number	Assessment parameters	The results that show are very good
1.	Interface	87 %
2.	Navigation menu	71 %
3.	Translation results	98 %
4.	User Guide	73 %
5.	Informative	98 %
6.	Recording sensitivity	87 %
Average		86 %

From the results in Figure 3 it can be concluded that 86% of respondents rated translator technology as very good. This research also gets some advice from people with hearing impairment such as improving accuracy, increasing vocabulary, and improving appearance. And needs to be made an Android-based application.

4. CONCLUSION

This new technology on translating spoken language (audio) to Indonesian sign language system is capable to translate spoken language to SIBI language. The stages in conducting translation are speech recognition, text processing, basic words, images of SIBI, stemming, indexing, sentences in sign language, and video in SIBI. Video is used to allow the people with hearing disabilities to receive output easily. This translating technology has been tested through converting spoken sentences. The total number of spoken sentences is 100 sentences. From the test, it was obtained the data such as: precision value of 76% and accuracy value of 78%. The recall value in this system is already good in the number of 79%. From that, it can be concluded that the system has been able to translate spoken sentences to pictured sentences in the form of SIBI images. Whereas for interface assessment, navigation menu, translation results, user guide, informative, and recording sensitivity. Value by respondents is very good, with an average value of 86%.

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International Journal of Electrical and Computer Engineering (IJECE) Vol. 9, No. 4, August 2020, pp. xx~xx ISSN: 2088-8708, DOI: 10.11591/ijece.v9i4.ppxx-xx ? 101 A New Technology on Translating Indonesian Spoken Language into Indonesian Sign Language System (SIBI) Risky Aswi Ramadani1, I Ketut Gede Dharma Putra2, Made Sudarma3, Made Sudarma3, Ida Ayu Dwi Giriantari4 1,4PDIT, Universitas Udayana, Denpasar, Bali, 80234, Indonesia Article Info ABSTRACT (10 PT) Article history: People with hearing disabilities are those who are unable to hear, resulted in Received Jun 9, 2018 their disab ility to communicate using spoken language. The solution offered Revised Nov 20, 2018 in this research is by creating a one way translation technology to interpret spoken language to Indonesian Sign Language System (SIBI). The input in Accepted Jan 11, 2019 this application are sentences used by common society who are not familiar with SIBI. Those spoken language will be converted using this technology to Keywords: allow people with hearing disability to communicate with the society around them. Spoken language is a language produced orally and is in the form of Spoken language audio sound. Indonesian Sign Language System (SIBI) is Bahasa Indonesia Translator which is delivered by using hand sign language with the same morphology to SIBI common Bahasa Indonesia. The mechanism applied here is by catching the Hearing Disabilities sentences (audio) spoken by common society to be converted to texts, by Speech Recognition using speech recognition. The texts are then processed in text processing to select the input texts. The next stage is stemming the texts into prefixes, basic words, and suffixes. Each words are then being indexed and

matched to SIBI. Afterwards, the system will arrange the words into SIBI sentences based on the original sentences, so that the people with hearing disabilities can get the information contained within the spoken language. This technology success rate were tested using Confusion Matrix, which resulted in precision value of 76%, accuracy value of 78%, and recall value of 79&. This technology has been tested in SMP-LB Karya Mulya on the 7th grader students with the total of 9 students. From the test, it is obtained that 89% of students stated that this technology runs very well. This is an open access article under the CC BY-SA license. Corresponding Author: I Ketut Gede Dharma Putra, PDIT, Universitas Udayana, Denpasar, Bali, 80234, Indonesia Email: ikgdarmaputra@unud.ac.id 1. INTRODUCTION (10 PT) Deaf people refers to that who has disabilities in hearing function. This condition might be either temporary or permanent. For those living around people with hearing disabilities, a special communication form is highly needed in order to properly deliver the message in a conversation[1-3]. Indonesian Sign Language System or Sistem Isyarat Bahasa Indonesia (SIBI) is a sign language system specifically developed for people with hearing disabilities3. Indonesian Sign Language System follows Indonesian grammatical structure, and the morphology is also based on Bahasa Indonesia [4-6]. The Indonesian Sign Language System also includes prefixes, basic words, and suffixes [7]. Within the Information technology field, especially in Indonesia, there are still very limited researchers developing technology on translating language specific for people with hearing disabilities. Journal homepage: http://ijece.iaescore.com ISSN: 2088-8708 102 ? Technologies which have been developed currently for people with hearing disabilities are Indonesian vocabularies dictionary, and Indonesian Sign Language morphology[8,9] Creating special facilities for people with hearing disabilities is a heavy task. In 2001, the Indonesian Government had just established the dictionary of Indonesian Sign Language System, of which during that time there were only a few technology developments on the field. Meanwhile, the hearing disabled people were in high needs of communication tools to be used in receiving information in the form of audio[10]. The solution of this problem is to develop a one way translation technology from spoken language to Indonesian Sign Language System. In 2018, we developed a data set on Indonesian Sign Language System according to the morphology in Bahasa Indonesia. The data set includes prefixes, basic words, and suffixes. The research was entitled “Database of Indonesian Sign System” [11]. This research is the continuation from the preceding research in 2018. In this research a technology would be developed to conduct one way translation from spoken language to Indonesian Sign Language System[12]. Indonesia Novelty of this research is being able to make an interpreter of spoken language into Indonesian sign language, by following the morphology of Indonesian. Input used in this research consists of sentences delivered orally (audio), which then was recorded using microphones in laptops or mobile phones. The voice would subsequently be converted into texts using Speech Recognition technology [13-15]. The texts would later enter the Processing stage. Text processing is used to select input sentences [16,17]. Text Processing consists of several stages such as case folding, tokenizing, and stemming. Case Folding is conducted to homogenize the letters to lower case letters. Tokenizing is used to trim the sentences to words. The last stage is Stemming which is used to separate word elements to prefixes, basic words, and suffixes [18,19]. The words which have been identified into a number of prefixes, basic words, and suffixes would then go through indexing process with the prepared database[20]. Finally, the words would be converted to a word in Indonesian Sign Language System (Images). In order not to change the information contained in Indonesian Sign Language System, the pictures will be arranged in the formation based on the input sentences. This

translation technology has gone through two stages of tests. The first test was using Confusion Matrix aimed to identify accuracy, precision, and recall[21,22]. The second test was conducted to understand to what extent the students of SMP-LB Karya Mulya are able to use this technology. 2. RESEARCH METHOD (10 PT) This research focuses on technology on translating spoken Bahasa Indonesia to Indonesian Sign Language System. To implement this technology, a long process should be conducted. The process spans from inserting input in the form of sentences which are normally used by Indonesian people in regular conversation to produce output in the form of sign language to be received by people with hearing disabilities. This application was built in Website Base so that it is accessible in all kinds of platforms[23]. More detailed explanation and scheme are depicted in the following flowchart. Int J Elec & Comp Eng, Vol. 9, No. 4, August 2020 : xx - xx Int J Elec & Comp Eng ISSN: 2088-8708 ? 103 Figure 1. Flowchart of the New Technology on Translating Spoken Language to Indonesian Sign Language System. 2.1. Speech Recognition Speech Recognition is the process of converting audio to texts. Audios are sourced from the society who are not familiar with sign language system but are aiming to deliver message towards their hearing impaired counterparts. Information conveyed by the society is in the form of spoken sentences (audio). Then, the audio input would be converted into texts by using Speech Recognition[24,25]. The output produced from Speech Recognition process are sentences (texts). The following is a simplified figure showing the Speech Recognition process. pronounce sentences in spoken language Speech Sentence Output Recognitio (text) n Figure 2. Processing audio to texts Speech recognition is bimetric recognition, which is the process of a computer recognizing what someone is saying based on the tone of voice that is converted into digital text. This system is very good if it is used to develop communication applications for the general public with hearing impairers. The process is to convert sound spectrum data into digital form and convert it to text Speech Recognition has several steps that are important for recognizing sounds. The following are the steps that Speec Reconation uses to recognize sound. a. Receiving input data. b. Extraction, i.e. input data storage as well as database creation c. Benchmarking / matching, which is the stage of matching new data with voice data (matching grammar) in the database. d. User identity validation e. After the data is validated, the user (general public) can submit information that will be conveyed to the deaf through Micrhophone. f. After the Sound is saved, the system will convert the data into text. 2.2. Text Processing The texts produced in the previous stage were not arranged yet, therefore Text Processing is needed to arrange and to split the texts based on their syllables[26,27]. The following are stages in text processing. a. Case Folding Case Folding is the stage where texts were homogenized to lower cases. Below is the case folding process figure. Saya memakan nasi saya memakan nasi Figure 3. Case Folding Process b. Tokenizing Tokenizing is splitting the previously homogenized texts into words. Figure 4. Tokenizing Process Title of manuscript is short and clear, implies research results (First Author) ISSN: 2088-8708 104 ? c. Stemming Furthermore, stemming is the process to separate prefixes, basic words, and suffixes[28,29] Stemming is made from Bahasa Indonesia morphology structure, which is depicted below: Prefix + Basic Word + Suffix Affixation is the process of adding / affixing or affixing. Affixation consists of: 1) prefix (prefix): ber-, be-, PER-, per-, di-, ter-, ke, se 2) suffix (suffix): -kan, -an, -i The use of words in Indonesian usually gets a prefix or suffix, for example the word eat, the word gets a prefix of the word and the word (makan)eat basically. The following is a list of words that get prefix and suffix. Table 1. List of Sentences to Test Number Word Prefix Basic Word Suffix 1. Memakan(eat) Me- Makan(eat) 2. Membaca(read) Mem- baca(read) 3.

Bersihkan(cleaning) bersih(cleaning) -kan 4. Menulis(write) Me- tulis(write) 5. Mandikan(bathe) Mandi(bathe) -kan Stemming in this research is specifically designed to build translator technology for people with hearing disabilities. The images of Sign Language System or Sistem Bahasa Isyarat (SBI) are sourced from Dictionary of Sign Languages published in 2001 by the Department of Education. The total data of words taken is 3340 words consist of basic words, prefixes, and suffixes. To develop this technology, a data set is needed to store the words/ texts. The texts would later be stored in database, and are called as basic words in this research. Texts (SIBI) were stored in repository or specified folder entitled "Image of SIBI". The purpose of separating basic words and images of SIBI is to accelerate the data collection process. By splitting the prefixes and suffixes, stemming process will identify the basic words. The identified basic words are later traced for its Id. Every words going through this translator technology should pass stemming process, in the following can be seen the example of sentence input and the stemming process. Figure 5. Stemming Process The processed basic words were then shown based on their Ids, the Ids were subsequently matched with the images of words (SIBI) stored in the repository. d. Text to Image The process to convert texts to images (SIBI) utilizes Id as the connector between texts and images of texts (SIBI). Image of texts (SIBI) were stored in a specified repository, to allow faster access30. Below is the simplified figure showing the process of converting texts to images of texts (SIBI). Int J Elec & Comp Eng, Vol. 9, No. 4, August 2020 : xx - xx Int J Elec & Comp Eng ISSN: 2088-8708 ? 105 Figure 6. Flowchart of indexing texts with images In this research, Indexing is conducted to match the texts with images (SIBI). The following chart illustrates the matching process. Figure 7. Illustration on Matching Text Id to Image Id e. Sentences in Sign Language Images of words (SIBI) which were previously separated then being arranged in a sentence (SIBI). Images of sentences (SIBI) can be easily seen by the people with hearing disabilities. The display in this output is still in black and white based on its sources in the dictionary which were obtained through image scanning. The following is the image of sentence (SIBI) output. Figure 8. Sentences in the Form of Indonesian Sign Language System (SIBI) 3. RESULTS AND DISCUSSIONS 3.1 Analisa Akurasi Presisi dan Recall Model testing is an essential step, considering the application will be directly related to the people with hearing disability[30,31]. To analyze accuracy, precision, and recall test of this application, Confusion Matrix is used. Data is used to test 100 sentences (audio) to be converted to images of texts (SIBI). Table 2. List of Sentences to Test Title of manuscript is short and clear, implies research results (First Author) ISSN: 2088-8708 106 ? Number Setence 1 saya membaca buku setiap sore 2 stop, apa yang kamu lakukan 3 ayo silahkan airnya diminum Data in Table 2 is data used in system testing. By using Confusion Matrix, researcher can assess system success rate, by calculating accuracy, precision, and recall as success parameter. The chart below shows accuracy, precision and recall calculation. Figure 9. Research Result Analysis using Confusion Matrix The data is obtained from the application testing results. From the data, researcher is allowed to acquire accuracy, precision, and recall values of the application. The detailed calculation is shown below. $Accuracy = (TP+TN)$ ..... (1) $TP+TN+FP+FN$ = (38+40) 38+40+12+10 = 0,78 $Precirinn = TP$ ..... (2) $TP+FP$ = 38 38+12 = 0,76 $Recall = TP\ TP+FN$ ..... (3) = 38 38+10 = 0,79 The calculation has resulted in the values of precision is 76%, accuracy is 78%, and recall is 79%. It can be concluded from the values that this technology run well. 3.2 Testing of Translator Technology in Students of Smplb Karya Mulia Surabaya Testing of translator technology in Surabaya Mulya Junior High School-LB students is needed, considering that this translator technology will be used by

deaf people. Translator technology was tested on 1st grade students of SMP-LB Surabaya, these students were aged 12-13 years. Teachers who acted as the general public gave sentences (spoken) totaling 3 people. While the deaf students who received sentences (Indonesian Sign Language System) amounted to 9 people. The following is a photo of the trial activities carried out at SPM-LB Karya Mulya Surabaya. Figure 9. Trial translator system Translating Indonesian Spoken Language into Indonesian Sign Language System (SIBI) Int J Elec & Comp Eng, Vol. 9, No. 4, August 2020 : xx - xx Int J Elec & Comp Eng ISSN: 2088-8708 ? 107 instrument is needed to measure the success of translator technology, in the pilot phase a questionnaire is used. To analyze the number of students from SMP-LB Karya Mulya Surabaya who rate this application it is good to use the following equation. **Ilccx clrlrla** % = **rlral rclrc** ∗ **000 Y** (4) From equation (4), it is found that the percentage of students who gave excellent grades, can be seen more clearly in the table below. Table 3. Results of the assessment by questionnaire Number Assessment parameters The results that show are very good 1. Interface 87 % 2. Navigation menu 71 % 3. Translation results 98 % 4. User Guide 73 % 5. Informatif 98 % 6. Recording sensitivit 87 % Average 86 % From the results above it can be concluded that 86% of respondents rated translator technology as very good. This research also gets some advice from people with hearing impairment such as improving accuracy, increasing vocabulary, and improving appearance. And needs to be made an Android-based application. 4. CONCLUSION This new technology on translating spoken language (audio) to Indonesian Sign Language System is capable to translate spoken language to SIBI language. The stages in conducting translation are Speech recognition, Text Processing, Basic Words, Images of SIBI, Stemming, Indexing, Sentences in Sign Language, and Video in SIBI. Video is used to allow the people with hearing disabilities to receive output easily. This translating technology has been tested through converting spoken sentences. The total number of spoken sentences is 100 sentences. From the test, it was obtained the data such as: precision value of 76% and accuracy value of 78%. The recall value in this system is already good in the number of 79%. From that, it can be concluded that the system has been able to translate spoken sentences to pictured sentences in the form of SIBI images. Whereas for interface assessment, navigation menu, translation results, User Guide, Informative, and recording sensitivity. Value by respondents is very good, with an average value of 86%. REFERENCES [1] Y. Toba et al., "Considering multi-modal speech visualization for deaf and hard of hearing people," 2015 10th Asia-Pacific Symposium on Information and Telecommunication Technologies (APSITT), Colombo, 2015, pp. 1-3, doi: 10.1109/APSITT.2015.7217102. [2] V. E Newton and S. R. Shah,"Improving communication with patients with a hearing impairment," Community Eye Health. Vol. 26, pp. 6–7,2013 [3] U. Lemke and S.. Scherpiet," Oral communication in individuals with hearing impairment—considerations regarding attentional,",Front Psychol. Vol. 17.pp.8-15, 2015 [4] S. D Larasati, V. Kuboň and D. Zeman , "Indonesian Morphology Tool (MorphInd): Towards an Indonesian Corpus, " International Workshop on Systems and Frameworks for Computational Morphology, vol. 4,pp119-192, 2011 [5] F. Pisceldo, R. Mahendra,R. Manurung and I. W. Arka," A Two-Level Morphological Analyser for the Indonesian Language," Association for Computational Linguistics. vol. 5, pp. 1-6, 2014 [6] Alwi, Hasan, S. ardjowidjojo, H. Lapoliwa,"Tata Bahasa Baku Bahasa Indonesia," Pusat dan Balai Pustaka, Jakarta, 2003. [7] Departermen Pendidikan Nasional Indonesia, "Sistem Isyarat Bahasa Indonesia, " Pusat dan Balai Pustaka, Jakarta, 2002. [8] A. W. Yanuardi, S. Prasetio and P. P. Johannes Adi,"Indonesian Sign Language Computer Application for the Deaf,"International Conference on Education Technology and Computer, Shanghai, Vol 2, pp 57-65, 2010. [9] M. N. Baehaqi, M. Irzal

and F. H. Indiyah, "Morphological Analysis of Speech Translation into Indonesian Sign Language System (SIBI) on Android Platform,"International Conference on Advanced Computer Science and information Systems (ICACSIS),Bali, pp. 205–210.2015 Title of manuscript is short and clear, implies research results (First Author) ISSN: 2088-8708 108 ? [10] W. K. Mprah, "Sources and Use of Sexual and Reproductive Health Information Among Deaf People in Ghana," Indonesian Journal of Disability Studies,vol. 1,pp 1-11, 2014. [11] R. A. Ramadhani, I. D. Putra, M. Sudarma and I. A. Giriantari," Database of Indonesian Sign System," in International Conference on Smart Green Technology in Electrical and Information Systems, Bali,Indonesia, Vol. 3 pp. 225–228, 2018. [12] R. M. McGuire, J. Hernandez-Rebollar, T. Starner, V. Henderson, H. Brashear and D. S. Ross, "Towards a one-way American sign language translator, International Conference on Automatic Face and Gesture Recognition, Seoul, Vol. 6 ,pp. 620-625. 2004. [13] T. Shimada, R. Nishimura, M. Tanaka, H. Kawahara, and T. Irino, "Developing a method to build Japanese speech recognition system," Conference Anthology,China,pp. 120-125, Jan 2013 [14] A. de, N. Adriana, C. Maria and Daniela, Speech recognition in individuals with sensorineural hearing loss, Brazilian Journal of Otorhinolaryngology, Vol. 28 , pp. 1-5, 2016 [15] C. Brookes, "Speech-to-text systems for deaf, deafened and hard-of-hearing people," in Seminar on Speech and Langua for people with hearing disabilities. The images of Sign Language System or Sistem Bahasa Isyarat (SBI) are sourced from Dictionary of Sign Languages published in 2001 by the Department of Education. The total data of words taken is 3340 words consist of basic words, prefixes, and suffixes. To develop this technology, a data set is needed to store the words/ texts. The texts would later be stored in database, and are called as basic words in this research. Texts (SIBI) were stored in repository or specified folder entitled "Image of SIBI". The purpose of separating basic words and images of SIBI is to accelerate the data collection process. By splitting the prefixes and suffixes, stemming process will identify the basic words. The identified basic words are later traced for its Id. Every words going through this translator technology should pass stemming process, in the following can be seen the example of sentence input and the stemming process. Figure 5. Stemming Process The processed basic words were then shown based on their Ids, the Ids were subsequently matched with the images of words (SIBI) stored in the repository. d. Text to Image The process to convert texts to images (SIBI) utilizes Id as the connector between texts and images of texts (SIBI). Image of texts (SIBI) were stored in a specified repository, to allow faster access30. Below is the simplified figure showing the process of converting texts to images of texts (SIBI). Int J Elec & Comp Eng, Vol. 9, No. 4, August 2020 : xx - xx Int J Elec & Comp Eng ISSN: 2088-8708 ? 105 Figure 6. Flowchart of indexing texts with images In this research, Indexing is conducted to match the texts with images (SIBI). The following chart illustrates the matching process. Figure 7. Illustration on Matching Text Id to Image Id e. Sentences in Sign Language Images of words (SIBI) which were previously separated then being arranged in a sentence (SIBI). Images of sentences (SIBI) can be easily seen by the people with hearing disabilities. The display in this output is still in black and white based on its sources in the dictionary which were obtained through image scanning. The following is the image of sentence (SIBI) output. Figure 8. Sentences in the Form of Indonesian Sign Language System (SIBI) 3. RESULTS AND DISCUSSIONS 3.1 Analisa Akurasi Presisi dan Recall Model testing is an essential step, considering the application will be directly related to the people with hearing disability[30,31]. To analyze accuracy, precision, and recall test of this application, Confusion Matrix is used. Data is used to test 100 sentences (audio) to be converted to images of texts (SIBI). Table 2. List of Sentences to Test Title of manuscript is short and clear, implies

research results (First Author) ISSN: 2088-8708 106 ? Number Setence 1 saya membaca buku setiap sore 2 stop, apa yang kamu lakukan 3 ayo silahkan airnya diminum Data in Table 2 is data used in system testing. By using Confusion Matrix, researcher can assess system success rate, by calculating accuracy, precision, and recall as success parameter. The chart below shows accuracy, precision and recall calculation. Figure 9. Research Result Analysis using Confusion Matrix The data is obtained from the application testing results. From the data, researcher is allowed to acquire accuracy, precision, and recall values of the application. The detailed calculation is shown below. $Accuracy = (TP+TN)$ ..... (1) $TP+TN+FP+FN$ = (38+40) 38+40+12+10 = 0,78 $Precirinn = TP$ ..... (2) $TP+FP$ = 38 38+12 = 0,76 $Recall = TP\ TP+FN$ ..... (3) = 38 38+10 = 0,79 The calculation has resulted in the values of precision is 76%, accuracy is 78%, and recall is 79%. It can be concluded from the values that this technology run well. 3.2 Testing of Translator Technology in Students of Smplb Karya Mulia Surabaya Testing of translator technology in Surabaya Mulya Junior High School-LB students is needed, considering that this translator technology will be used by deaf people. Translator technology was tested on 1st grade students of SMP-LB Surabaya, these students were aged 12-13 years. Teachers who acted as the general public gave sentences (spoken) totaling 3 people. While the deaf students who received sentences (Indonesian Sign Language System) amounted to 9 people. The following is a photo of the trial activities carried out at SPM-LB Karya Mulya Surabaya. Figure 9. Trial translator system Translating Indonesian Spoken Language into Indonesian Sign Language System (SIBI) Int J Elec & Comp Eng, Vol. 9, No. 4, August 2020 : xx - xx Int J Elec & Comp Eng ISSN: 2088-8708 ? 107 instrument is needed to measure the success of translator technology, in the pilot phase a questionnaire is used. To analyze the number of students from SMP-LB Karya Mulya Surabaya who rate this application it is good to use the following equation. **Ilccx clrlrla % = rlral rclrc ∗ 000 Y** (4) From equation (4), it is found that the percentage of students who gave excellent grades, can be seen more clearly in the table below. Table 3. Results of the assessment by questionnaire Number Assessment parameters The results that show are very good 1. Interface 87 % 2. Navigation menu 71 % 3. Translation results 98 % 4. User Guide 73 % 5. Informatif 98 % 6. Recording sensitivit 87 % Average 86 % From the results above it can be concluded that 86% of respondents rated translator technology as very good. This research also gets some advice from people with hearing impairment such as improving accuracy, increasing vocabulary, and improving appearance. And needs to be made an Android-based application. 4. CONCLUSION This new technology on translating spoken language (audio) to Indonesian Sign Language System is capable to translate spoken language to SIBI language. The stages in conducting translation are Speech recognition, Text Processing, Basic Words, Images of SIBI, Stemming, Indexing, Sentences in Sign Language, and Video in SIBI. Video is used to allow the people with hearing disabilities to receive output easily. This translating technology has been tested through converting spoken sentences. The total number of spoken sentences is 100 sentences. From the test, it was obtained the data such as: precision value of 76% and accuracy value of 78%. The recall value in this system is already good in the number of 79%. From that, it can be concluded that the system has been able to translate spoken sentences to pictured sentences in the form of SIBI images. Whereas for interface assessment, navigation menu, translation results, User Guide, Informative, and recording sensitivity. Value by respondents is very good, with an average value of 86%. REFERENCES [1] Y. Toba et al., "Considering multi-modal speech visualization for deaf and hard of hearing people," 2015 10th Asia-Pacific Symposium on Information and Telecommunication

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