FINAL PLAGIARISM REPORT

Summation of each part:

Total= (3+0+1+0+0+2+2+0+0+1+2+2+1+0+2+1+1+0) %

=18%

<u>Detailed each part description is below:</u>

SmallSEOTools

PLAGIARISM SCAN REPORT

Words	1000	Date	August 13,2020
Characters	6425	Exclude Url	

3% Plagiarism	97% Unique	10 Plagiarized Sentences	59 Unique Sentences

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CHAPTER 1 INTRODUCTION 1.1 Introduction The Sign language is very important for people who have hearing and speaking deficiency generally called Deaf and Mute. It is the only mode of communication for such people to convey their messages and it becomes very important for people to understand their language. Sign language plays a vital role for person with disability (deaf and dumb) to communicate among themselves or with normal people in a non-verbal manner. Gestures are the primary method to convey messages, which are usually conducted in a three-dimensional space, known as a signing space [1], through an integration of manual and non-manual signals. Manual signals commonly correspond to hand motions and hand posturing, whereas non-manual signals correspond to an external appearance such as mouth movements, facial expressions, and body orientation [2]. Nevertheless, sign language has not been standardized globally. Each nation has developed its own sign language, such as the American Sign Language (ASL) and Germany Sign Language (GSL). However, each sign language varies slightly within different regions of the same country. Hence, it can be a challenge to develop a standardized sign language interpretation system for use worldwide. In a previous study, sign languages have been recognized using two major techniques, i.e., vision and non-vision approaches [3]. In fact, vision method is the major technique applied for sign recognition in the past decades. A system that uses a camera to observe the information obtained through hand and finger motions is the most widely adopted visual-based approach [4]. Tremendous effort and study has gone into the development of vision-based sign recognition systems worldwide. Indeed, vision-based gesture recognition systems can be subdivided into direct and indirect approaches. A direct approach detects the hand gestures based on the RGB color spaces of the skin color. For instance, Goyal et al. [5] identified Indian Sign Language (ISL) using the scale invariance Fourier transform (SIFT) algorithm by searching the matched key points between the input image and images stored in a database. A similar method was also applied by More et al. [8] using the SIFT algorithm, which further reduces the dimensions of the feature vector using a principal component analysis (PCA) algorithm for speeding up the processing time. To detect the dynamic hand gestures used in Japanese Sign Language (JSL), Murakami et al. [9] proposed the use of recurrent neural networks capable of recognizing the JSL finger alphabet, which has 42 symbols. In contrast, Chowdary et al. [10] used a simple scanning method to compute the orientation and movement of fingers in binary converted images captured from a web camera. Khan et al. [11] proposed a more sophisticated gesture recognition system using digital images, including image filtering (pre-processing), image segmentation, color segmentation, skin detection (finger and hand detection using binary images), and template matching.

Meanwhile, an indirect approach identifies the fingers and hand gestures based on the RGB color spaces segmented based on different colors for each finger using a data glove. A possible segmentation method using RGB color spaces along with a hand glove for gesture detection was proposed by Siby et al. [12]. This method utilizes the RGB color space values extracted from a captured hand gesture image of a data glove, and compares the values with those stored in a database. The exploitation of a vision-based method is greatly affected by the processing of the images, such as image filtering, background cancellation, color segmentation, and boundary detection. For instance, diverse and uncontrolled background images can influence the skin color segmentation or movement detection. Indeed, many researchers have failed to address these complications, and no solid solutions have yet been proposed. Consequently, a non-vision based method is an alternative approach. This method typically utilizes flex and motion sensors to measure the flexion of fingers and the orientation of the hand, respectively. Dawane et al. [13] attached five flex sensors on a glove with respect to each finger to identify hand gestures by matching the motions with those in a stored motion database. Preetham et al. [14] also proposed a similar technique of using flex sensors, but mapped the sensor data to a character set, which was implemented using a minimum mean square error (MMSE) algorithm for gesture recognition. The results are displayed as text on an LCD screen. This technique was improved by Patil et al. [15]; here, the bending of each sensor is further divided into three flexions, namely, a complete bend (finger close), partial bend, and straightening (finger open). Each ASL alphabet is then mapped according to the bend flexions to be used for template matching. On the other hand, inertial motions of hand or fingers are alternative approach for gestures recognition. Kim et al. [16] developed a glove-based 3-D hand motion tracking and gesture system that consists of three tri-axis accelerometer sensors placed on the thumb, middle finger, and back of the hand, respectively. The glove is able to detect simple rule-based hand gestures (e.g., scissor, rock, and paper) based on two different angular positions of the sensors: horizontal (z-axis) and vertical (x-axis) gestures. Lu et al. [17] implemented a YoBu glove with total of 18 inertial

motion unit (IMU) sensors. Each finger consists of three IMMUs at each joint with a total of 15 for the five fingers. The remaining IMU sensors are placed on the arm, forearm, and upper arm. An extreme kernel-based learning machine is implemented to identify specific gestures based on a total of 54-dimension extracted features. On the other hand, Lim et al. [18] proposed a novel method that uses a small-sized infrared optic sensor, developed as a virtual button, to observe finger flexion patterns on the wrist caused by moving fingers. Five dynamic gestures were proposed: “bye,” “hi,” “hold,” “release,” and “wave,” all of which are detected using a hidden Markov model (HMM) algorithm. Xie et al. [19] developed an accelerometer based smart ring to detect eight basic and twelve complex gestures in 2-D space. A segmentation algorithm is utilized to identify subject gestures which are further encoded by a Johnson

Sources	Similarity
Sign Language Recognition System For Deaf And Dumb People the sign language is very important for people who have hearing and speaking deficiency generally called deaf and mute. it is the only mode of communication for such people to convey their messages and it becomes very important for people to understand their language. https://www.ijert.org/research/sign-language-recognition-system-for-deaf-and-dumb-people-IJERTV2IS4261.pdf	3%

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Words	987	Date	August 13,2020
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code. Hsu et al. [20] presented an inertial-based digital pen to recognize the handwriting and gestures with dynamic time warping (DTW) method. The pen is hold by the user when writing the numerals or English lowercase letters and further transmitted wirelessly to a computer for online recognition. The similar hand gesture recognition approach with DTW method is proposed by Yin et al. [21] that adopted training-free method which did not require training samples. The gesture recognition process is carried out by first extracting the features followed by a robust template matching method. Besides that, Galka et al. [22] proposed an accelerometer glove for sign language recognition which consisted of seven active three-axis acceleration sensors with five located on the fingers (one sensor on each finger), one on the arm and one on the wrist. The sign recognition model is defined by a HMM and a parallel HMM approach. Cai et al. [23] also developed a wireless data glove type with four fingers button. The raw sensor data are converted into movement, acceleration, rotation and other features for gesture recognition.

Meanwhile, Liu et al. [24] presented an interesting idea to integrate inertial and vision depth sensors with HMM model to recognize six hand gestures, including “wave”, “hammer”, “punch”, “draw X”, “circle” and “other” gestures. However, the proposed system is not feasible in practical usage as both sensors needed to present for high accuracy gestures recognition. Nevertheless, a simple data glove with three-axis accelerometer, magnetometers and gyroscopes is proposed by Kim et al. [25] which converted the sensor data into angle data for sign language recognition. Sousa et al. [26] presented a GyGSLA system, a wearable glove that aimed to help inexperienced people in learning the new Portuguese sign language alphabet which is tested with three completely inexperienced sign language subjects. The similar study is also performed by Caporusso et al. [27] by introducing dbGLOVE, a wearable device for supporting deaf-blind people to communicate with others. Meanwhile, physiological sensors such as sEMG are also another popular gesture recognition technique. Lu et al. [28] proposed a score-based sensor fusion scheme using four sEMG sensors and a three-axis accelerometer connected to a mobile application to realize gestures-based real-time interaction. A set of 4 small-scale gestures, 15 large-scale gestures and user defined personalized gestures are proposed in the study. A similar method is also proposed by Wu et al. [29] with four sEMG and an inertial sensor that placed on the wrist to detect 40 most commonly used ASL words. The study observed that only a single channel of sEMG located on the wrist is sufficient for the ASL recognition. Likewise, Wu et al. [30] fused the information from an inertial sensor and sEMG sensor which are placed on a wearable system to recognize 80 commonly ASL signs with selected feature subset and processed by a support vector machine classifier. This paper aims to lower the barrier in communication with normal people. The main aim of the proposed system is to develop a cost effective system which can give voice to voiceless person with the help of Smart Gloves. It means that using smart gloves communication will not be a barrier between two different communities and they will be able to communicate easily with the normal person. This study aims at the development of a sign language interpretation system by analyzing hand and finger gestures from a smart wearable device. The finger gestures are observed through the flexion of the flex sensors, whereas the hand gestures are examined based on the hand motion through the orientation derived from an inertial motion sensor. The gestures are recognized using a support vector machine (SVM) model implemented in the wearable device. In the sign language alphabet, most of the letters are defined purely by the flexion of each finger Fig. 1.1 The ASL Alphabet, according to the Indiana Institute of Disability and Community India being the one of the largest population about 133.92 crores unfortunately consists of 40 to 80 million persons with disability, and it’s a big challenging problem to overcome the standard of living of those people with the help of technology The following data represents the population of person with disability: Fig. 1.2 Disabled Population by sex and residence India, 2011 Fig. 1.3 Disabled Populations by Type of Disability India, 2011 1.2 Methodology To understand the implications of Indian Sign Language, it is important to have a sense of the scope of the language, as well as the current methods of communicating between ISL users and non-users and how these methods accurately reflect the grammar and mechanics of the language. These factors influenced technological components of the glove throughout development of this proof-of concept. This includes the underlying theory, practices, and methods of using relevant sensors, digital and analog signal conversion, processing, and output methods. By understanding the behaviors and applications of the different components at a fundamental level, one can more easily understand how they can be optimally used for the creation of this product. The main purpose is to design a smart wearable glove, which can be used in hand. The proposed wearable system outperforms the existing method, for instance, although background lights, and other factors are crucial to a vision-based

processing method, they are not for the proposed system [6]. With the help of sensors, the actual movement of figures will be recorded. Corresponding patterns will be concluded. Accordingly, the conversion into voice is done. 1.3 Expected Outcome of the Project Projects have aimed to develop technology to facilitate communication between hearing and non-hearing people. The outcome is system generated voice after analyzing the data obtained from the sensors which monitors the following: Movements of the hand in 3D space. The resistance in the flex sensors on bending the figures at specific angles. 1.4 Major Inputs (infrastructure) required The projects are a combination of various hardware to accept the data and software which manipulates the input to produce the

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output. Hardware Flex ?Sensors, Triple Axis Accelerometer, Wi-Fi Module, Push Button, LEDs, Speaker, Battery, Arduino Nano, Raspberry Pi, Wires. Software Matlab, Anaconda, Arduino OpenCV: It is an open source computer vision programming functions library aimed at developing applications based on real time computer vision technologies. ? 1.5 User Requirements and Design Specifications Several difficulties are faced by Indian-born ISL users when communicating with those of the hearing community. ISL speaking people understand these difficulties best, so requirements that they explicitly state take priority. These requirements will later be taken into consideration when deciding on product specifications. Explicit Requirements Based on multiple interviews with ISL users, there are several explicitly-stated requirements of a sign-language translating glove. These include the speed of translation and the accuracy of the device. This and the glove accuracy, or if and how often it can detect and translate the correct gesture as the user signs it, determine the reliability of the glove. The device accuracy also involves the device’s ability to incorporate the various motions that ISL signs involve. This includes not only the rotation and flexion of hands and fingers, but also the orientation of the hand. Implicit Requirements In addition to the requirements specified by ISL users, the team has defined five requirements of the device that increase the prototype’s usefulness to ISL users. Several aspects and interactions of the device with its users and environment were taken into consideration. The requirements are as follows: Easy to Use - Any complications in its user interface would inhibit the glove’s use in everyday life. The user should be able to begin translation without much difficulty or delay. Each translation should be done without any unnecessary button-pressing or other interfacing. Portable - The system should not be dependent on a computer or other attached system. It should be able to be brought almost anywhere the user goes, with the possible exception for underwater. Affordable - Not much financial aid is available for assistive devices. This device should be accessible by the average person by practical and affordable means. Reliable - There is a certain degree of accuracy that the device should maintain. This threshold has been decided by our team to be of about 90% accuracy. If the device does not accurately and consistently translate signs, then the user will resort to time consuming alternatives such as writing on pen and paper and the device will have no use. Aesthetically Pleasing - For marketability purposes, the device shall be aesthetically pleasing and easily wearable without any factors that hinder convenience during extended periods of time. This includes a smooth, professional appearance without any components that irritate, cut, bruise, or otherwise cause discomfort for the user.

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opencv: it is an open source computer vision programming functions library aimed at developing applications based on real time computer vision technologies, visionmatlab:

https://www.ijirae.com/volumes/vol1/issue%2012/Dec%20Issue-1/08.DCCS10085.pdf

PLAGIARISM SCAN REPORT

Words	972	Date	August 13,2020
Characters	6107	Exclude Url	

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Plagiarism	Unique	Plagiarized Sentences	Unique Sentences

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CHAPTER 2 LITERATURE SURVEY 2.1 Literature Survey Sign language plays a vital role for person with disability (deaf and dumb) to communicate among themselves or with normal people in a non-verbal manner. Gestures are the primary method to convey messages, which are usually conducted in a three-dimensional space, known as a signing space [1], through an integration of manual and non-manual signals. Manual signals commonly correspond to hand motions and hand posturing, whereas non-manual signals correspond to an external appearance such as mouth movements, facial expressions, and body orientation [2]. Nevertheless, sign language has not been standardized globally. Each nation has developed its own sign language, such as the American Sign Language (ASL) and Germany Sign Language (GSL). However, each sign language varies slightly within different regions of the same country. Hence, it can be a challenge to develop a standardized sign language interpretation system for use worldwide. In a previous study, sign languages have been recognized using two major techniques, i.e., vision and non-vision approaches [3]. In fact, vision method is the major technique applied for sign recognition in the past decades. A system that uses a camera to observe the information obtained through hand and finger motions is the most widely adopted visual-based approach [4]. A direct approach detects the hand gestures based on the RGB color spaces of the skin color. For instance, Goyal et al. [5] identified Indian Sign Language (ISL) using the scale invariance Fourier transform (SIFT) algorithm by searching the matched key points between the input image and images stored in a database. This paper aims to lower this barrier in communication with normal person. The main aim of the proposed system is to develop a cost effective system which can give voice to voiceless person with the help of Smart Gloves. It means that using smart gloves communication will not be barrier between two different communities and they will be able to communicate easily with the normal person. 2.2 Review of the previous work Table 2.1 Review of the previous work Reference Methodology Conclusion Limitation [1] S. Goyal, I. Sharma and S. Sharma, “Sign language recognition system for deaf and dumb people,” Int. J. Eng. R. Technol., vol. 2, no. 4, pp. 382-387, Apr. 2013. 1. A direct approach detects the hand gestures. 2. Indian Sign Language (ISL) using the scale invariance Fourier transform (SIFT) algorithm by searching the matched key points between the input image and images stored in a database 1. Based on the RGB color spaces of the skin color, detects hand gestures. 1. Requirement of color space. 2. For every alphabet approximately 5 images at different angles and distances need to be stored [2] S. P. More and A. Sattar, “Hand gesture recognition system using image processing,” presented at Int. Conf.
Electrical, Electronics, Opt. Techniq., Chennai, India, Mar. 2016 1. A method was applied by More et al. using the SIFT algorithm. 2. It reduces the dimensions of the feature vector using a principal component analysis (PCA) algorithm for speeding up the processing time. 1. Similar to RGB based color space, which reduces dimension using PCA Algorithm 1. Large database is required in order to store the images. [3] K. Murakami and H. Taguchi, “Gesture recognition using recurrent neural network,” in Proc. SIGCHI Conf. Human Factors Comput. Syst., New York, USA, 1991. 1. To detect the dynamic hand gestures used in Japanese Sign Language (JSL). 2. Murakami et al proposed the use of recurrent neural networks. 3. It was capable of recognizing the JSL finger alphabet (42 symbols). 1. Use of Recurrent Neural Networks. 1. Mainly used for JSL. 2. Limited to 42 symbols only. [4] T. Khan and A. H. Pathan, “Hand gesture recognition based on digital image processing using matlab,” Int. J. Sci. Eng. R., vol. 6, no. 9, pp. 338-346, Sep. 2015. 1. Khan et al. proposed a more sophisticated gesture recognition system using digital images, image filtering (pre-processing), segmentation, skin detection (finger and hand detection using binary images), and template matching. 1. Uses image filtering, segmentation, color segmentation, and skin detection 2. Binary conversion is done. 1. It’s incapable of measuring the motions of hands or figures. 2.3 Significance of Research Work The main significance of the smart gloves is to convert the sign language into voice. It will help the person with disability to communicate easily with others. Indian sign language consists of various directions and combinations of figures which represent the different alphabets. With the help of hand gestures, data is taken as input and then analyzed. In this paper, a smart sign language interpretation system using a wearable hand device is proposed to meet this purpose. This wearable system utilizes ten flex-sensors, and a three-axis inertial motion sensor to distinguish the characters in the Indian Sign Language alphabet. The entire system mainly consists of three modules: a wearable device with a sensor module and a processing module, and a display unit [6]. 2.4 Related Work Wherever using the concept of gestures, few systems had been developed in the past to recognize the gestures made using hands but with limitations of recognition rate and time which include: Using CMOS camera : The proposed algorithm consisted of four major steps which are namely Image Acquisition, Feature Extraction, Orientation Detection and Gesture
Recognition which is also shown in the below given Fig. 2.1. While deciding on the following algorithm it was observed that pre-processing steps that are to be applied on the images for removal of noise in the background was not at all required and the approach was concluded to be simple and easy to implement. The steps of the methodology are further explained in details: Fig. 2.1 Flowchart of Sign Language Recognition System using CMOS Using image processing technique: This approach use 3D model description [3] for modeling and analysis of the hand shape. It

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It searches for kinematic parameters and are requires by making 2D projection from 3D model of the hand to correspond edge images of the hand. But lot of hand features might be lost in 2d projection. Different types of methods are there including Volumetric and Skeletal type. Volumetric model deals with 3D visual appearance of human hand and usually used in real time applications. The problem is it deals with all the parameters of the hand which are huge dimensionality. To overcome volumetric hand parameter problem, skeletal method can be used. It limits the set of parameters to model the hand shape from 3D structure. Flex sensor based glove : When a particular alphabet is shown using sign language, it involves bending of the fingers thereby resulting in the bending of the flex sensors; there occurs a change in resistance of the flex sensor. A range of voltage values are given for each bend of the flex sensor for every finger. Thus, for every alphabet, each flex sensor is given a particular range of voltage values so as to distinguish it from other alphabets. The tilt sensor is used to measure orientation of the hand and fingers. The angle at which the hand is bent is given a range of values to distinguish alphabets that have similar bends so as to reduce ambiguities. The voltage values generated by flex and tilt sensors are all analog in nature. These analog values are converted into digital format using the ADC of ARM 7. The digital voltage values generated are compared and analyzed with previously stored values in the ARM flash memory. The set of values that matches with the input values is selected and the alphabet corresponding to those values are given as the output of the ARM. This process is known as template matching, where raw input data collected is compared with predefined data to give the appropriate output. The alphabet so generated is transmitted to an Android device using a Wi-Fi module. The alphabet is displayed on the Android device using the Blynk App where different widgets can be dragged and dropped based on the application of the user. Fig. 2.2 The Experimental Setup Fig. 2.3 Alphabet displayed on the screen These techniques required lots of devices, database and collection of image sets. For every alphabet approximately 5 images at different angles and distances need to be stored in order to complete analysis of the dataset.

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Words	905	Date	August 13,2020
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3.1 Data collection Module For this study, a custom-made wearable device was taken to hold the hardware. The wearable device holder is printed using flexible filaments with good elasticity. These filaments enable functional hinges, joints, and shaped parts, allowing the device to fit different hand sizes. Five finger holders were also designed using a flexible filament placed on the first joint of each finger to hold the flex sensors. Similarly, these flexible holders can also accommodate different finger sizes of different users. Different components will be used in order to collect the data of hand gesture: Flex Sensor Flex sensors and strain gauges are two types of sensors that measure the degree by which an object is bent. These devices take advantage of a material's resistance and how this changes as the material is subject to mechanical strain. Resistance is influenced by the length of a particular material (L), as well as its cross sectional area (A), charge carrier mobility (μ), and charge carrier density (N). Using these properties, the resistance of a material can be found using the formula in Equation 1 where qe represents the number of Coulombs per carrier. Equation for the resistance of a material: ¤= ¤/¤¤*¤*¤*¤ (3.1) This formula can be applied to use a material's resistance like a sensor. By stretching a material, the length L increases, resulting in a larger resistance, while compressing or decreasing the value of L causes the resistance to become smaller. The flex sensor consists of an internal resistor. The flex sensors are bidirectional in nature and hence it can detect change in resistance in both positive and negative directions. The internal circuitry of the flex sensor is a voltage divider circuit which gives different values of voltage based on the amount of bending of the fingers, due to the change in resistance inside the flex sensor. Three-axis Accelerometer The three-axis accelerometer is used to measure the orientation of the hand and fingers. The internal circuit of a three-axis accelerometer consists of one fixed capacitor and one variable capacitor. Due to the orientation or tilt of the hand a change in capacitance results in proportional voltage change. 15 Wi-Fi Module ESP8266 is a 16 pin self- contained networking unit. These are low power devices which work on UART protocols and are programmed using AT commands. Serially the data is sent from the processor to this unit with the help of UART protocol. When a particular alphabet is shown using sign language, it involves bending of the fingers thereby resulting in the bending of the flex sensors; there occurs a change in resistance of the flex sensor. A range of voltage values are given for each bend of the flex sensor for every finger. Thus, for every alphabet, each flex sensor is given a particular range of voltage values so as to distinguish it from other alphabets. Microcontroller (Arduino Nano) Arduino Nano is the main controller used in this project. It is a microcontroller based board on the Atmega 328k. It has 20 digital input and output pins with 7 pins for PWM. 3.2 Processing Module To simplify and optimize the coding implementation, features are extracted from the sensor data and serve as inputs to the built-in SVM classifier to determine the sign language alphabet letters [6]. In this study, the signs are classified into 28 classes using a support vector machine (SVM) [7]. An SVM is a binary supervised learning classifier, that is, the class labels can only take the values of +1 and -1. The training procedure used a quadratic optimization algorithm to derive structural axes to separate the training dataset into n numbers of a hyperplane. The classified sign gestures from the proposed smart wearable device are transmitted to the sign interpretation system. 3.3 Application Module The service or system converts the received text into an output, which is played back concurrently by the mobile or laptop device speaker. In this study, the Android-based sign interpretation application is merely utilized for receiving classified sign gestures from the smart wearable device and further displaying the results on the screen. Also converting to speech simultaneously. 16 3.4 Algorithm: Sign Classifier In this study, the signs are classified into 28 classes using a support vector machine (SVM) [7]. An SVM is a binary supervised learning classifier, that is, the class labels can only take the values of +1 and -1. The training procedure used a quadratic optimization algorithm to derive structural axes to separate the training dataset into nnumbers of a hyperplane. Assume the i-th training sample using (¤¤,¤¤),¤¤¤{−1,+1},¤=1,2,3,...,¤, (3.2) Where ¤¤ is the feature vector and

¤¤ is the training label in accordance to the feature vectors of the i-th training datasets. The decision boundary is defined as ¤(¤)=¤·¤−¤, (3.3) Where the i-th feature is classified as positive (+1) if ¤(¤)>0, and negative (-1) if ¤( )<0. The separating hyperplane line is structured at ( )=0. The points positioned around the separating hyperplane line are known as support vectors (SVs) and their distance to the hyperplane line is known as the margin. Optimization of the SVM is calculated by finding the smallest distance among all SVs, as shown in (3), which is subject to (4). Min‖¤‖/22 (3.4) w,b ¤¤(¤¤¤−¤)≥1 (3.5) The values of +1 and -1 are expressed as correctly classified alphabet and incorrectly classified alphabet respectively. The values of +1 and -1 are expressed as correctly classified alphabet and incorrectly classified alphabet respectively.

Sources	Similarity
(PDF) Smart Wearable Hand Device for Sign Language Interpretation... filaments enable functional hinges, joints, and shaped parts, allowing the device to fit different hand sizes.these flexible holders can also accommodate different finger. sizes of different users. finger gestures are exploited through the flexion of flex. https://www.researchgate.net/publication/321507095_Smart_Wearable_Hand_Device_for_Sign_Language_Interpretation_System_With_Sensors_Fusion	1%
Sign Language Glove - Worcester Polytechnic Institute flex sensors are sensors which measure the degree by which an object is bent.code library, and successfully outputted two asl signs through a bluetooth module to a smartphone. a high level diagram of the system is illustrated below in figure 2. figure 2: high-level diagram of glove system. https://studylib.net/doc/18497525/sign-language-glove---worcester-polytechnic-institute	1%

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Introduction to Support Vector Machines Support Vector Machines (SVMs) are a group of supervised learning methods used for classification, regression and outliers detection. The advantages of support vector machines are: ¤ Effective in high dimensional spaces. ¤ Still effective in cases where number of dimensions is greater than the number of samples. ¤ Uses a subset of training points in the decision function (called support vectors), so it is also memory efficient. ¤ Versatile: different Kernel functions can be specified for the decision function. Common kernels are provided, but it's also possible to specify custom kernels. The disadvantages of support vector machines include: ¤ If the number of features is much greater than the number of samples, avoid overfitting in choosing Kernel functions and regularization term is crucial. ¤ SVMs do not directly provide probability estimates, these are calculated using an expensive five-fold cross-validation. The support vector machines in scikit-learn support both dense (numpy.ndarray and convertible thereto by numpy.asarray) and sparse (any scipy.sparse) sample vectors as input. However, to use an SVM to form predictions for sparse data, it must are fit on such data. For optimal performance, use C-ordered numpy.ndarray (dense) or scipy.sparse.csr_matrix (sparse) with dtype=float64. 3.5.1 Classification SVC, NuSVC and LinearSVC are classes capable of performing multi-class classification on a dataset. SVC and NuSVC are similar methods, but accept slightly different sets of parameters and have different mathematical formulations (see section Mathematical formulation). On the other hand, LinearSVC is another implementation of Support Vector Classification for the case of a linear kernel. Note that LinearSVC doesn't accept keyword kernel, as this is often assumed to be linear. It also lacks a number of the members of SVC and NuSVC, like support. 3.6 Flowchart "A picture is worth a thousand words," but it's rather important to know which picture and which 1000 words. There is no doubt that graphical tools, like the flowchart or box diagram, provide useful pictorial patterns that readily depict procedural detail. However, if graphical tools are misused, the incorrect picture may cause the incorrect software. A flowchart is quite simple pictorially. A box is employed to point a processing step. A diamond logical condition, and arrows show constructs. The sequence is represented as two processing boxes connected by an line (arrow) of control. Condition, also called if causes then-part processing to occur, and if false, invokes else represented using two slightly different forms. The do while tests a condition and executes a loop task repetitively as long because the condition holds true. A repeat until executes the loop task first, then tests a condition and repeats the task until the condition fails. The selection (or select-case) construct shown within the figure is really an extension of the if parameter is tested by successive decisions until a real condition occurs and a case part processing path is executed. 3.6 Flowchart "A picture is worth a thousand words," but it's rather important to know which picture and which 1000 words. There is no doubt that graphical tools, like the flowchart or box diagram, provide useful pictorial patterns that readily depict procedural detail. However, if graphical tools are misused, the incorrect picture may cause the incorrect software. A flowchart is quite simple pictorially. A box is employed to point a processing step. A diamond logical condition, and arrows show constructs. The sequence is represented as two processing boxes connected by an line (arrow) of control. Condition, also called if causes then-part processing to occur, and if false, invokes else represented using two slightly different forms. The do while tests a condition and executes a loop task repetitively as long because the condition holds true. A repeat until executes the loop task first, then tests a condition and repeats the task until the condition fails. The selection (or select-case) construct shown within the figure is really an extension of the if parameter is tested by successive decisions until a real condition occurs and a case part processing path is executed. Fig. 3.2 Flowchart constructs. Another graphical design tool, the box diagram, evolved from a desire to develop a procedural design representation that might not allow violation of the structured constructs. Developed by Nassi and Shneiderman [NAS73] and extended by Chapin [CHA74], the diagrams (also called Nassi- Shneiderman charts, N following characteristics: (1) functional domain (that is, the scope of repetition or if else) is well defined and clearly visible as a picturing , (2) arbitrary transfer of 18 "A picture is worth a thousand words," but it's rather important to know which picture and which 1000 words. There is no doubt that graphical tools, like the flowchart or box ide useful pictorial patterns that readily depict procedural detail. However, if graphical tools are misused, the incorrect picture may cause the incorrect software. A flowchart is quite simple pictorially. A box is employed to point a processing step. A diamond logical condition, and arrows show the flow of control. Fig. 3.2 illustrates three structured constructs. The sequence is represented as two processing boxes connected by an line (arrow) of control. Condition, also called if then-else, is depicted as a choice diamond that if true, part processing to occur, and if false, invokes else-part processing. Repetition is represented using two slightly different forms. The do while tests a condition and executes a long as the condition holds true. A repeat until executes the loop task first, then tests a condition and repeats the task until the condition fails. The selection (or case) construct shown within the figure is really an extension of the if parameter is tested by successive decisions until a real condition occurs and a case part

Sources	Similarity
1.4. Support Vector Machines — scikit-learn 0.23.2 documentation the support vector machines in scikit-learn support both dense (numpy.ndarray and convertible to that by numpy.asarray) and sparse (any scipy.sparse) sample vectors as input. however, to use an svm to make predictions for sparse data, it must have been fit on such data. https://scikit-learn.org/stable/modules/svm.html	1%

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Words	934	Date	August 13,2020
Characters	5891	Exclude Url	https://www.1000sourcecodes.com/2012/05/software-engineering-structured.html

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Flowchart "A picture is worth a thousand words," but it's rather important to know which picture and which 1000 words. There is no doubt that graphical tools, like the flowchart or box diagram, provide useful pictorial patterns that readily depict procedural detail. However, if graphical tools are misused, the incorrect picture may cause the incorrect software. A flowchart is quite simple pictorially. A box is employed to point a processing step. A diamond logical condition, and arrows show constructs. The sequence is represented as two processing boxes connected by an line (arrow) of control. Condition, also called if causes then-part processing to occur, and if false, invokes else represented using two slightly different forms. The do while tests a condition and executes a loop task repetitively as long because the condition holds true. A repeat until executes the loop task first, then tests a condition and repeats the task until the condition fails. The selection (or select-case) construct shown within the figure is really an extension of the if parameter is tested by successive decisions until a true condition occurs and a case part processing path is executed. Fig. 3.2 Flowchart constructs. Another graphical design tool, the box diagram, evolved from a desire to develop a procedural design representation that might not allow violation of the structured constructs. Developed by Nassi and Shneiderman [NAS73] and extended by Chapin [CHA74], the diagrams (also called Nassi- Shneiderman charts, N following characteristics: (1) functional domain (that is, the scope of repetition or if else) is well defined and clearly visible as a picturing , (2) arbitrary transfer of 18 "A picture is worth a thousand words," but it's rather important to know which picture and which 1000 words. There is no doubt that graphical tools, like the flowchart or box ide useful pictorial patterns that readily depict procedural detail. However, if graphical tools are misused, the incorrect picture may cause the incorrect software. A flowchart is quite simple pictorially. A box is employed to point a processing step. A diamond logical condition, and arrows show the flow of control. Fig. 3.2 illustrates three structured constructs. The sequence is represented as two processing boxes connected by an line (arrow) of control. Condition, also called if then-else, is depicted as a choice diamond that if true, part processing to occur, and if false, invokes else-part processing. Repetition is represented using two slightly different forms. The do while tests a condition and executes a long as the condition holds true. A repeat until executes the loop task first, then tests a condition and repeats the task until the condition fails. The selection (or case) construct shown within the figure is really an extension of the if parameter is tested by successive decisions until a true condition occurs and a case part Fig. 3.2 Flowchart constructs. Another graphical design tool, the box diagram, evolved from a desire to develop a n representation that would not allow violation of the structured constructs. Developed by Nassi and Shneiderman [NAS73] and extended by Chapin [CHA74], the Shneiderman charts, N-S charts, or Chapin charts) have the aracteristics: (1) functional domain (that is, the scope of repetition or if else) is well defined and clearly visible as a picturing , (2) arbitrary transfer of "A picture is worth a thousand words," but it's rather important to know which picture and which 1000 words. There is no doubt that graphical tools, like the flowchart or box ide useful pictorial patterns that readily depict procedural detail. However, if graphical tools are misused, the incorrect picture may cause the incorrect software. A flowchart is quite simple pictorially. A box is employed to point a processing step. A diamond represents a illustrates three structured constructs. The sequence is represented as two processing boxes connected by an line (arrow) cted as a decision diamond that if true, part processing. Repetition is represented using two slightly different forms. The do while tests a condition and executes a long as the condition holds true. A repeat until executes the loop task first, then tests a condition and repeats the task until the condition fails. The selection (or case) construct shown in the figure is actually an extension of the if-then-else. A parameter is tested by successive decisions until a true condition occurs and a case part Another graphical design tool, the box diagram, evolved from a desire to develop a n representation that would not allow violation of

the structured constructs. Developed by Nassi and Shneiderman [NAS73] and extended by Chapin [CHA74], the S charts, or Chapin charts) have the aracteristics: (1)
functional domain (that is, the scope of repetition or if-thenelse) is well defined and clearly visible as a pictorial representation,
(2) arbitrary transfer of 19 control is impossible, (3) the scope of local and/or global data are often easily determined, (4) recursion is easy to represent. 3.7 ER Diagram An Entity Relationship Diagram (ERD) shows the connection of entity sets stored during a database. An entity during this context is an object, a component of knowledge . An entity set is a collection of similar entities. These entities have attributes that define its properties. It illustrates how "entities" such as people, objects, and concept related to each other with in a system. ER diagrams are most frequently wont to design or debug relational databases within the fields of software engineering business information systems, educations and research. ER diagram, also known as ERD'S or ER models, they are used a defined set of symbols such as rectangles, diamonds ovals as connecting lines to depicts the interconnectedness of entities, relationship and their attributes.

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Words	964	Date	August 13,2020
Characters	5859	Exclude Url	https://www.scribd.com/document/239955110/UML-Use-Case-Diagram

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3.8 Use-Case Diagram A use case diagram is usually simple. It does not show the details of the use cases. ● It only summarizes some of the relationships between use cases, actor and systems. ● It does not show the order of steps being performed. A use case diagram at its simplest may be a representation of a user's interaction with the system that shows the connection between the user and therefore the different use cases during which the user is involved. It can identify the different types of users of a system and the different use cases and will often be amid other sorts of diagrams also . Now as we have to discuss that the use case diagram is dynamic in nature there should be some internal or external factors for creating the interaction. These internal and external agents are known as actors. So use case diagrams are consists of actors, use cases and their relationships. The diagram is employed to model the system/subsystem of an application. A single use case diagram captures a specific functionality of a system. Purpose The purpose of use case diagram is to capture the dynamic aspect of a system. But this definition is too generic to describe the purpose. So in short , the needs of use case diagrams are often as follows: ¤ Used to gather requirements of a system. ¤ Used to get an outside view of a system. ¤ Identify external and internal factors influencing the system. ¤ Show the interacting among the requirements are actors. 3.9 Data Flow Diagram (DFD) A DFD illustratehow data is processed by a system in terms of inputs and outputs. As name suggests, it focuses on the flow of information, where data comes from, where it goes and how it gets stored. It represents the flows of data between different processes in a business. It is a graphical technique that depicts information flow and therefore the transforms that are applied as data move form input to output. It provides an easy , intuitive method for describing business processes without focusing on the details of computer systems. DFDs are attractive technique because they provide what users do instead of what computers do. Types of DFD Data Flow Diagrams are either Logical or Physical. ¤ Logical DFD - This type of DFD concentrates on the system process and flow of data in the system. For example during a Banking software , how data is moved between different entities. ¤ Physical DFD - This type of DFD shows how the data flow is actually implemented in the system. It is more specific and shut to the implementation Representation of Components DFDs only involve four symbols. They are: ¤ Process ¤ Data Object ¤ Data Store ¤ External entity 3.10 Decision Tree A decision tree gives a graphic view of the processing logic involved in deciding and the corresponding actions taken. The edges of a choice tree represent conditions and therefore the leaf nodes represent the actions to be performed counting on the result of testing the condition. Decision trees are helpful, not only because they are graphics that help us to 'see' what we are thinking, but also because making a choice tree requires a scientific , documented thought process. Often, the most important limitation of our deciding is that we will only select from the known alternatives. Decision trees help formalize the brainstorming process so we can identify more potential Decision trees are commonly used in operations research and operations management. If, in practice, decisions need to be taken online with no recall under incomplete knowledge, a choice tree should be paralleled by a probability model as a best choice model or online selection model algorithm. Another use of decision trees is as a descriptive means for calculating conditional probabilities. Decision trees, influence diagrams, utility functions, and other decision analysis tools and methods are taught to undergraduate students in schools of business, health economics, and public health, and are samples of research or management science methods. 3.11 Decision Table Decision tables are a concise visual representation for specifying which actions to perform depending on given conditions. They are algorithms whose output may be a set of
actions. Each decision corresponds to a variable, relation or predicate whose possible values are listed among the condition alternatives. Each action may be a procedure or operation to perform, and the entries specify

whether (or in what order) the action is to be performed for the set of condition alternatives the entry corresponds to. In other words, a choice table is a superb tool to use in both testing and requirements management. Essentially it is a structured exercise to formulate
requirements when dealing with complex business rules. Decision tables are used to model complicated logic. They can make it easy to ascertain that each one possible combinations of conditions are considered and when conditions are missed, it is easy to see this. There are three things in Decision tree: ¤ Conditions ¤ Rules ¤ Actions Conditions in Decision Table explain the lead role playing actors in the project. It is the main component of the table Actions work on the basis of conditions which is required for projects. It shows the working behavior of lead role playing terms. Rules are expressed in Decision table by “Y” or “N” for YES and NO respectively. The following steps are applied to develop a choice table: 1. List all actions which will be related to a selected procedure (or module). 2. List all conditions (or decisions made) during execution of the procedure. 3. Associate specific sets of conditions with specific actions, eliminating impossible combinations of conditions; alternatively, develop every possible permutation of conditions. 4. Define rules by indicating what action(s) occurs for a group of conditions.

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Characters	2135	Exclude Url	https://www.tutorialspoint.com/uml/uml_class_diagram.htm

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3.12 Class Diagram Class diagram may be a static diagram. It represents the static view of an application. Class diagram isn't only used for visualizing, describing, and documenting different aspects of a system but also for constructing executable code of the software application. It provides a structural view of systems. It captures the static structure of Object-Oriented systems, or how they're structured instead of how they behave. Class diagrams support architectural design. It represents the fundamentals of Object-Oriented systems. They identify what classes there are, how they interrelate and the way they interact. 3.13 Activity Diagram Activity diagram is another important diagram in UML to explain the dynamic aspects of the system. Activity diagrams are the object-oriented equivalent of flow charts and data-flow diagrams from structured development. Activity diagrams describe the work flow behavior of a system. the method flows within the system are captured within the activity diagram. It illustrates the dynamic nature of a system by modeling the flow of control from activity to activity. 3.14 Component Diagram Component diagrams are different in terms of nature and behavior. Component diagrams are used to model the physical aspects of a system. Now the question is, what are these physical aspects? Physical aspects are the weather like executables, libraries, files, documents, etc. which reside during a node. Component diagrams are wont to visualize the organization and relationships among components during a system. These diagrams also are wont to make executable systems. Purpose of Component Diagrams Component diagram may be a special quite diagram in UML. the aim is additionally different from all other diagrams discussed thus far . It doesn't describe the functionality of the system, but it describes the components wont to make those functionalities. The purpose of the component diagram are often summarized as: ¤ Visualize the components of a system. ¤ Construct executables by using forward and reverse engineering. ¤ Describe the organization and relationships of the components.

Sources	Similarity
It represents the static view of an application Class diagram is not... class diagram is not only used for visualizing, describing and documenting different aspects of a system but also for constructing executable code of the software application. disha sareen 1000378 uml-lab the components of the diagram above are explained below: 1. this diagram... https://www.coursehero.com/file/pjhi88/It-represents-the-static-view-of-an-application-Class-diagram-is-not-only-used/	1%

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4.1 Introduction: Data collection module For this study, a custom-made wearable device was taken to carry the hardware. The wearable device holder is printed using flexible filaments with good elasticity. These filaments enable functional hinges, joints, and shaped parts, allowing the device to suit different hand sizes. Five finger holders were also designed employing a flexible filament placed on the primary joint of every finger to carry the flex sensors. Similarly, these flexible holders also can accommodate different finger sizes of various users. Different components are going to be utilized in order to gather the info of hand gesture: 4.2 Approach Following are the essential devices liable for collecting data. 4.2.1 Flex Sensor The flex sensor consists of an indoor resistor. The flex sensors are bidirectional in nature and hence it can detect change in resistance in both positive and negative directions. the interior circuitry of the flex sensor may be a potential divider circuit which provides different values of voltage based on the quantity of bending of the fingers, thanks to the change in resistance inside the flex sensor. The flex sensor like most of the sensors measures the physical quantity but do so within the unique way. The flex sensor measures the quantity of stress that's applied on the sensor while it is being bent that's when the flex sensor is formed to bent the resistive film present inside the flex changes its resistance thanks to the mechanical stress that's applied thereto while being bent. The more the sensor is bent the more are going to be change in resistance. So we will say that flex sensor measures the quantity of force or bending angle by exploiting the change in its resistance. Types of Flex Sensor These sensors are classified into two types supported its size namely 2.2-inch flex sensor & 4.5-inch flex sensor. The size, also because the resistance of those sensors, is dissimilar except the working rule . Therefore the acceptable size are often preferred supported the need . Here this text discusses an overview of two .2-inch flex-sensor. this sort of sensor is employed in various applications like computer interface, rehabilitation, servo control , security system, music interface, intensity control, and wherever the buyer must modify the resistance throughout bending. In fact, the flex sensor consists of both omnidirectional and bidirectional types. The omnidirectional flex sensor changes its resistance when it bends in one direction only, whereas the bidirectional type changes its resistance when it bends in both the upward and downward directions. Pin Configuration of flex sensor The pin configuration of the flex sensor is shown below. it's a two-terminal device, and the terminals are like p1 & p2. This sensor doesn't contain any polarized terminal like diode otherwise capacitor, which suggests there's no positive & negative terminal. the specified voltage of this sensor to activate the sensor ranges from 3.3V -5V DC which may be gained from any sort of interfacing. Pin P1: This pin is usually connected to the +ve terminal of the facility source. Pin P2: This pin is usually connected to GND pin of the facility source. Working of the Flex Sensor Let us now see how the Flex sensor are often utilized in the circuit. As we've seen within the previous discussion that the Flex sensor measures the bending or the strain applied therein way by altering its resistance correspondingly. So we will say that the Flex sensor is essentially the rheostat whose resistance depends upon the quantity of bend. Also notice that the Flex sensor is that the analog sensor so so as to live the change in resistance corresponding to the quantity that the flex sensor is bent, we'd like an easy potential divider circuit. The circuit for reading the change in voltage as a results of the change in resistance is shown within the figure below: Now allow us to understand the working of the above circuit. As are often seen within the figure that the Flex sensor is connected to the 1 kilo ohm resistor in potential divider configuration. So if the resistance of the Flex sensor varies with the quantity of the bending the drop as governed by the potential divider equation varies across the 1 kilo resistor and therefore the flex sensor itself. The variation of the voltage level can then easily be read on the analog pin of the Arduino microcontroller development board. So this is often the way the flex sensor works. Specifications & Features of flex sensor The specifications and features of this sensor include the subsequent . ¤ Operating voltage of this sensor ranges from 0V to 5V ¤ It can function on low- voltages. ¤ Power rating is 1 Watt for peak & 0.5 ¤ Operating temperature ranges from ¤ Flat resistance is 25K Ω ¤ The tolerance of resistance are going to be ±30% ¤ The range of bend resistance will range from Application of flex sensor The applications of the flex-sensor include the subsequent . ¤ Medical Instruments ¤ Peripherals of Computer ¤ Robotics ¤ physiotherapy ¤ Virtual Motion (Gaming) ¤ Musical Instruments

Sources	Similarity
Sign Language Recognition using a Smart Hand the flex sensors are bidirectional in nature and hence it can detect change in resistance in both positive and negative directions.due to the orientation or tilt of the hand a change in capacitance results in proportional voltage change. ©ijraset (ugc approved journal): all rights are reserved. https://www.ijraset.com/fileserve.php?FID=16762	1%
(PDF) Smart Wearable Hand Device for Sign Language Interpretation... the bidirectional type changes its resistance when it bends in. fig. 2. 3d printed finger holder using a flexible filament that can accommostudy, recognition with only flex sensors and inertial sensor. are denoted as 1st version and addition of pressure sensors for. sensor level fusion are designated as... https://www.researchgate.net/publication/321507095_Smart_Wearable_Hand_Device_for_Sign_Language_Interpretation_System_With_Sensors_Fusion	1%

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4.2.2 Three-axis Accelerometer The three-axis accelerometer is employed to live the orientation of the hand and fingers. The internal circuit of a three-axis accelerometer consists of 1 fixed capacitor and one variable capacitor. thanks to the orientation or tilt of the hand a change in capacitance leads to proportional voltage change. Accelerometers are devices that measure velocity of an object. They measure in meters per second squared (m/s single G-force for us here on planet Earth is like 9.8 m/s with elevation (and are going to be a special value on different planets thanks to variations in gravitational pull). Accelerometers are useful for sensing vibrations in systems or for orientation applications. How an Accelerometer Works Accelerometers are electromechanical devices that sense either static or dynamic forces of acceleration. Static forces include gravity, while dynamic forces can include vibrations an movement Accelerometers can measure acceleration on one, two, or three axes. 3 becoming more common because the cost of development for them decreases. Generally, accelerometers contain capacitive plates internally. a number of these are fixed, while others are attached to minuscule springs that move internally as acceleration forces influence the sensor. As these plates move in reference to one another , the changes. From these changes in capacitance, the acceleration are often determined. How an Accelerometer Works Accelerometers are electromechanical devices that sense either static or dynamic forces of acceleration. Static forces include gravity, while dynamic forces can include vibrations an Accelerometers can measure acceleration on one, two, or three axes. 3-axis units are becoming more common because the cost of development for them decreases. ntain capacitive plates internally. a number of these are fixed, while others are attached to minuscule springs that move internally as acceleration forces influence the sensor. As these plates move in reference to one another , the capacitance between them s. From these changes in capacitance, the acceleration are often determined. Accelerometers are electromechanical devices that sense either static or dynamic forces of acceleration. Static forces include gravity, while dynamic forces can include vibrations and axis units others attached minuscule springs that move internally as acceleration forces influence Other accelerometers are often centered around piezoelectric materials. These tiny crystal structures output electrical charge when placed under mechanical stress (e.g. acceleration) How to hook up with an Accelerometer Accelerometers will communicate over analog, digital, pulse- width modulated connection interface. Analog - Accelerometers with an analog interface show accelerations through varying voltage levels. These values generally fluctuate between ground and therefore the supply voltage level An ADC on a microcontroller can then be wont to read this value. These are generally less costly than digital accelerometers. Digital - Accelerometers with a digital interface can either communicate over communication protocols. These tend to possess more functionality and be less susceptible tonoise than analog accelerometers. Pulse-Width Modulation (PWM) Accelerometers that output data over pulse-width modulation (PWM) output square waves with a known period, but a requirement cycle that varies with changes in acceleration. Power- Accelerometers are generally low-power devices. the specified current typically falls within the micro (µ) or milli-amp range, with a supply voltage of 5V or less. the present consumption can vary counting on the settings (e.g., power saving mode versus standard operating mode). These different modes can make accelerometers compatible for battery powered applications. confirm that proper logic levels are matched, especially with the digital interfaces. Range Most accelerometers will have a selectable range of forces they will measure. These ranges can vary from ±1g up to ±250g. Typically, the smaller the range, the more sensitive the readings are going to be from the accelerometer. for instance , to live small vibrations on a tabletop, employing a small-range accelerometer will provide more detailed data than employing a 250g range (which is more fitted to rockets). Additional Features Some accelerometers include features like tap detection (useful for low-power applications), free-fall detection (used for Active disk drive Protection), temperature compensation (to increase accuracy in dead reckoning situations) and 0-g range sensing, which are other features to require into consideration when purchasing an accelerometer. The need for these sorts of features on the accelerometer are going to be determined by the appliance in which the accelerometer is incorporated. There also are IMUs (Inertial Measurement Units) available, which may include accelerometers, gyroscopes and even, occasionally, magnetometers into one IC package or board. Some samples of this include the MPU6050 and MPU9150. These are commonly utilized in motion tracking applications and UAV guidance systems, where location and orientation of an object is vital . 4.2.3 Wi-Fi Module ESP8266 may be a 16 pin self-contained networking unit. These are low power devices which work on UART protocols and are programmed using AT commands. Serially the info is shipped from the processor to the present unit with the assistance of UART protocol. When a specific alphabet is shown using signing , it involves bending of the fingers thereby leading to the bending of the flex sensors; there occurs a change in resistance of the flex sensor. a variety of voltage values are given for each bend of the flex sensor for every finger. Thus, for each alphabet, each flex sensor is given a specific range of voltage values so on distinguish it from other alphabets. AWi-Fi microchip module, introduced by Espressif Systems, that comes with both TCP/IP and Microcontroller capability. ESP8266 is extremely user-friendly, features low cast and develops a simple TCP/IP connection by connecting microcontrollers with Wi-Fi. it's ability to hosting or offloading all Wi-Fi function to other processors. the primary contribute this series was ESP-01 that gained a sheer attention within the market but created barrier because it came with Chinese documentation.Later many features are added to the present device that mainly comes with English documentation. it's easy to use and even a mean person can make their feet wet with the training of this device. during this tutorial, we discuss ESP8266 Wi-Fi module, its features, specifications, applications and everything you would like to understand to form it run during a real-time.

Sources	Similarity
Acceleration Measurement with Accelerometer and Arduino - YouTube accelerometers are devices that measure acceleration, which is the rate of change of the velocity of an object. they measure in meters per second squared (m/s2) or in g-forces (g). a single g-force for us hereaccelerometers are useful for sensing vibrations in systems or for orientation applications. https://www.youtube.com/watch?v=FRube7xI7lM	1%
Accelerometer Basics - learn.sparkfun.com how an accelerometer works. accelerometers are electromechanical devices that sense either static or dynamic forces of acceleration.most accelerometers will have a selectable range of forces they can measure. these ranges can vary from ±1g up to ±250g. https://learn.sparkfun.com/tutorials/accelerometer-basics/all	1%

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Words	841	Date	August 13,2020
Characters	5137	Exclude Url	https://www.theengineeringprojects.com/2018/08/introduction-to-esp8266.html

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Introduction to ESP8266 ESP8266 is a cost-effective Wi-Fi module that supports both TCP/IP and microcontrollers. It runs at 3V with maximum voltage range around 3.6V. More often than not, i under name ESP8266 Wireless Transceiver. This module stays ahead of its predecessor in terms of processing speed and storage capability. It can be interfaced with the sensors and other devices and requires very little modification and development to make it compatible with other devices. Components and GPIO pins interfaced on the little chip are very compact that makes it suitable for hard to reach places. It covers little space and everything is laid out on the PCB board quite precisely that n external circuitry is required to put this device in the running condition. No external RF circuitry is required that makes it suitable to work under all operating conditions. It is a very useful device for wireless networking, however, there are some limitations i.e. external logic level converter is needed as it doesn't support 5 Technical Specifications ¤ It is also known as a system microcontroller, antenna switches, RF balun, power amplifier, standard digital peripheral interfaces, low noise receive amplifier, power management module and filter capability. ¤ The processor is based on 80 MHz. 37 Fi module that supports both TCP/IP and microcontrollers. It runs at 3V with maximum voltage range around 3.6V. More often than not, i under name ESP8266 Wireless Transceiver. This module stays ahead of its predecessor in terms of processing speed and storage capability. It can be interfaced with the sensors and other devices and requires very little ent to make it compatible with other devices.
Components and GPIO pins interfaced on the little chip are very compact that makes it It covers little space and everything is laid out on the PCB board quite precisely that n external circuitry is required to put this device in the running condition. No external RF circuitry is required as this module comes with self-calibrated RF capability that makes it suitable to work under all operating conditions. vice for wireless networking, however, there are some limitations i.e. external logic level converter is needed as it doesn't support 5-3V logic shiting. Fig. 4.10 ESP8266 It is also known as a system-on-chip (SoC) and comes with a 32- microcontroller, antenna switches, RF balun, power amplifier, standard digital peripheral interfaces, low noise receive amplifier, power management module and The processor is based on Tensilica Xtensa Diamond Standard 106Micro and runs at Fi module that supports both TCP/IP and microcontrollers. It runs at 3V with maximum voltage range around 3.6V. More often than not, it also comes This module stays ahead of its predecessor in terms of processing speed and storage capability. It can be interfaced with the sensors and other devices and requires very little Components and GPIO pins interfaced on the little chip are very compact that makes it It covers little space and everything is laid out on the PCB board quite precisely that no calibrated RF capability vice for wireless networking, however, there are some limit ¤ It incorporates 64 KiB boot ROM, 80 RAM. ¤ It supports Wi-Fi 802.11 b/g/n around 2.4 GHz and other features including 16 GPIO, Inter-Integrated Circuit (I^2C), Serial Peripheral Interf interfaces with DMA. ¤ External QSPI flash memory is accessed through SPI and supports up to 16 MiB and 512 KiB to 4 MiB is initially included in the module. ¤ It is a major development in terms of wireless communication with lit contains onboard regulator that helps in providing 3.3V consistent power to the board.
¤ It supports APSD which makes it an ideal choice for VoIP interfaces. How to Power Up the Module We can power up the device with PC port using USB to Serial adaptor. The 2 AA and LIPO batteries are equally handy for powering up the device. It is advised to not power this device directly with 5V dev board. Doing so can severely affect the quality and overall performance of the devicse ESP8266 Pinout ESP8266 comes with eight pins named: a. RX b. VCC (+3.3 V; can handle up to 3.6 V) c. GPIO 0 General-purpose I/O No. 0 d. RST, Reset e. CH_PD (Chip power-down) f. GPIO 2 General-purpose I/O No. 2 g. TX h. GND Each pin comes with a specific function associated with it where Vcc and GND are voltage source and ground respectively. RX and TX are used for communication

where TX is dedicated for data transmission and RX is used receiving data. Applications This module is widely used in many projects with the intention of Wi-Fi capability, however following are the main applications. ¤ Wireless Web Server ¤ Geolocation using ESP8266 ¤ Pressure Sensors on Railway Tracks ¤ Air Pollution Meter ¤ Temperature logging system ¤ World's smallest IoT project ¤ Wi-Fi controlled robot ¤ Humidity and temperature monitoring ¤ M2M using ESP8266 ¤ Home appliances ¤ Home automation ¤ Smart plugs and lights ¤ Industrial wireless control ¤ Baby monitors ¤ IP cameras ¤ Sensor networks ¤ Wearable electronics Security ID tags

Sources	Similarity

Automated Blood Bank with Embedded System: International Research... it runs at 3v with maximum voltage range around 3.6v. more often than not, it also comes under name esp8266 wireless transceiver. this module stays ahead of its predecessor in terms of processing speed and storage capability. https://www.scribd.com/document/415708135/IRJET-V6I5602	1%

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4.2.4 Microcontroller (Arduino Nano) Arduino Nano is the main controller used in this project. It is a microcontroller based board on the Atmega 328k. It has 20 digital input and output pins with 7 pins for PWM. It is the open-source microcontroller development board based on the ATMEGA328P microcontroller IC. The microcontroller IC on which the Arduino UNO and Arduino NANO is based is usually the same by the way sometimes the difference lies in the package type of the microcontroller IC. Having same microcontroller IC it follows that the crucial specifications of both the Arduino UNO and Arduino NANO are essentially the same. The Arduino NANO is usually preferred over the Arduino UNO when there's limitation on the space constraint. Arduino NANO is sort of small in size as compared to the Arduino UNO and can easily be mounted on the Breadboard making it useful in Breadboard based prototypes.Arduino NANO 14 Digital Input / Output pins and eight analog pins. The Arduino NANO has two additional Analog to Digital converters as compare to the Arduino UNO in order that NANO has two additional Analog pins. Arduino NANO has one UART, one Inter microcircuit (I2C) computer bus and one Serial Peripheral Interface (SPI) computer bus. Arduino UNO also has one UART, one SPI and one I2C interface on board. Out of the 14 digital input / output pins 5 pins are PWM (Pulse Width Modulation) enabled. The discussion on the PWM phenomenon and therefore the peculiar use of those PWM enabled pins are going to be discussed later in the posts. Some differences that exist between Arduino UNO and Arduino NANO will be pointed out later in the post. The Arduino NANO looks like the one in the following C. Understanding Arduino Nano The Arduino board is meant in such how that it's very easy for beginners to urge started with microcontrollers. This board especially is breadboard friendly is extremely easy to handle the connections. Let's start with powering the Board. Powering the Arduino Nano There are totally three ways by which we can power our Nano. USB Jack: Connect the mini USB jack to a phone charger or computer through a cable and it will draw power required for the board to function Vin Pin: The Vin pin are often furnished with a unregulated 6-12V to power the board. The onboard voltage regulator regulates it to +5V +5V Pin: If you've got a regulated +5V supply then you'll directly provide this o the +5V pin of the Arduino. Input/output: There are totally 14 digital Pins and eight Analog pins on your Nano board. The digital pins can be wont to interface sensors by using them as input pins or drive loads by using them as output pins. A simple function like pinMode() and digitalWrite() are often wont to control their operation. The operating voltage is 0V and 5V for digital pins. The analog pins can measure analog voltage from 0V to 5V employing a ny of the 8 Analog pins using a simple function liken analogRead() These pins aside from serving their purpose also can be used for special purposes which are discussed below: ¤ Serial Pins 0 (Rx) and 1 (Tx): Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip. ¤ External Interrupt Pins 2 and 3: These pins can be configured to trigger an interrupt on a coffee value, a rising or falling edge, or a change in value. ¤ PWM Pins 3, 5, 6, 9 and 11: These pins provide an 8-bit PWM output by using analogWrite() function. ¤ SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK): These pins are used for SPI communication. ¤ In-built LED Pin 13: This pin is connected with an built-in LED, when pin 13 is HIGH – LED is on and when pin 13 is LOW, its off. ¤ I2C A4 (SDA) and A5 (SCA): Used for IIC communication using Wire library. ¤ AREF: Used to provide reference voltage for analog inputs with analogReference() function. ¤ Reset Pin: Making this pin LOW, resets the microcontroller. 4.3 Introduction to Arduino IDE Arduino IDE is an open source software that's mainly used for writing and compiling the code into the Arduino Module. It is a politician Arduino software, making code compilation too easy that even a
standard person with no prior technical knowledge can get their feet wet with the learning process. It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt

functions and commands that play an important role for debugging, editing and compiling the code in the environment. A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more. Each of them contains a

microcontroller on the board that is actually the information in the form of code. The main code, also referred to as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded within the controller on the board. The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the specified code and later is employed for compiling and uploading the code into the given Arduino Module. This environment supports both C The IDE environment is especially distributed into three sections 1. Menu Bar 2. Text Editor 3. Output Pane 44 Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code. The main code, also referred to as a sketch, created on the IDE platform will ultimately generate s then transferred and uploaded in the controller on the board. The IDE environment mainly contains two basic parts: Editor and Compiler where former is code and later is used for compiling and uploading the code into This environment supports both C and C++ languages.

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CHAPTER 5 DATA PROCESSING MODULE 5.1 Introduction: Data processing module To simplify and optimize the coding implementation, features are extracted from the sensor data and serve as inputs to the built-in SVM classifier to determine the sign language alphabet letters [6]. In this study, the signs are classified into 28 classes using a support vector machine (SVM) [7]. An SVM is a binary supervised learning classifier, that is, the class labels can only take the values of +1 and -1. The training procedure used a quadratic optimization algorithm to derive structural axes to separate the training dataset into n numbers of a hyperplane. Fig. 5.1 Training Data The classified sign gestures from the proposed smart wearable device are transmitted to the sign interpretation system. 5.2 Introduction to MATLAB MATLAB is a multi-paradigm numerical computing environment and proprietary programming language developed by MathWorks. MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages. The name MATLAB stands for MATrixLABoratory. MATLAB was written originally to provide easy access to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects. It is a high-performance language for technical computing. It integrates computation, visualization, and programming environment. Furthermore, MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming. These factors make MATLAB an excellent tool for teaching and research. MATLAB has many advantages compared to conventional computer languages (e.g., C, FORTRAN) for solving technical problems. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. The software package has been commercially available since 1984 and is now considered as a standard tool at most universities and industries worldwide. It has powerful built-in routines that enable a very wide variety of computations. It also has easy to use graphics commands that make the visualization of results immediately available. Specific applications are collected in packages referred to as toolbox. There are toolboxes for signal processing, symbolic computation, control theory, simulation, optimization, and several other fields of applied science and engineering. Starting MATLAB After logging into your account, you can enter MATLAB by double-clicking on the MATLAB shortcut icon (MATLAB 7.0.4) on your Windows desktop. When you start MATLAB, a special window called the MATLAB desktop appears. The desktop is a window that contains other windows. The major tools within or accessible from the desktop are: The Command Window The Command History The Workspace The Current Directory The Help Browser The Start button Fig. 5.2 Home page of MATLAB Writing a MATLAB program Using Command Window: Only one statement can be typed and executed at a time. It executes the statement when the enter key is pressed. This is mostly used for simple calculations. Using Editor: Multiple lines of code can be written here and only after pressing the run button (or F5) will the code be executed. Note: Statements ending with a semicolon will not be displayed in the command window, however, their values will be displayed in the workspace. Any statement followed by % in MATLAB is considered as a comment. Vector Operations: Operations such as addition, subtraction, multiplication and division can be done using a single command instead of multiple loops 5.3 Introduction to Anaconda Anaconda® is a package manager, an environment manager, a Python/R data science distribution, and a collection of over 7,500+ open-source packages. Anaconda is free and easy to install, and it offers free community support. Anaconda distribution comes with over 250 packages automatically installed, and over 7,500 additional open-source packages can be installed from PyPI as well as the conda

package and virtual environment manager. It also includes a GUI, Anaconda Navigator, as a graphical alternative to the Command Line Interface (CLI). The big difference between conda and the pip package manager is in how package dependencies are managed, which is a significant challenge for Python data science and the reason conda exists. When pip installs a package, it automatically installs any dependent Python packages without checking if these conflict with previously installed packages. It will install a package and any of its dependencies regardless of the state of the existing installation. Because of this, a user with a working installation of, for example, Google Tensor flow, can find that it stops working having used pip to install a different package that requires a different version of the dependent numpy library than the one used by Tensor flow. In some cases, the package may appear to work but produce different results in detail. In contrast, conda analyses the current environment including everything currently installed, and, together with any version limitations specified (e.g. the user may wish to have Tensor flow version 2,0 or higher), works out how to install a compatible set of dependencies, and shows a warning if this cannot be done. Open source packages can be individually installed from the Anaconda repository, Anaconda Cloud (anaconda.org), or the user's own private repository or mirror, using the conda install command. Anaconda, Inc. compiles and builds the packages available in the Anaconda repository itself, and provides binaries for Windows 32/64 bit, Linux 64 bit and MacOS 64-bit. Anything available on PyPI may be installed into a conda environment using pip, and conda will keep track of what it has installed itself and what pip has installed. Custom packages can be made using the conda build command, and can be shared with others by uploading them to Anaconda Cloud,PyPI or other repositories. The default installation of Anaconda2 includes Python 2.7 and Anaconda3 includes Python 3.7. However, it is possible to create new environments that include any version of Python packaged with conda. Packages available in Anaconda Over 250 packages are automatically installed with Anaconda. Over 7,500 additional open-source packages (including R) can be individually installed from the Anaconda repository with the conda install command.

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Sources

Anaconda Individual Edition — Anaconda documentation

thousands of other packages are available from anaconda cloud. you can download other packages using the pip install command that is installed with anaconda. pip packages provide many of the features of

https://docs.anaconda.com/anaconda/

Anaconda Navigator — Anaconda documentation

anaconda navigator is a desktop graphical user interface (gui) included in anaconda® distribution that allows you to launch applications and easily manage conda packages, environments, and channels withou

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[4] = fSensor4; PreData[i][5] = fSensor5; PreData[i][8] = cSensor0; PreData[i][9] = cSensor1; PreData[i][10]= cSensor2; PreData[i][11] = cSensor3; PreData[i][12] = cSensor4; return; }

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CHAPTER 6 CONCLUSION AND FUTURE SCOPE 6.1 Conclusion In this study, we successfully designed and implemented a novel and smart wearable hand device as a sign interpretation syste subjects gave a high rating to the proposed smart wearable sign interpretation system in terms of its comfort, flexibility, and portability. The device holders were simple gloves using a flexibl hand device will consider the design of a smaller sized printed circuit board, the inclusion of words and sentences at the sign language level, and instantly audible voice output components. sign language gesture alongside with the already existing alphabets. The Android Application can be customized to add further features like incorporation of voice for the sign language gest glove," presented at the 26th Chinese Control and Decision Conf., Changsa, China, May 31 - June2, 2014. A. Z. Shukor, M. F. Miskon, M. H. Jamaluddin, F. A. Ibrahim, M. F. Asyraf and M. B. Bahar, recognition based communication system for silent speakers," presented at the Int. Conf. Human Comput. Interact., Chennai, India, Aug. 23-24, 2013. S. V. Matiwade and M. R. Dixit, "Electroni and S. Sharma, "Sign language recognition system for deaf and dumb people," Int. J. Eng. R. Technol., vol. 2, no. 4, pp. 382-387, Apr. 2013 B. G. Lee, Member, IEEE, and S. M. Lee "Smart Wearabl Lazzaro, B. Manor and E. Gordon, "Decomposing skin conductance into tonic and phasic components," Int. J. Psychophys., vol.25, no. 2, pp. 97-109, Feb. 1997. S. P. More and A. Sattar, "Hand g recognition using recurrent neural network," in Proc. SIGCHI Conf. Human Factors Comput. Syst., New York, USA, 1991 P. R. V. Chowdary, M. N. Babu, T. V. Subbareddy, B. M. Reddy and V. Ela and A. H. Pathan, "Hand gesture recognition based on digital image processing using matlab," Int. J. Sci. Eng. R., vol. 6, no. 9, pp. 338-346, Sep. 2015. J. Siby, H. Kader and J. Jose, "Hand gesture module," Int. J. Sci. R., vol. 6, no. 5, pp. 2226-2230, May 2017. C. Preetham, G. Ramakrishnan, S. Kumar and A. Tamse, "Hand talk- implementation of a gesture recognizing glove," presented at 2 no. 11, pp. 1-6, Nov. 2014. J. Kim, N. D. Thang and T. Kim, "3-D hand motion tracking and gesture recognition using a data glove," presented at IEEE Int. Symp. Industrial Elec. 2009, Seoul, South Qingdao, China, Dec. 3-7, 2016. J. Lm, D. Lee, B. Kim, I. Cho and J. Ryou, "Recognizing hand gestures using wrist shapes," presented at 2010 Digest Technical Papers Int. Conf. Consumer Elec., L L. Hsu, C. L. Chu, Y. J. Tsai and J. S. Wang, "An inertial pen with dynamic time warping recognizer for handwriting and gesture recognition," IEEE Sensors J., vol. 15, no. 1, pp. 154-163, Jan. 2015. L 843-864, Sep. 2014. J. Galka, M. Masior, M. Zaborski, K. Barczewska, "Inertial motion sensing glove for sign language gesture acquisition and recognition," IEEE Sensors J., vol. 16, no. 16, pp. 631 Liu, C. Chen, R. Jafari and N. Kehtarnavaz, "Fusion of inertial and depth sensor data for robust hand gesture recognition," IEEE Sensors J., vol. 14, no. 6, pp. 1898-1903, Jun. 2014. K. W. Kim, M. S Rodrigues, J. Monteiro, P. J. S. Cardoso and R. Lam, "GyGSLA: a portable glove