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GESTURE KEYBOARD USING ARDUINO

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ABSTRACT

Different keyboards are available in the market, with variations in size, layouts, programs, and functionalities. Recently, virtual keyboards are also in use but for every single keyboard, the user should remember the arrangement of keys in order to enter different characters. Remote-based gesture keyboard is a system that serves on the Internet of Things [IoT] architecture and embedded with Arduino as well as the accelerometer and machine learning process that enforces the system to perform in the desired direction. The remote-based gesture keyboard is the model, where the user can enter text and number in a text editor by moving a hand to the specific motion of characters in the air using Arduino. Arduino operates as a remote where gestures relocate into the air, translating into letters, and exposing them on a computer screen.

Keywords— gesture, Arduino, remote, keyboard.

I.INTRODUCTION

The keyboard plays a vibrant role in the computer system for the entry of data by pressing the number of keys. In today's generation screen touch keyboards are mostly used and gesture keyboards also used only for physically disabled people and for special use. There is plenty of variation in layouts of the physical keyboard such as AZERTY, QWERTY, Dvorak Colemak, Maltron, and JCUKEN. [1], Not only this virtual keyboard also gets eminent and this is the era of mobile and networking devices generally people use speech to text technology but many times it does not provide the precise outcome.

Remote based gesture keyboard is one of the electronic devices based on machine learning algorithms and organized by python programming language. It is a system that transforms gesture motion into text defined by the accelerometer in the air. It is being deliberate to help the user for entering text without using a specific layout. This model will also support multi linguistics functionality so the user doesn't need to use the different keyboards for entering text. It is similar to writing in a notebook using a pen where a remote act as a pen and notebook will be a text editor. The advantage of this project is users don't prerequisite for using the remote. The user also doesn't need to use various functional keys for different languages.

The essential step for constructing this system is to create the motion tracking device that is based on 3 major components such as accelerometer, Arduino and switches. The Arduino serial monitor is configured and set the baud rate to 38400 at Arduino IDE, now the overall module will work on sci-kit learn's a library that converts signals into letters through accelerometer and every single character and digit will store in data set. When the data set is ready it will train the module through a machine learning algorithm.

II.PROBLEM DEFINITION

Remote based gesture keyboard slightly overcome some of the major problems of the traditional keyboard such as disability, lack of accuracy, damaging and layout practice. This device can be connected in a wireless or wired manner. For a wired manner, it is connected through USB and for the wireless manner, it is connected through Bluetooth. The concept of the remote-based gesture keyboard is the user can enter text and number in a text editor by moving hand in the specific motion of the character in the air by using Arduino. Arduino will work as a remote where gestures which will be moving into air translating into letters and display them into a computer screen.

III. LITERATURE SURVEY

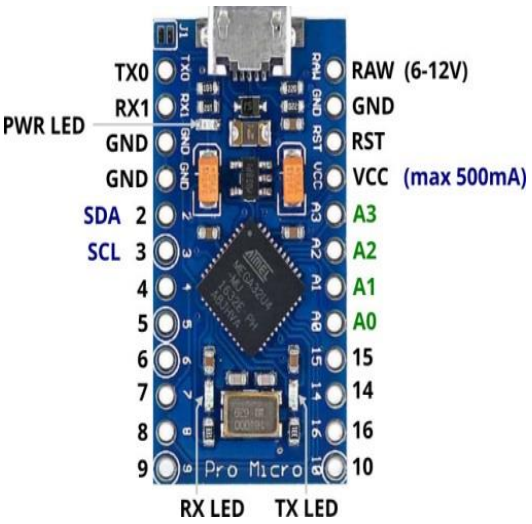
1) M. Shakunthaladevi Dept. of Embedded System technologies SKP Engineering College Tiruvannamalai, India R. B. Revathi. Assistant Professor, ECE SKP Engineering College Tiruvannamalai, India The hand gestures provide a natural and intuitive communication modality for human computer interaction. Efficient human computer interfaces (HCIs) have to be developed to allow computers to visually recognize in real time hand gestures. This project deals with real time hand gesture recognition using AVR Microcontroller. The existing system uses Digital camera for hand gesture recognition. The camera was used as an input device and the object need to present in front of the camera for capturing gesture. It limits mobility and cannot use camera in dark area as well as cost is very high. The camera specifications significantly affect GRS (Gesture Recognition System) characteristics. The proposed system, based on the input signal from the MEMS (Micro Electro Mechanical System) accelerometer sensors measure the acceleration such as tilt, shock & vibrate. It is reliably and accurate detect. Here, the tilt motion information produced by the human subjects and transmitted to the AVR microcontroller.

2) A. G. Jaramillo and M. E. Benalcázar, "Real-time hand gesture recognition with EMG using machine learning," *2017 IEEE Second Ecuador Technical Chapters Meeting (ETCM)*, 2017, pp. 1-5, doi: 10.1109/ETCM.2017.8247487.The recognition of gestures using EMG is not a trivial task because there are several physiological processes in the skeletal muscles underlying their generation. In the scientific literature, there are several hand gesture recognition models, but they have limitations both in the number of gestures to be recognized (i.e., classes) and in the processing time. Therefore, the primary goal of this research is to obtain a real-time hand gesture recognition model for various applications in the field of medicine and engineering with a higher recognition accuracy than the real-time models proposed in the scientific literature and a higher number of gestures to recognize (i.e. in the order of the dozens). The proposed model has five stages: acquisition of the EMG signals, preprocessing (e.g., rectification and filtering), feature extraction (e.g., time, frequency and time-frequency), classification (e.g., parametric and nonparametric) and post-processing. Generally, the main difficulties of the hand gesture recognition models with EMG using Machine Learning are: the noisy behavior of EMG signal, and the small number of gestures per person relative to the number of generated data by each gesture (e.i., curse of dimensionality). Solving these two issues could also lead to solutions for other problems such as face recognition and audio recognition, for which these two issues are a major concern.

3) T. Tai, Y. Jhang, Z. Liao, K. Teng and W. Hwang, "Sensor-Based Continuous Hand Gesture Recognition by Long Short-Term Memory," in *IEEE Sensors Letters*, vol. 2, no. 3, pp. 1-4, Sept. 2018, Art no.6000704, doi: 10.1109/LSENS.2018.2864963.
Abstract: This article aims to present a novel sensor-based continuous hand gesture recognition algorithm by long shortterm memory (LSTM). Only the basic accelerators and/or gyroscopes are required by the algorithm. Given a sequence of input sensory data, a many-to-many LSTM scheme is adopted to produce an output path. A maximum a posteriori estimation is then carried out based on the observed path to obtain the final classification results. A prototype system based on smartphones has been implemented for the performance evaluation. Experimental results show that the proposed algorithm is an effective alternative for robust and accurate hand-gesture recognition.

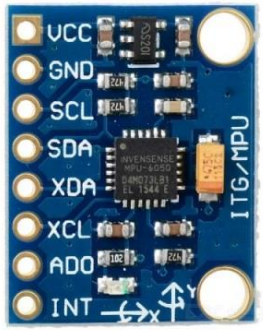
IV. TECHNICAL REQUIREMENTS

1) Arduino Pro Micro



It is a 5V 16MHz Compatible Board. It is based on the ATmega32U4. The ATmega32U4 has an internal USB transceiver so that no bulky external USB chip is required. It has 10-bit ADC, 12 DIOs, 5 PWM pins and hardware serial connections TX and Rx. A voltage regulator on board is present which accepts voltage up to 12VDC.

2) Accelerometer Mpu 6050



The MPU-6050 is a motion processing device. It combines a 3-axis accelerometer and a MEMS 3-axis gyroscope on the same silicon chip together with a Digital Motion Processor capable of processing 6- axis Motion Fusion algorithm. MPU6050 sensor module is complete 6-axis Motion Tracking Device. It combines 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor all in small package. Also, it has additional feature of on-chip Temperature sensor. It has I2C bus interface to communicate with the microcontrollers. It has Auxiliary I2C bus to communicate with other sensor devices like 3-axis Magnetometer, Pressure sensor etc. If 3-axis Magnetometer is connected to auxiliary I2C bus, then MPU6050 can provide complete 6-axis Motion Fusion output.

V. SYSTEM DESIGN

5.1 Circuit Diagram

The Circuit Diagram of Gesture Keyboard using Arduino is shown in Fig.1

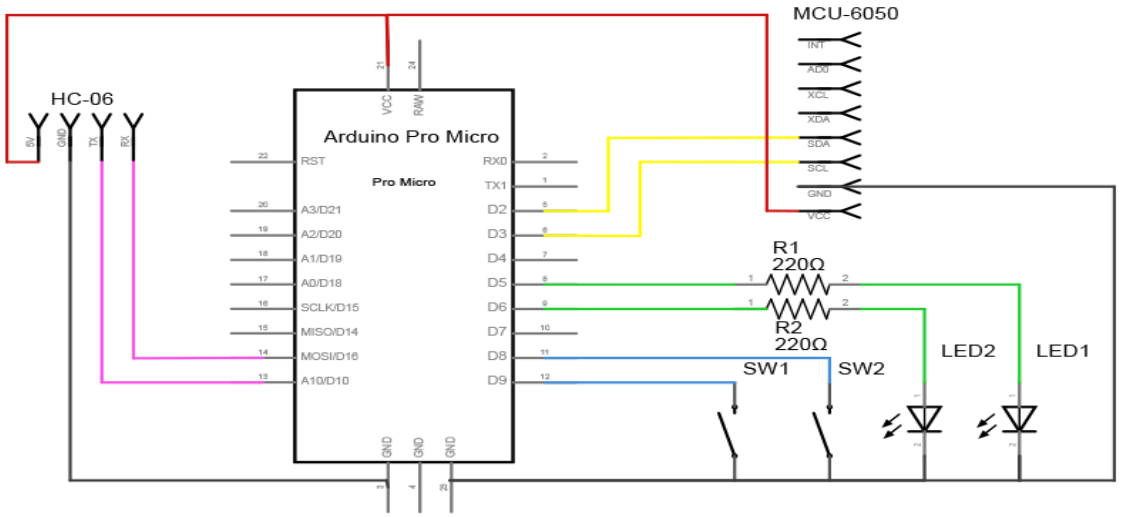


Fig.1 Circuit Diagram of Gesture Keyboard using Arduino

HC 06 will be connected with Arduino pro micro and accelerometer for connection between monitor and remote in a wireless manner. Arduino and accelerometer are connected through SDA and SLA pins. Arduino is connected to the ground to supplying power to the whole model. An accelerometer is used for motion gestures into x and y direction. SciKit learns the library of python provides a PyGARL framework for recognizing motion. PyGARL library is a python gesture analysis recognition library. PyGARL worked as storing of data in text format, we can add ample of data into this library. The support vector machine algorithm of machine learning is helped to clustering and regressing of data recognized by gesture and compare with store data. When data is matched it will display on the screen.

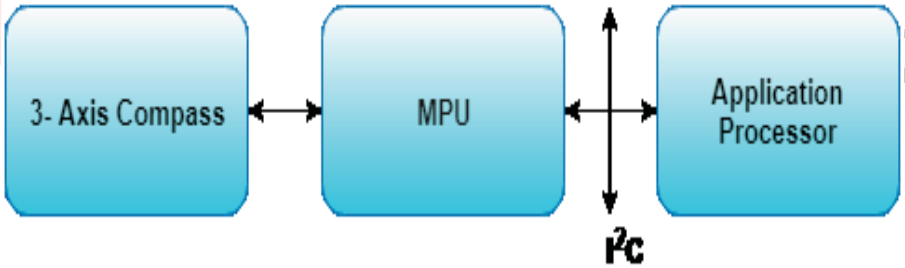


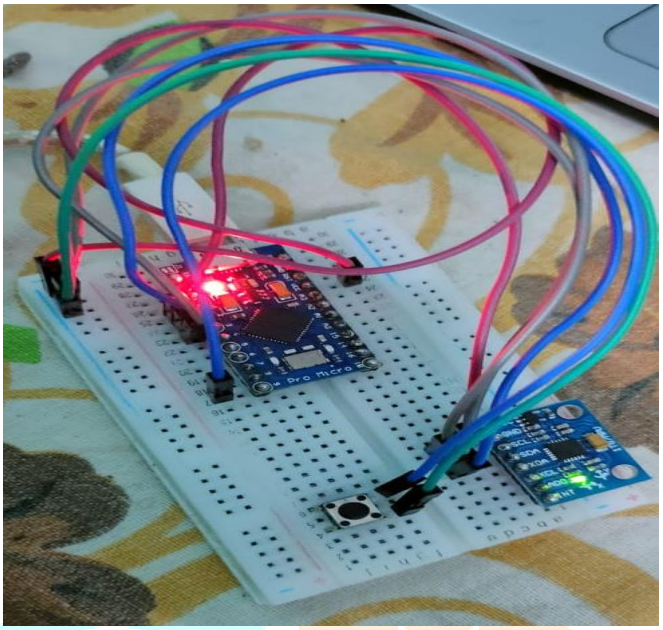
Fig. 2. Structure of MPU-6050

The Arduino pro micro is a microcontroller board based on the ATmega32U4 datasheet. It has 20 digital input/output pins, where 7 pins can be used as PWM output and 12 as analog input. This microcontroller contains 16 MHz oscillators, a micro USB connection, an ICSP header, and a reset button. Arduino pro microcontroller is similar to the Arduino Leonardo. In that, the ATmega32U4 has built-in USB communication to eliminating the need for a secondary processor. The MPU-6050 accelerometer is a motion tracking device designed for the low power, low cost, and high performance requirements of smartphones, tablets and wearable sensors.

The MPU-6050 device combines a 3-axis gyroscope and a 3-axis accelerometer on the same silicon die, together with an onboard digital motion processor, which processes complex 6- axis motion fusion algorithms. The device can access external magnetometers or other sensors through an auxiliary master I²C bus, allowing the devices to gather a full set of sensor data without intervention from the system processor. The devices are offered in a 4 mm x 4 mm x 0.9 mm QFN package. For precision tracking of both fast and slow motions, the parts feature a user-programmable gyro full-scale range of ±250, ±500, ±1000, and ±2000 °/sec (DPS), and a user programmable accelerometer full-scale range of ±2g, ±4g, ±8g, and ±16g. HC-06 is a Bluetooth module designed for establishing short-range wireless data communication between two microcontrollers or systems. HC-06 uses frequency hopping spread spectrum technique (FHSS) to avoid interference with other devices

and to have full-duplex transmission. The device works on the frequency range from 2.402 GHz to 2.480GHz.

5.2 Connection Diagram



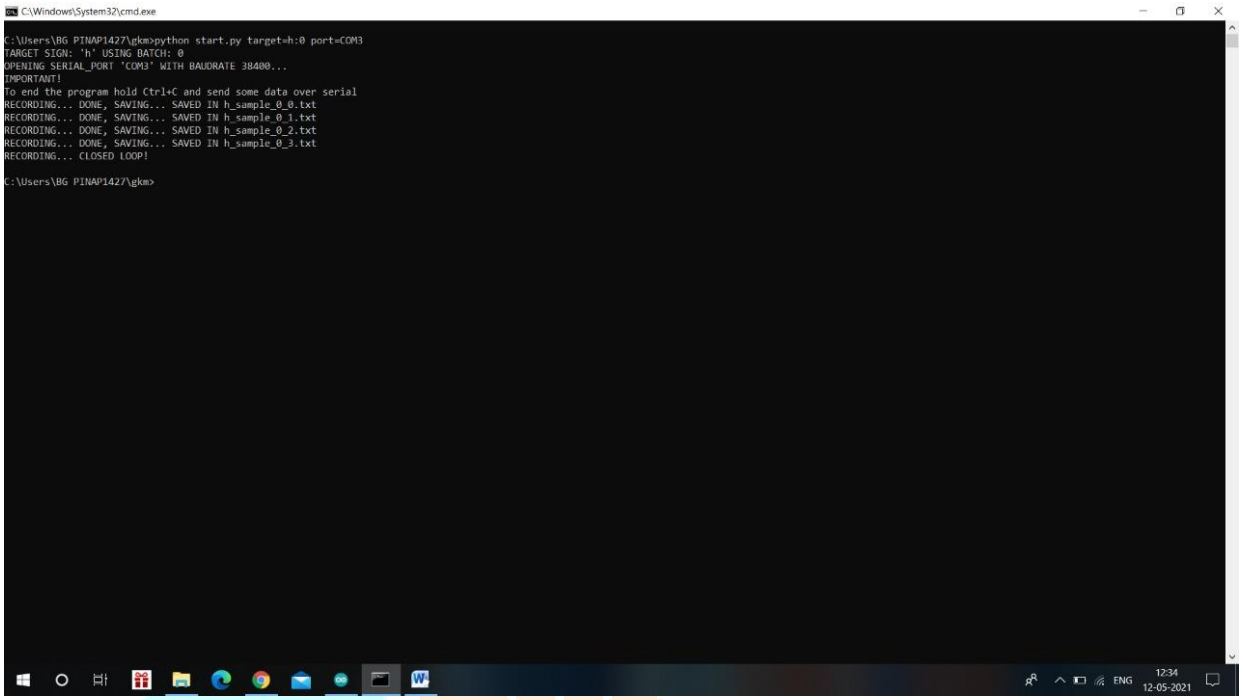
VI. FUTURE SCOPE

The remote-based gesture keyboard is a unique idea that provides joy at work and also contains multi-linguistic functionality, this system can be embedded with smartwatches with the addition of a high data transfer rate. This system could be part of the educational environment for teaching staff. We can enhance it to build the system in a waterproof environment so it can be used in underwater. This system can be combined with the projector so the user can write and explain the point by entering the content or point without using a traditional keyboard. This system can be more suitable for small children to engage them in a study that will be joyful and it can speed up their writing skills.

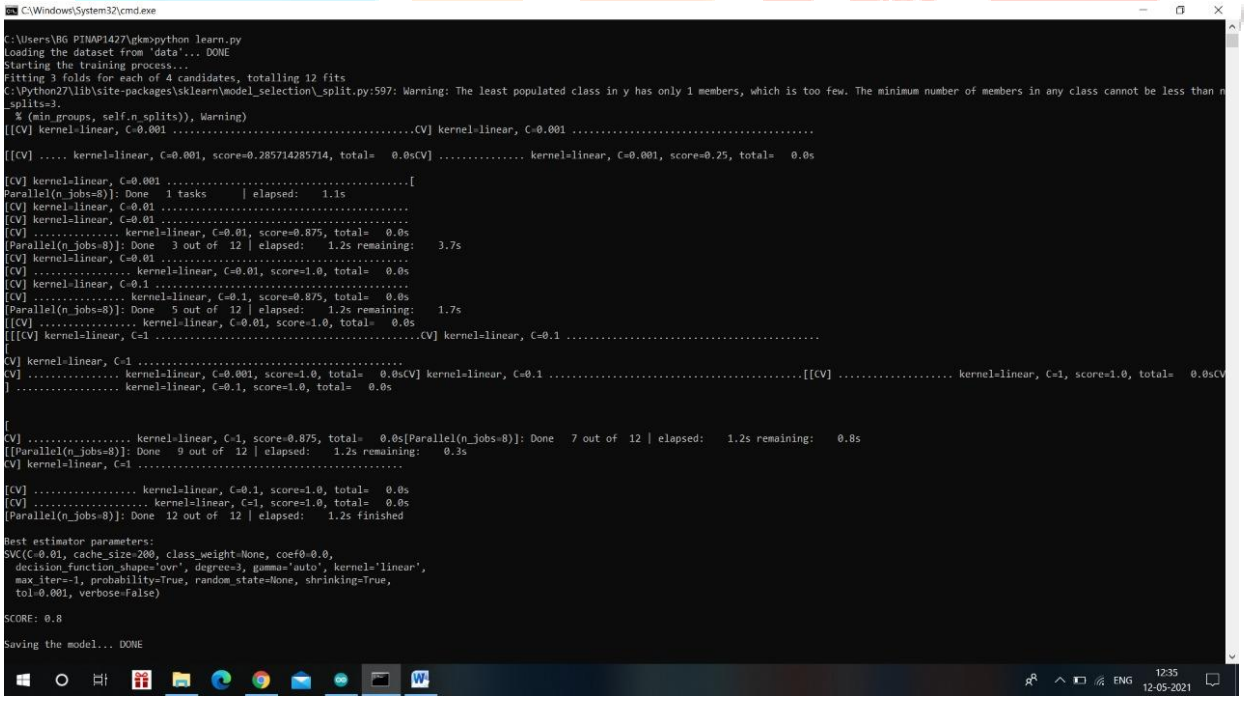
VII. RESULTS

Overcoming numerous obstacles, we removed all glitches from the application. After thoroughly testing the application module wise and as a whole, we can safely assure that it is a perfectly working application with a user friendly interface and fully functional modules sufficing requirements of end user. The whole process of developing this particular application was indeed a fruitful endeavor and we are confident that this application will help user in situation.

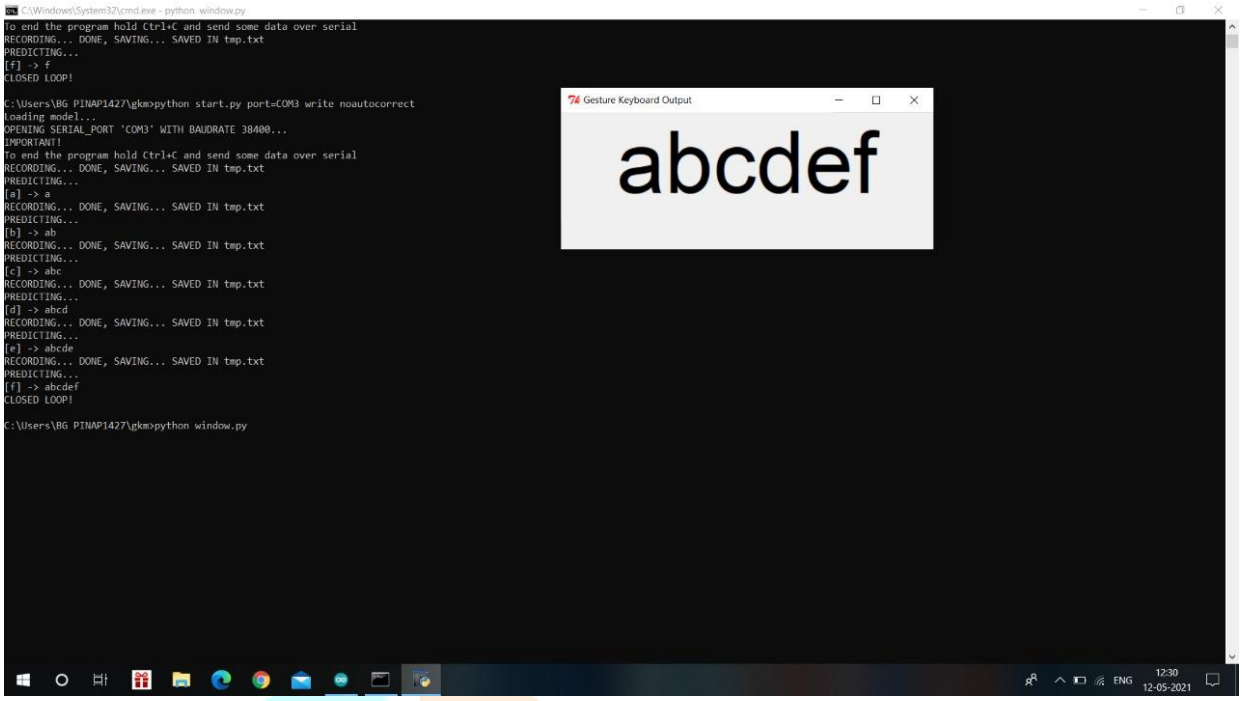
7.1 Creating Data Sets



7.2 Saving and Learning the Model



7.3 Final Output



VIII. CONCLUSION

The remote-based gesture keyboard concept describes the new idea and it is not only for technical purposes but also can be used in for market potentials. This project will engage some various apparatus that is new for the educational organization. It will be very helpful in school for learning purposes, and also gives enjoyment. This system is also providing multilingual functionality, so the user can easily manage and make a gesture of a particular language.

The aim of a project is the user could enter values or characters without seating in front of a computer and easy to use. The main factor of this project is users don't have to learn prerequisites and don't have to remember buttons as compared to a traditional keyboard, so it makes the huge difference between numerous different keyboards and gesture-based system. This project has some conflict issues such as 100% accuracy of letters because many people's handwriting is different so the data set will be large if enter number of the font family.

This project can be used as a wired or wireless manner. in a wireless manner if some obstacles occur then bandwidth will be decreased these can be overcome in a future enhancement.

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3] Tsung-Ming Tai, Yun-JieJhang, Zhen-WeiLiao, Kai-Chung Teng, Wen-JyiHwang (2018), "Sensor-Based Continuous Hand Gesture Recognition by Long Short Term Memory", IEEE Sensors Letters.