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Hand Gesture Recognition Application for Physically Disabled People

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Abstract: ***In the Proposed model, a communication system which converts signal languages, used by dumb people, Quadriplegia and paraplegia are disabilities that result from injuries to the spinal cord and neuromuscular disorders into speech. It is done based on a narrative hand gesture recognition technique. The solution approach consists of a hardware module and software module. In hardware module- The gesture recognition is done with the help of a sensor glove which consists of 5 accelerometer sensors, a microcontroller and that are best positioned in fingers upon analysis of American Sign Language Signs. The design of glove and the concept of decoding gestures by considering the axis orientation with respect to gravity and the corresponding voltage levels are discussed. The accelerations of a hand motion in three perpendicular directions are detected by accelerometers and acceleration values were transmitted to microcontroller. An automatic gesture recognition algorithm is developed to identify individual gestures in a sequence. As a final point, the gesture is recognized by comparing the acceleration values with the stored templates. According to recognized gesture, respective commands are played through speaker using voice chip.***

Keywords: MEMS Accelerometer, Microcontroller, Flux Sensor

1. Introduction

Gesture recognition is the process by which gestures made by the user are used to convey the information or for device control. In everyday life, physical gestures are a powerful means of communication. A set of physical gesture may compose an entire language, as in sign languages. They can efficiently convey a rich set of facts and feelings. This project makes the modest suggestion that gesture-based input is such a beneficial technique to convey the information or for device control with the help of identification of specific human gesture Research into the uses of gesture in human computer interaction is embryonic, and we hope to have stimulated others to work out their ingenuity in developing effective gestures. A primary goal of Gesture recognition research is to create a system which can identify specific human gestures and use them to convey information or for device control. Interface by computers using gesture of the human body, classically hand movements. In gesture recognition technology, a camera reads the actions of the human body and communicates the data to computer that uses the gestures as input to control devices or applications.

Gesture recognition is a topic in computer science and language technology with the goal of interpreting human gesture via mathematical algorithms. Gesture can create from any physical motion or state but commonly originate from the face or hand. Current focuses in the field contain emotion recognition from the face and hand gesture recognition. Several approaches have been made using cameras and computer vision algorithms to interpret sign language. Through, the identification and recognition of posture, proxemics, gait, and human behaviours is also the subject of gesture recognition techniques.

2. Proposed Model

To overcome the limitations such as unexpected ambient optical noise, slower dynamic response, and relatively large data collections/processing of vision-based method, and to strike a balance between accuracy of collect data and cost of devices , a micro Inertial Measurement Unit is utilized in this project to detect the accelerations of hand motions in three dimensions. The proposed recognition system is executed based on MEMS acceleration sensors. Since bulky computation burden will be brought if gyroscope are used for inertial dimension, our current system is based on MEMS accelerometers only and gyroscope are not implemented for motion sensing Figure 1: shows accelerometers architecture of the proposed gesture recognition system based on MEMS accelerometer. The details of the individual steps are described below. The sensing device sense acceleration in three axes. Those sensed signals are restriction and given to the controller circuit. The controller balances the incoming signal values with the pre-stored values. Commands for each gesture were separately allotted to each channel in the voice chip. When the incoming acceleration value matches with pre-stored one corresponding channels will be enabled and the command be displayed. The same be played through the speaker after amplification since the signal from voice chip is very low.

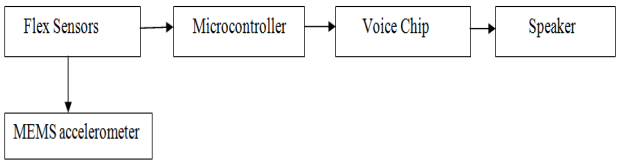


Figure 1: Proposed System

3. System Description

The system is intended and built using the flex sensor, MEMS, PIC16F88 Micro controller. Our sensing device produces the analog values corresponding to the acceleration of three axes. Acceleration values for the eight gestures were placed in the lookup table in controller. Each incoming gestures values for all three axes be compared with every axis value in the table. The tolerance level for each axes

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is±5.When the detected gesture is same as that of collected one, one channel among eight in the voice chip will be automatically enabled.

The same be also played through speaker using APR9600 voice chip. It is 8 channel voice chip. Since the algorithm is based on the acceleration values which is generalized from gesture motion analysis, it is not narrowed to specific users. Therefore, there is no requirement to train users before using it.

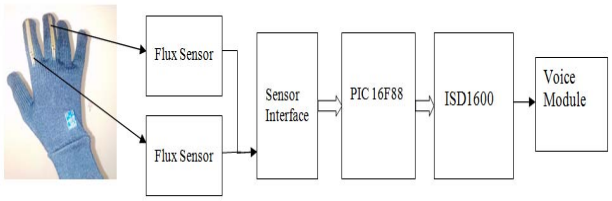


Figure 2: Block diagram of this project

4. Flex Sensor

Flex sensor are analog resistors. These resistors work as changeable analog voltage divider. Inside the flex sensor are carbon resistive elements with thin flexible substrate. More carbon denotes less resistance. When the substrate is bent the sensor creates resistance output relative to the bend radius. The flex sensor attains great form-factor on a thin flexible substrate. When the substrate is bent, the sensor creates a resistance output correlated to the bend radius as shown Figure 1. Similar the radius, higher will be the resistance value.

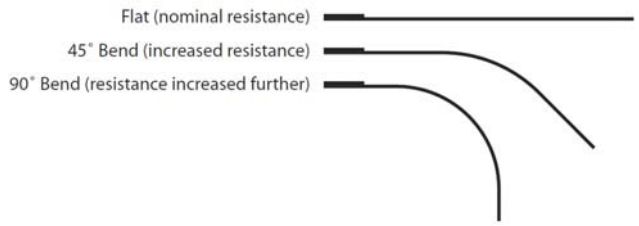


Figure 3: Working of Flex Sensor

The impedance buffer in the circuit is a single sided operational amplifier used with these sensors as shown Figure2.Since low bias current of the op amp reduces error due to source impedance of the flex sensor as voltage divider. The variation in prevention or bending of flex sensor results in variation of resistance itself. The signal conditioning circuit is used to read these resistance changes and it is given to ADC.

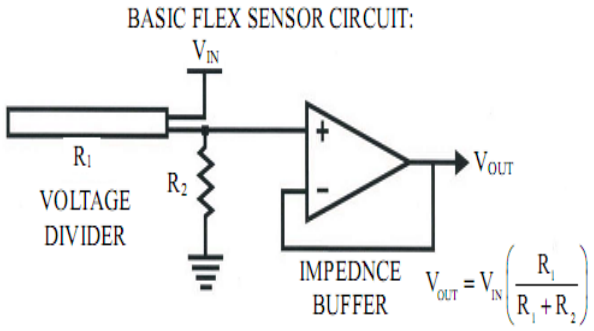


Figure 4: Flex Sensor circuit

5. MEMS Accelerometer

MicroElectro Mechanical System (MEMS) (also written micro–electro–mechanical, MicroElectro Mechanical, or microelecronic and micro electromechanical systems and the related micro mechatronics) is the technology of very small devices; it merge at the nano-scale into nano electromechanical systems (NEMS)and nanotechnology. MEMS are as well referred to as micro machines (in Japan), or micro systems technology- MST (in Europe). MEMS are separate and distinct from the hypothetical vision of molecular nanotechnology or molecular electronics. MEMS are the components made up of micrometers size in between 1 to 100(.001 to 0.1mm) and MEMS devices generally range in size from 20 micrometers (20 millionths of a metre) to a millimetre (i.e. 0.02 to 1.0 mm). They usually consist of a central unit that processes data (the microprocessors) and several components that interact with the surroundings such as micro sensors. At these size scales, the normal constructs of classical physics are not forever useful. Because of the large surface area to volume ratio of surface effects. MEMS such as electrostatics and wetting dominate over volume effects such as inertia or thermal mass.

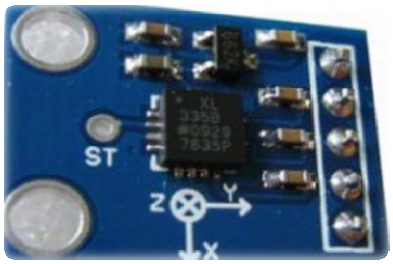


Figure 5: MEMS

The sensor consists of a micro–machined structure on a silicon wafer. The structure is suspended by poly silicon springs which allow it to deflect in the when subject to acceleration in the X, Y and/or Z axis .Deflection reasons a change in capacitance between fixed plates and plates attached to the suspended structure. This change in capacitance on every axis is converted to an output voltage proportional to the acceleration on that axis.

6. PIC16F88 Micro Controller

PIC is a family of modified Harvard architecture microcontrollers prepared by Microchip Technology, derived

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from the PIC1650 in the beginning developed by General Instrument's Microelectronics classification. The call PIC primarily populated to "Peripheral Interface Controller"' now it is "PIC"' only. PICs are popular with both industrial developers and hobbyists alike due to their low value, wide avail facility, large consume base, extensive collection of application notes, avail facility of low value or free development tools, and serial programming (and re-programming with flash memory) cap facility.

Performance: The architectural judgment is directed at the maximization of speed-to-value ratio. The PIC architecture was among the first scalar CPU designs and is still among the simplest and economical. An example of this is a video sync pulse generator. This is no longer true in the innovativeness PIC models; because they have a synchronous interrupt latency of three or four cycles.

Advantages:

1. Easy to learn because of Small instruction set
2. RISC architecture
3. Oscillators are in built with selectable speeds
4. Entry level is very easy, in-circuit programming plus in-circuit debugging PICK
5. Microcontrollers are expensively very high
6. Wide range of interfaces it includes I²C, SPI, USB, USART, A/D and comparators are programmed, PWM, LIN, CAN, PSP, and Ethernet
7. Easy to handle for hobby utilize due to Avail facility of processors in DIL package

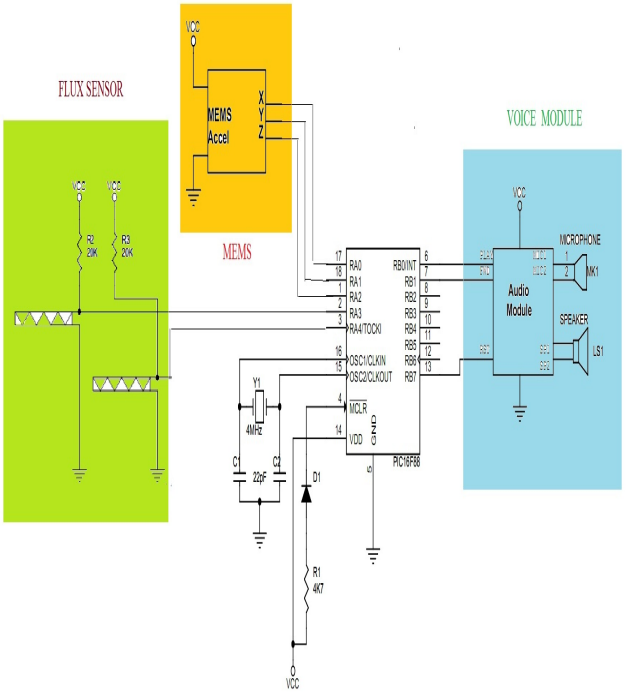


Figure 6: PIC 16F88 Interfacing with Flux sensor, MEMS, Voice Module

7. ISD1700

The winbond ISD1700 chip order series is high quality, fully integrated, single- chip multi message voice record and playback device ideally suited to a variety of electronic systems. The message duration is user selectable in ranges from 26 seconds to 120 seconds, depending on the specific device. The sampling frequency of each device can also be adjusted from 4 kHz to 12 kHz with an external resister. The ISD1700 is designed for operation in either standalone or microcontroller (SPI) model. The device incorporates a proprietary message management system that allows the chip to self –manage address locations for multiple messages. This unique feature provides sophisticated messaging flexibility in a simple push-button environment.

The devices include an on-chip oscillator(with external resistor control), microphone preamplifier with Automatic Gain Control(AGC),an auxiliary analog input, anti–aliasing filter ,Multi- level storage (MLS)Array , smoothing filter , volume control, Pulse Width Modulation(PWM) class D speaker driver, and current output. The ISD1700 devices also support an optional “VAlert” (voice Alert) feature that can be used as a new message indicator. With vAlert, the IC strobes an external LED to indicates that a new message is present.

Four special sound effect locations are reserved for audio confirmation of commands, such as “Start Record”,”Stop Record”, and “Erase”. Recording are stored in on-chip Flash memory cells providing zero-power message storage. This unique single-chip solution is made possible through Winbond’s patented Multi-Level Storage (MLS) technology. Audio date are stored directly in solid-state memory without digital compression, providing superior quality voice and music reproduction. Voice signals can beefed into the chip through two independent paths: a differential microphone input and a single – ended analog input.

For outputs, the ISD1700 supplies a Pulse Width Modulation (PWM) Class D speaker driver and a separate analog output simultaneously. The PWM can directly drive a standard 8Ω speaker or typical buzzer, while the separate analog output can be configured as a single-ended current or voltage output to drive an externalamplifier.TheISD1700device automatically come into power down mode for power conservation when an operation is completed. In the SPI mode, the user has full control via the serial interface in operating the device. This contains random access to any location in the memory array by specifying the start address and end address of operations.SPI mode also allows access to the Analog Path Configuration (APC) register. This register permits flexible configuration of audio channels, inputs, outputs and mixing.

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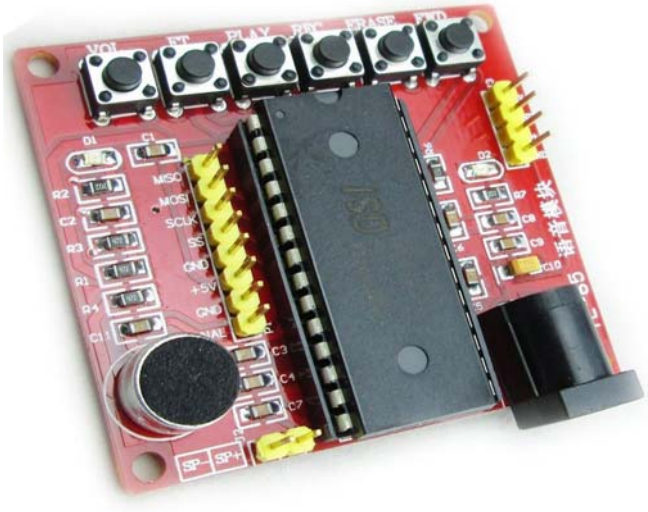


Figure 7: ISD1600

REC: level-triggering for recording.
PLAY: edge-trigger for individual message or level-trigger for looping playback sequentially.
ERASE: edge-triggered erase for first or last message or level- triggered erase for all messages.
FWD: edge-trigger to advance to the next message or fast message scan during the playback.
VOL: 8 levels output volume control.
RESET: return to the default state.

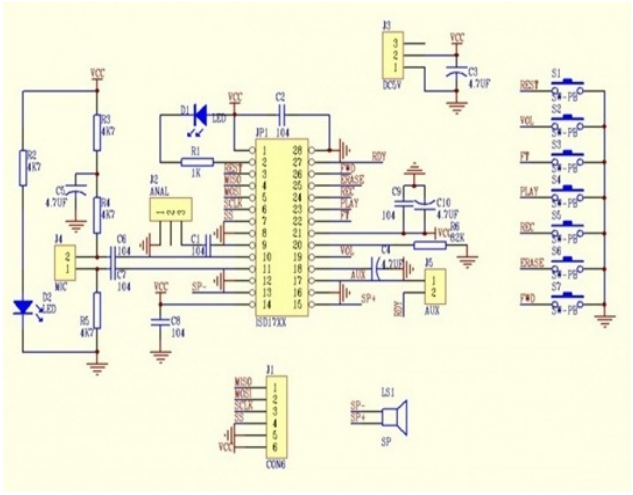


Figure 8: ISD1600 interfacing

8. Conclusion

In this paper, presented work on gesture recognition through the use of MEMS accelerometer. This work used 3 axes acceleration values, where the existing system used only 2 axes values. So, it provides accuracy of this system .The system consists of one ADXL335 accelerometer for sensing the hand posture, a microcontroller and display unit with speaker. The incoming acceleration value for each gesture will be compared with values in the stored templates. Since the standard gesture patterns are generated by motion analysis and are simple features represented by only acceleration values, big data base and complex recognition systems were not required and now needs to collect as many gesture made by different people as possible to improve the recognition accuracy. The advantage of this approach is the potential of mobility. The main aim of this work is to make a system which can act as an artificial vocal tract of speech impaired people without the use of complex form of inputs. In this work used a simple MEMS accelerometer which is very easy to wear and it doesn't need any special training, so it's user friendly and can be used by all.

9. Future Scope

Researchers are going on development of hand gesture recognition using nervous system of human. A system with more advanced algorithm than proposed and existing one have to developed, and use the same to detect gesture made by the people for automation.

10. Result



Figure 8: Sign languages into speech language



Figure 9: Health monitoring report through android smart phone

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References

[1] K.C. Shriharipriya and K. Arthy, "Flex sensor based hand gesture recognition system", in Proceedings

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[2] S.F. Ahmed, et al., "Electronic speaking glove for speechless patients" In the IEEE Jaya, Conference on Sustainable Utilization and Development in Engineering and Technology, Petaling Malaysia, 2010, pp. 56-60
[3] D. Xu (2006), "A neural network approach for hand gesture recognition in virtual reality driving training system of SPG," presented at the 18th Int. Co nf. Pattern Recognition
[4] S. Zhou, Z. Dong, W. J. Li, and C.P. Kwong (2008), "Hand- written character Recognition using MEMS motion sensing technology," in Proc. IEEE/AS ME Int. Conf. Advanced Intelligent Mechatronics , pp.1418–1423
[5] L. Bretzner and T. Lindeberg(1 998), "Relative from extended sequences of sparse point and line correspondences using the affine trifocal tensor," in Proc.5th Eur. Conf. Computer Vision, Berlin, Germany,1406, Lecture Notes in Computer Science, pp.141–157, Springer Verlag
[6] J.K.Oh,S J. Cho, and W. C. Banget al. (2004), "Inertial sensor based recognition of 3-D Character gestures with an ensemble of classifiers," presented at the 9th Int. Workshop on Frontiers in Handwriting Recognition
[7] T. H. Speeter (1992),"Transformation human hand motion for tele manipulation," Presence, 1, pp. 63–79
[8] Russell,stuart,and peter Norvig. Artificial Intelligence: A Modern Approch. Prentice Hall, Englewood Cliffs, NJ, 1995
[9] Rabiner, L.R. "A Tutorial on Hidden Markov Models and Selected Application in Speech Recognition."Proceeding of the IEEE77 (2):267-296, 1989
[10] W. T. Freeman and C. D. Weissman (1995), "TV control by hand gestures,"presented at the IEEE Int. Workshop on Automatic Face and Gesture Recognition, Zurich, Switzerland

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