Gesture Based Message Teller for Disabled Person via Voice and GSM

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Abstract— In the Proposed model, a communication system which converts gesture, used by dump people, Quadriplegia and paraplegia are disabilities that result from injuries to the spinal cord and neuromuscular disorders into speech. The main aim of the project is to implement a low cost reliable system which will help to establish communication between paralytic or disabled patients and a nurse. A patient can easily send messages to the nurse by just tilting an accelerometer connected to a body part capable of movement. This angle of tilt is sent to a central controller which then initiates communication between the patient (transmitter) and nurse (receiver) and also decides which message is to be transmitted based on the tilt angle and fall detection of a patient is also detected by using accelerometer. These commands are received by voice module and audio will be played through speaker. Along with this a real time medicine reminder also implemented. If a care taker is far away from patient, gesture message is send to smart phone of a nurse via GSM and if the nurse is not responding for patient gestures for 3-4 times the message will be send to relations smart phone. 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 and send as message through GSM.

Key words: Patient Communication, Accelerometer, Real Time User Defined Medicine Alarms, GSM, Zigbee, Voice Module

I. INTRODUCTION

Gesture recognition technologies are much advanced in the today world. Nowadays, a lot of active research is taking place in the wireless field and very less in its public implementations. Lot of techniques has been devised for sensing the hand gestures & doing the appropriate actions. A technique based on glove is a popular mode of recognizing hand gestures. It uses a sensor attached to a glove that detects hand movements. Among the large number of advancements done in the medical sector, very few actually focus on helping patients with disabilities to communicate. Although monitoring systems make it easier for nurse or care taker to collect and observe a patient's vitals in home, there aren't many options for actual verbal communication for disabled patients. Here we propose a simple yet effective way to solve this problem. The main purpose is to replace the conventional approach of patient-nurse communication with modern technologies that provide a much faster and reliable way to do so. In the current scenario, the patient has to be dependent on a family member or care taker who have to care of patient constantly. Our objective is to make such patients independent to communicate with the nurse by the simple task of tilting a device located on his back of the hand that is capable of movement. This will not only help the patient but also ease out the nurse's or family members job. After the patient sends the message the nurse can remotely monitor their requests and provide assistance without any further delay. It is not possible that a family member or caretaker of a patient monitor patient constantly without making time for them. To overcome this, our proposed system replaces this with GSM which send a commands of patient to care taker if theye are out of home. To make the system more dynamic and decisive a real time medicine reminder is implemented to assist the care taker in her daily routine by providing time and medicine for each patient.

II. 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 system which mainly consists of a transmitter and a receiver section. In the transmitter section (at the patient side), a three axis accelerometer is placed on the hand of the patient. This accelerometer is capable of measuring the static acceleration due to gravity and thus finding the angle at which the device is tilted with respect to the earth. Whenever patient needs any help he tilts the accelerometer in different directions. This acts as an input to the accelerometer while output of it is in volts that is connected to the controller board which acts as the processing unit. The output of the accelerometer depends on the tilt angles and is read by the controller and it also detect the fall detection of patient. The output from controller is send to the zigbee which transmit signal to the receiver section. Figure1 shows the block diagram of transmitter section.

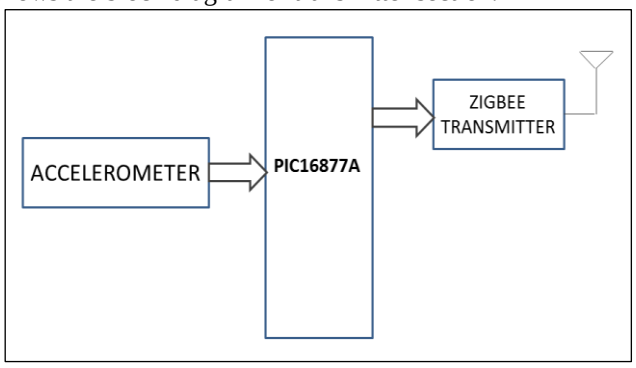

Fig. 1: Block diagram of Transmitter

At the receiver side, zigbee will receive the message and send it to the controller board on the receiver side which is then given to voice module to get a voice message, the nurse will remotely take the required action to cater to the needs of the message. If a nurse is far away from the patient information will be send as message and continuous motion of same direction shown from patient then message will be send to smart phone of patients relative. Taking medication at the right time is a serious business, the Medicine Reminder

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is another feature of this device to prompt the nurse the time to give patients their medicines. The Medicine Reminder is intended to be used by the nurse or caretaker so that a mistake is never made in giving the medicines. Figure 2 shows the receiver section.

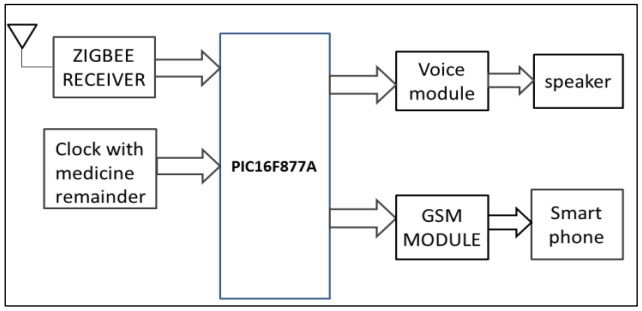


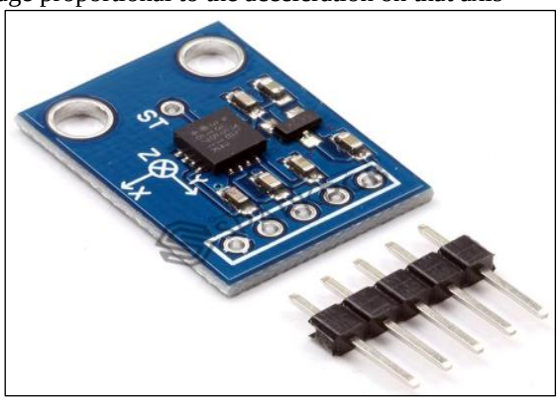
Fig. 2: Block diagram of receiver

III. 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 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. GSM module is used to send a message to caretaker and relatives in case of critical situations. 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.

A. MEMS Accelerometer

Micro-Electro Mechanical System (MEMS) (also written micro–electro–mechanical, Micro-Electro 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 millimeter (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. 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



B. PIC16F877A Micro Controller

PIC is a family of modified Harvard architecture microcontrollers prepared by Microchip Technology, derived. 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' the PIC microcontroller PIC16f877a is one of the most renowned microcontrollers in the industry. This controller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it use FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output. PIC16F877A is used in many pic microcontroller projects. PIC16F877A also have many application in digital electronics circuits. PIC16f877a finds its applications in a huge number of devices. It is used in remote sensors, security and safety devices, home automation and in many industrial instruments. An EEPROM is also featured in it which makes it possible to store some of the information permanently like transmitter codes and receiver frequencies and some other related data. The cost of this controller is low and its handling is also easy. It's flexible and can be used in areas where microcontrollers have never been used before as in coprocessor applications and timer functions etc.

1) 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.

2) 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) 5.Wide range of interfaces it includes I²C, SPI, USB, USART, A/D and comparators are programmed, PWM, LIN, CAN, PSP, and Ethernet.

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3) ISD1700 (Voice Module):

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 "V Alert" (voice Alert) feature that can be used as a new message indicator. With v Alert, 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.

4) GSM:

GSM is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity. GSM networks operate in four different frequency ranges. Most GSM networks operate in the 900 MHz .GSM 900 uses 890–915 MHz to send information from the mobile station to the base station (uplink) and 935–960 MHz for the other direction (downlink).This 25MHz band width is subdivided into 124 carrier frequency channels, each spaced 200 KHz apart. The channel data rate is 270.833Kbit/s GSM has used a variety of voice codec's to squeeze 3.1 kHz audio into between 5.6 and 13 kbit/s. Originally, two codec's, named after the types of data channel they were allocated, were used, called Half Rate (5.6 kbit/s) and Full Rate (13 kbit/s). These used a system based upon linear predictive coding (LPC). In addition to being efficiency with bit rates, these codec's also made it easier to identify more \ important parts of the audio. There are five different cell sizes in a GSM network—macro, micro, Pico, femto and umbrella cells. The coverage area of each cell varies according to the implementation environment. Macro cells can be regarded as cells where the base station antenna is installed on a mast or a building above average roof top level. Micro cells are cells whose antenna height is under average roof top level; they are typically used in urban areas. Pico cells are small cells whose coverage diameter is a few dozen meters; they are mainly used indoors. Femto cells are cells designed for use in residential or small business environments and connect to the service provider's network via a broadband internet connection. Umbrella cells are used to cover shadowed regions of smaller cells and fill in gaps in coverage between those cells.

GSM networks operate in a number of different frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G). Most 2G GSM networks operate in the 900 MHz or 1800 MHz bands. Some countries in the Americas (including Canada and the United States) use the 850 MHz and 1900 MHz bands because the 900 and 1800 MHz frequency bands were already allocated. Most 3G GSM networks in Europe operate in the 2100 MHz frequency band. The rarer 400 and 450 MHz frequency bands are assigned in some countries where these frequencies were previously used for first-generation systems. GSM-900 uses 890–915 MHz to send information from the mobile station to the base station (uplink) and 935–960 MHz for the other direction (downlink), providing 124 RF channels (channel numbers 1 to 124) spaced at 200 kHz. Duplex spacing of 45 MHz is used.

5) Zigbee:

The explosion in wireless technology has seen the emergence of many standards, especially in the industrial, scientific and medical (ISM) radio band. There have been a multitude of proprietary protocols for control applications, which bottlenecked interfacing. Need for a widely accepted standard for communication between sensors in low data rate wireless networks was felt. As an answer to this dilemma, many companies forged an alliance to create a standard which would be accepted worldwide. It was this Zigbee Alliance that created Zigbee. Bluetooth and Wi-Fi should not be confused with Zibgee. Both Bluetooth and Wi-Fi have been

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developed for communication of large amount of data with complex structure like the media files, software etc. Zigbee on the other hand has been developed looking into the needs of communication of data with simple structure like the data from the sensors.

IV. 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.

V. 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.

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