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Hand Gesture Recognition To Translate Voice And Text

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ABSTRACT— *Gesture-XPLAIN aims at solving the problem of limited communication abilities of those people, who only knows sign language, to talk naturally with the rest of the world by transforming their sign language gestures it into a form of verbal communication. The goal is to create a smart glove system and a mobile device that can continuously recognize sign language gesture and translate that into spoken words. The glove is fitted with a flex-sensors, gyroscope, magnetometer and accelerometer sensors to sense the movement made by hand and fingers. A low power ARM Cortex-M4 microcontroller recognizes the movement by means of acquiring, processing and running a sensor fusion algorithm. The system translates the sign recognized into meaningful text. This text is then transferred to a smart phone app over a Bluetooth channel where the text will be converted into speech.*

Keywords— *gesture , flux sensor, accelerometer, ,magnetometer.*

1, INTRODUCTION

An Embedded system is a computer system designed for specific control functions within a larger system, often with real time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. By contrast, a general-purpose computer, such as a Personal Computer (PC), is designed to be flexible and to meet a wide range of end-user needs. Physically, embedded systems range from portable devices such as digital watches and MPEG (Motion Picture Experts Group) Layer-3 Sound File (MP3) players, to large stationary installations like traffic lights and factory controllers. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure.This system is primarily designed to help the deaf and dumb people. Gesture-Explain aims at solving the problem of limited communication abilities of these people, who only knows sign language, to talk naturally with the rest of the world by transforming their sign language gesture it into a form of verbal communication. The goal is to create a smart glove system and a mobile device that can continuously recognize sign language gesture and translate that into spoken words. The glove fitted with a flex-sensor, gyroscope, magnetometer and accelerometer sensor to sense the movement made by hand and fingers. A low power ARM Cortex-M4 microcontroller recognizes the movement by means of acquiring, processing and running a sensor fusion algorithm. Gesture-XPLAIN aims at solving the problem of limited communication abilities of those people, who only knows sign language, to talk naturally with the rest of the world by transforming their sign

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language gestures it into a form of verbal communication. The goal is to create a smart glove system and a mobile device that can continuously recognize sign language gesture and translate that into spoken words

2, EXISTING SYSTEM

HAND movement recognition, in its different approaches, has been a topic of research since the early 90s , . Regardless of the passage of time, the topic is still relevant , most likely due to the tons of data provided by human limb movement (measured by different devices, such as IoT, CCTV, smart home electronics, etc.).
Researchers are trying to use the human hand as a precise controller of electronic devices. There are domains where this method of movement acquisition is in high demand. The first example concerns medicine. For young interns, the possibility of surgery simulation, including hand movements, would be a valuable experience. The second example, which is directly connected to the topic of this work, is sign language recognition. Deaf people, in order to maintain their independence, must be able to communicate with other people and interact with consumer devices. An efficient gesture recognition system, when correctly used, could improve their quality of life.

2.1 Measurement Resolution

The manufacturer guarantees 10-bit resolution for the acceleration sensors, which translates to 1024 recognizable states. The transmission line length caused by the length of the human arm results in a high-frequency noise in the system. The highest values of noise reveal that the actual resolution is 7-bit (128 recognizable states). Another experiment, which tested the Signal to Noise Ratio (SNR), proved that the value of the SNR is 40 dB for most sensors (noise level was estimated as an average signal, measured with stationary glove in different positions). Both parameters indicate that the value of noise is 1/100 the value of the signal. If such reasoning is followed, then: 1024/100 ~ 10 – uncertain states in the 10-bit resolution range. 3 lowest bits: 23 = 8 states. It can be therefore assumed that in most situations, the 3 lowest bits contain noise values. This confirms the resolution being 7-bit.

2.2 Signal Acquisition And Processing

All of the sensors employed in the Accelerometer Glove are 3-axis accelerometers. Each sensor is connected to a microcontroller by using the Serial Peripheral Interface (SPI) Bus. Data is acquired from the sensors synchronously. Following data collection, the entire set is sent to the PC through USB. The PC recognizes the device as a Serial Port (due to the Virtual COM Protocol implemented in the microcontroller). Then, the dataflow is intercepted by the GUI for acquisition and further processing.
The sensors are connected to a single SPI Bus. The measurements are collected with a frequency of 400 Hz. Each sensor is queried regarding the data in proper order, and, following a whole cycle, the measurements are sent to the PC. Due to time uncertainty, in a worst case scenario the data may be delayed by 2.5 ms. Such a delay is fully acceptable,

ISRJournals and Publications Page 477

isrjournals
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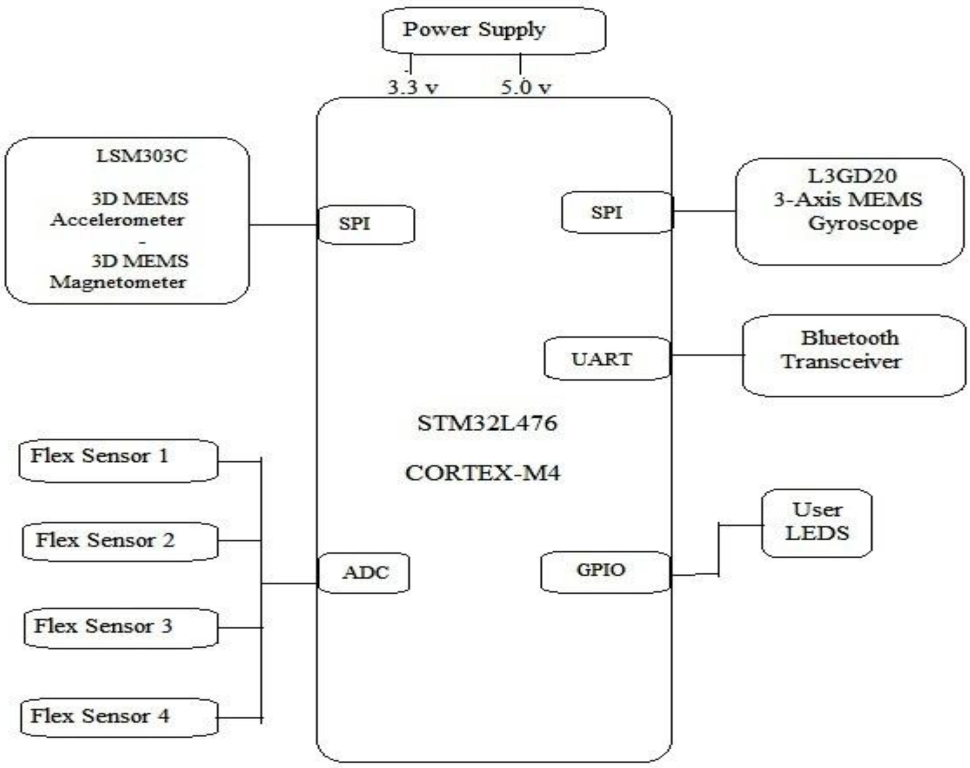
because natural upper limb movement, and even rapid movement, is slow enough to be recorded by acceleration sensors

3, PROPOSED SYSTEM

3.1 Gesture Explain

Gesture-XPLAIN aims at solving the problem of limited communication abilities of those people, who only knows sign language, to talk naturally with the rest of the world by transforming their sign language gestures it into a form of verbal communication. The goal is to create a smart glove system and a mobile device that can continuously recognize sign language gesture and translate that into spoken words.

The glove is fitted with a flex-sensors, gyroscope, magnetometer and accelerometer sensors to sense the movement made by hand and fingers. A low power ARM Cortex-M4 microcontroller recognizes the movement by means of acquiring, processing and running a sensor fusion algorithm. The system translates the sign recognized into meaningful text. This text is then transferred to a Smartphone app over a Bluetooth channel where the text will be converted into speech.



ISRJournals and Publications Page 478

isrjournals

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3.2 Inertial motion sensing glove for sign language gesture acquisition and recognition

In this paper described that the most popular systems for automatic sign language recognition are based on vision. They are user-friendly, but very sensitive to changes in regards to recording conditions. This article presents a description of the construction of a more robust system – an accelerometer glove – as well as its application in the recognition of sign language gestures. The basic data regarding inertial motion sensors and the design of the gesture acquisition system as well as project proposals are presented. The evaluation of the solution presents the results of the gesture recognition attempt by using a selected set of sign language gestures with a described method based on HMM and Parallel HMM approaches. The proposed usage of Parallel HMM for sensor-fusion modeling reduced the equal error rate by more than 60%, while preserving 99.75% recognition accuracy.

3.3 Different moment based gesture explanation:

This system is primarily designed to help the deaf and dumb people. But it can also be used by workers who work in high noise area, such as industrial machineries, to translate gestures into speech. The system can be built as a low cost alternative to existing solutions. Another feature that makes this project interesting is that users can teach the system new gestures and add them to the existing standard gesture library. This gives the system the flexibility to meet the high degree of variation among sign languages, and also the need to do some custom gestures for those industrial workers.Wearable sign language translates for deaf and dumb using sensor fusion based hand gesture recognition technology with speech generation Bluetooth. Signs are recognized for both audio and text format using the Bluetooth interface and AMR applications. Bluetooth interface application is used to recognise the signs from the audio. Android meets AMR application is used to recognise from the text. Flex sensor is fixed in the fingers that is helps to recognise the signs. This proposed system is used to communicate between the normal and deaf and dumb people.In this paper described that the generally dumb people use sign language for communication but they find difficulty in communicating with others who don't understand sign language. This project aims to lower this barrier in communication. It is based on the need of developing an electronic device that can translate sign language into speech in order to make the communication take place between the mute 11communities with the general public possible.

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4, HARDWARE DESCRPTION

4.1 Technology Used:

1) STM32L476, an ARM Cortex-M4 microcontroller with FPU
2) L3GD20, a 3-axis gyroscope
3) LSM303C, a 3D accelerometer and a 3D magnetometer
4) Flex sensor (3 fingers)
5) Bluetooth transceiver
6) Hand Glove
7) User LEDs
8) Buzzer
9) Battery

4.2 ARM Cortex-M4:

The **ARM Cortex™-M4** processor is the latest embedded processor by **ARM** specifically developed to address digital signal control markets that demand an efficient, easy-to-use blend of control and signal processing capabilities. The ARM® Cortex®-M4 processor is a high performance embedded processor with DSP instructions developed to address digital signal control markets that demand an efficient, easy-to-use blend of control and signal processing capabilities. The processor is highly configurable enabling a wide range of implementations from those requiring floating point operations, memory protection and powerful trace technology to cost sensitive devices requiring minimal area.

The ARM® Cortex®-M4 processor is an award winning processor specifically developed to address digital signal control markets that demand an efficient, easy-to-use blend of control and signal processing capabilities.

In the EFM32™ Wonder Gecko, the combination of high-efficiency signal processing functionality with the proven energy friendly Gecko technology makes for an easy-to-use microcontroller with the lowest energy consumption available.

ISRJournals and Publications
Page 480

isrjournals
International Journal of Advanced Research in Civil,Structural,Environmental and Infrastructure Engineering and Developing
Volume: 3, Issue: 1,Special Issue: 1 ,Apr,2017 ,ISSN_NO: 2320-723X

4.3 Cortex-M4 with FPU and Signal Processing Technologies

The Cortex-M4 processor has been designed with a large variety of highly efficient signal processing features applicable to digital signal control markets. The processor features extended single-cycle multiply-accumulate (MAC) instructions, optimized SIMD arithmetic, saturating arithmetic instructions and an optional single precision Floating Point Unit (FPU). These features build upon the innovative technology that characterizes the ARM Cortex-M series processors.

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