

Smart Communication System for Deaf- Dumb People

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Abstract— Communication is the best media used by the people to communicate with each other. Deaf-Dumb people find a difficulty in communicating with normal people and therefore they cannot be fully part and effective personnel in their societies. To overcome this problem a sign language interpreter system should be used for reducing the communication barrier between the deaf-dumb people and the normal ones. On the other Hand, almost all the currently used systems are based only on the American Sign Language and the English vocal language. Furthermore, all these systems have a very limited sign language database and so cannot be considered fully reliable. On the contrary, our proposed system deals with all these problems and has a very large database covering almost all the sign language database and supports the Arabic sign language and Arabic vocal language as well as efficient and friendly communication between deaf-dumb people and normal ones.

I. INTRODUCTION

Normal people have the ability to freely communicate between each other vocally without any barriers or obstacles, but they cannot communicate with other people who suffer from the ability of vocal communication with the common society. One of these incapable groups is the Deaf-Dumb People. This incapability makes them fall apart from being fully effective and dependable personnel in their society as they lack a very important aspect of anyone's character. As a result, they suffer a lot emotionally as they cannot fully present themselves. Moreover, their self-confidence is lowered making them unconfident and insecure among their society. However, now it is possible to overcome such problem and make Deaf-Dumb people able to normally communicate with the normal people without any difficulties. There are several systems for this purpose. Although an up-to-date technology is used in theses current systems but there remains drawbacks and disadvantages. The first system is Sign Language Converter this system is based on image processing using an Xbox 360 Kinect camera and sensor and a computer connected for processing [1]. The second system is Image Processing Based Language Converter system using a computer webcam and a computer to convert RGB images to binary [2]. The third system is the gesture vocalizer system using an ATMEGA16 as microcontroller for processing [3]. This system uses 4 flex sensors and an accelerometer in each hand for hand motion detection. A voice module and an LCD module is used for

output. The communication is done by means of an RF module. Also all the currently used systems have a very limited database and so a very limited number of signs can be translated and interpreted to comprehensible speech. Our proposed system covers a much larger amount and so considered more reliable and practical. Also, the current systems used ready-made flex sensors in the gloves of the deaf and dumb person and this ready-made flex sensor are unnecessarily over sensitive and so quite expensive for its required task and so this led us to think of a less expensive alternative eventually resulting in making our own flex sensors from scratch with a reasonable price just enough for our task.

II. PROPOSED SYSTEM

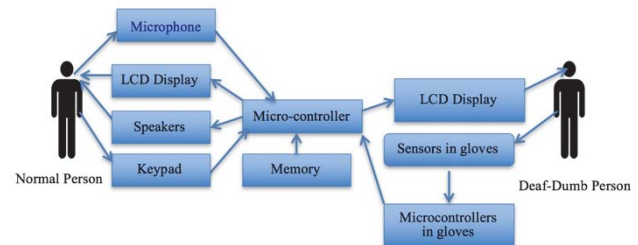


Fig. 1. Propsed system block diagram

Our proposed system block diagram is shown in Fig. (1). As shown in Fig. (1), the methodology of the proposed system is divided into two parts: communication from the deaf - dumb person to the normal person, and communication from the normal person to the deaf - dumb person.

A. Communcation From deaf-dumb person to normal person.

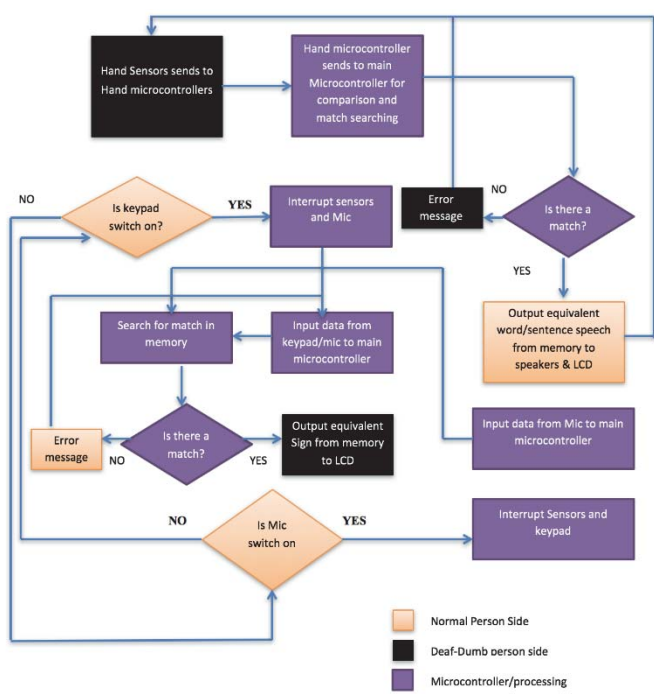
For a specific gesture, there are two parameters to be known: First, the fingers position that can be measured by the compressive sheet. Second, the hand orientation which can be indicated by the accelerometer. The data from the compressive sheet and the accelerometer are send to the gloves microcontroller to transmit it to the receiving end microcontroller using RF module. The receiving end microcontroller then generates a visible and hearable word or phrase corresponding to the sign (specific gesture). At the

receiving end there is a microcontroller contains memory loaded with almost the entire Arabic sign language database.

B. Communcation From normal person to deaf-dumb person.

Data from the normal person come as a speech using the microphone or as a text using the keypad. Data from the microphone or the keypad is sent to the receiving end microcontroller, which displays the corresponding word or phrase as a text and sign language images on the LCD.

III. SYSTEM FLOWCHART



IV. SYSTEM COMPONENTS

- Arduino Nano
- Arduino Mega
- Compressive Sheet
- Accelerometer
- Rechargeable batteries
- RF module
- Speaker & LCD

V. RESULTS AND DISCUSSION

Every gesture consists of movement and bending of fingers of hand in a particular order with specific angle correspondingly. We can calculate the finger bending using compressive sheets. The sensor values that are being generated by each of the compressive sheet and an accelerometer are fed to the gloves microcontroller. For every bending of compressive sheets and movement of an accelerometer, these sensors produce different decimal values based on positions of these sensors. The different gestures are assigned by unique numbers to identify a particular gesture, as shown in fig. 2. The received values from each glove microcontroller is divided into 6 digits ; the first digit is corresponding to the thumb bending and it has only two values 1

means unbended and 2 means totatlly bended. The next 4 digits are corresponding to the bending of the rest 4 fingers and they have 3 levels 1 means unbended , 2 means partially bended and 3 means totally bended. The last digit indicates the face of the hand and each hand has 6 faces.



Fig. 2. Gesture-Understand & corresponding values for right hand.

Then the gloves microcontrollers send these data to the receiving end microcontroller , which searches in its memory for a match and if a match found it generates a visible and hearable word or phrase coRESPONDING to the sign language. Figures (3) and (4) show our proposed system prototype. Also, table shows a comparison between the current used systems and our proposed system. The whole system is tested on various gestures and it produces fairly stable and good results, with a very low cost with respect to the most currently applied systems. Besides, the system contains more than 70 percent of the Arabic sign language gestures in its database so it is reliable to be practically used by deaf-dumb people.



Fig. 3. Front view & back view of the gloves .



Fig. 4. Front view & side view of the receiving end device .

TABLE I. COMPARISON WITH EXISTING DEAF -DUMB SYSTEMS

Parameters	Sign Language converter (2015)	Image Processing Based Language Converter (2016)	Gesture Vocalizer for Deaf and Dumb People (2016)	Our proposed System (2017)
Processing Device	Computer	Computer	Microcontroller (ATMEGA 16)	Microcontroller (ATMEGA328)
Communication Type	Two-way Communication	One-way Communication	One-way Communication	Two-way Communication
Database	Medium	Small	Small	large
Processing Speed	Slow	Slow	Medium	Fast
Portability	Not- portable	Not- portable	Portable	Portable
Sign Language	American - sign language	Arabic- sign language	American - sign language	Arabic- sign language
Cost	Expensive	Not Expensive	Expensive	Reasonable

VI. CONCLUSION

The system supports a friendly and portable two-way comprehensible communication between deaf-dumb and normal people. The system has Text and audio indication. The system design makes into consideration different glove sizes to fit everyone. Lastly the Output speech is in English and Arabic Language. The proposed system is the first system to use compressive sheet instead of flex sensors to capture the finger positions, therefore, the cost of the system is extremely low with respect to the most currently applied systems. Besides, the system contains an enormous Arabic sign language database which make the system reliable to be used. The system size is tremendously small and it is very light so it can be used freely indoors and outdoors (portable). The system processing speed is vastly fast due to the used developed recognition code.

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