SMART GLOVE

(Portable Sign Language Translator)

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***Abstract*— Our project is designed to help the unfortunate people who cannot speak to communicate with us. The project consists of a glove equipped with flex sensors that will be worn by the person. A portable screen in the form of a badge will also be worn by the person. In case the need arises to communicate, the person will have to just make the signs corresponding to ASL (American Sign Language) symbolizing the various characters to form words and those words will be displayed on a graphical LCD.**

The system works by sensing the voltage drop across the flex sensors combined with the voltage output of the accelerometer. This is then fed to the ADC input of the microcontroller. Here sampling is done and the digital values are stored (when unit is used for the first time), corresponding to each character. In this way the microcontroller learns the characters. When the sign is done again, these values are compared against the reference values and a real-time heuristic pattern matching algorithm (designed and developed by us) is executed in order to obtain the correct character match. The character is transmitted to another slave microcontroller. These characters or words are sent to the display driver. The display driver then outputs the character or word on the portable screen (Graphic LCD).

The Smart Glove is multi-faceted. There are added facilities to control the computer mouse pointer using the accelerometer mounted on the glove and also it to input text to the computer just like a keyboard! The receiver unit is connected to the USB port of the computer. The user just switches between the text and mouse mode to use it as a mouse or keyboard. The right and left click is done by moving the index and middle finger just like an ordinary 'click' action!

When the user changes the mode to wireless control, he/she will be able to control his/her home appliances with only the glove. The glove acts as a master remote control where a gesture will represent a specific appliance. The gesture can be changed or set by the user as per the device he wants. The slave unit is made up of another microcontroller that is wired to the appliance via a driver IC and relays.

This unit also can act as a control for a robot in the house in robot control mode. The robot can vary from a vacuum cleaner to a robotic wheel chair which the paralyzed or disabled person may sit on! Just by the movement in the hand, the robot is moved forward backward left or right. We have used the accelerometer mounted on the glove as input. In addition to this, the robot is also capable of storing the path traced by the user and following it automatically when told, without the user even controlling it!

I. INTRODUCTION

In today's world, communication plays a vital role in each one's life. Vocal communication helps in speeding up information transfer and helps us express emotions. What about those who are not so lucky to be blessed with a voice? How would this particular person communicate with the practical world? The answer: Sign Language!

We thought of converting sign language into text in real-time and then later on into speech as well. Hence the Smart Glove, which is a glove that is worn by the person who cannot speak. The glove is fitted with flex sensors that sense the bends of the fingers and with an accelerometer that will sense the movement of the hand. With these sensor inputs fed to a microcontroller chip, we perform pattern matching of the real-time samples using the 'Cornering Algorithm' (an algorithm developed by us). The output returned is a character which is then sent to a wireless remote display device unit (Graphic LCD) which is worn in the form of a badge. The glove also acts as a universal controller. It can be used to control house appliances by gestures, control the PC by acting as a wireless mouse and sign language keyboard and control a household robot too!

II. BACKGROUND

Consider a scenario in which a person who cannot speak is waiting for bus at the bus stop and wants to ask about the bus timings. How would he communicate in sign language with another person who does not understand sign language? This sparked off the idea behind our project: to design a portable language translator that would convert this sign language into an understandable language (English).

Sign Language is of two standards: ASL (American Standard Sign Language) and BSL (British Standard Sign Language). We conducted a survey in schools for the differently abled and in conclusion, decided to use ASL for our project. Along with this came the idea of making a universal controller for the

same person who wears the smart glove to ease his/her life and help empower him/her. So we thought of four basic modes to be followed.

- Sign to text mode
- Keyboard and mouse mode
- Device/appliance control mode
- Robot control mode

III. METHODOLOGY

The project is mainly divided into six modules, which was done after a thorough study. All the coding was done in embedded C.

1) **Designing of entire hardware circuit and hardware interfacing:** we designed the hardware schematic and estimated all the necessary I/O port configurations, interfaces, components etc. that were needed for our project. The final outcome this was the complete design of the circuit schematic for the project.

2) **Designing of glove and hardware interfacing of flex sensors with microcontroller:** Here we purchased a suitable glove and stitched the flex sensors to it, mounted the accelerometer and did all necessary connections as per the circuit diagram

3) **Designing of graphics and text functions:** here we designed the graphic LCD driver library in order to get text onto the screen. We had to design a font bitmap array and certain graphic functions also which were needed for animation and display of graphic content.

4) **Designing of data packets, encoding scheme and transmitter module:** Since our project was wireless (based on CC2500 wireless transceiver), we had to establish a protocol to be followed and design a data packet too. A simple data structure was implemented that would act as a data packet with all necessary fields required.

5) **Designing of data decoding scheme and receiver module:** having done the transmitter side, we did the receiver end program for the decoding and unpacking of the data packet. We designed a CC2500 configuration and interfacing library for the above two modules.

6) **Designing of pattern matching embedded software for the microcontroller:** we then started with the interfacing of the glove with the microcontroller. We first interfaced and checked the ADC for correct operation. Then we started coding the cornering algorithm and the rest of the program.

Then followed the fabrication and testing of our project. The code from each module was integrated and burnt into the microcontroller and practical tests were done on the hardware till the results were satisfactory. But there is always scope for further improvement of the unit and code.

IV. CONCLUSION

The portable sign language translator makes it a handy device to be used on the go. Using this device enables clear communication between people and helps the person who doesn't know sign language to understand its meaning and reciprocate in a better way. The very fact that this unit can actually learn the signs makes it more flexible to adjust to different people. This device can also be used as an aid to enhance the learning of sign language for students and elders alike.

In addition to all this, the Smart Glove provides a lot of other useful functions that will surely make the life of such unfortunate people a lot better and easier. The mouse control and text input combined with a full-fledged flexible and user programmable remote control makes the Smart Glove a great contraption.

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