

# Microcontroller based Hand Gesture Recognition System using Flex Sensor for Disabled People

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## ABSTRACT

In this paper, a communication system is used based on signal languages, used by dumb people. A narrative hand gesture recognition technique is the basis of this paper. This consists of a hardware module and software algorithm.

In hardware module- The gesture recognition is done using a sensor glove which consists of a microcontroller, accelerometer sensors which are positioned on fingers. Here the glove designing and gesture decoding are studied. The acceleration values of a hand motion are transmitted to microcontroller and these acceleration values in three perpendicular directions are detected by accelerometers. An algorithm of automatic gesture recognition is developed to identify all gestures in a sequence.

## Keywords

Flex sensor,Data Glove,Gesture recognition, Global system for mobile communication

## 1. INTRODUCTION

Gesture recognition is a process by which the gestures made by the user are used by the receiver. Human gestures are an efficient and powerful way of interaction. These are sometimes used to express ourselves. For example nodding may be used to show our consent, or raising a hand can be used to indicate that we are willing to speak something.

This paper focus on developing a help for disabled people using this gesture recognition technique. In this system the gestures are converted into text messages for communication. A number of techniques are used to convert these gestures into required output, typically either image based or device based, although hybrids are beginning to come about. [1] Although this technology is still in its emerging state, a number of applications have been implemented in real time. The basic concept involves the use of data gloves worn by disabled people. These gloves are designed using Flex sensors. The flex sensors are normally attached to the glove. Flex sensors are analog resistors that function as analog voltage dividers. The details of flex sensors are studied in further chapters.

All the gestures made are analyzed by microcontroller which interfaces the input and sends the information to GSM modem. A GSM is a modem used for wireless communication in this project. Like a mobile phone, a GSM modem requires a SIM card to operate. The information is sent to the receiver mobile phone by the GSM modem via SMS (Short Message Service).

This paper makes the suggestion that gesture based input is a very useful technique to convey the information for disabled people.

## 2. SYSTEM IMPLEMENTATION

Here the design and implementation of the system of hand gesture recognition of first category which is based on data glove is discussed. It includes the modules:

- Data Glove
- Tilt detection
- Gesture detection

### a. Data glove:

These systems consist of 3 Flex sensors. All the flex sensors are mounted on each of the finger of hand glove. The flex sensor patented technology is based on resistive carbon elements. As a variable printed resistor, the Flex sensor achieves great form factor on a thin flexible substrate.

### b. Tilt recognition:

The tilt recognition is the most important and the core part of the system. This module is based on a microcontroller controlled circuitary. In this module a microcontroller is used and three ports of this microcontroller are in use.

### c. Gesture Recognition:

It is the most important part of the system. Even a little bend of the finger is detected at this stage of the system, so the bending of the finger has infinite level of bends and the system is very sensitive to the bending of the finger.

## 3. SYSTEM ARCHITECTURE

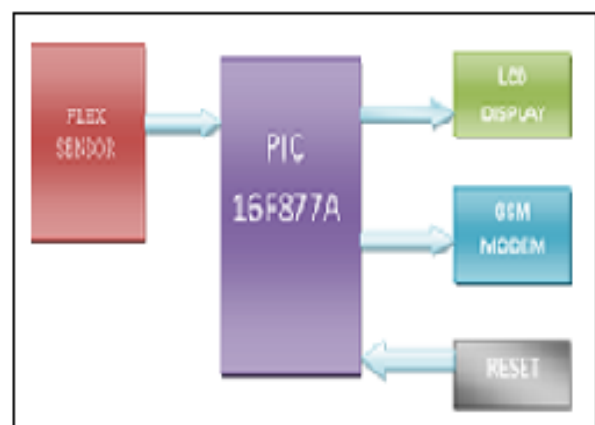


Figure 3: Block diagram of the system

### 3.1 System Description

“Recognition of gestures collectively suggests the process of tailing gestures of human to their depiction and translation to meaningful instructions.”

Gesture recognition research intends to design and implement the system using gesture as input. The gesture recognition in this paper is done using a flexible, resistive sensors known as 'Flex Sensor'. The main principle of a Flex sensor is that the change in resistance gives respective amount of change in voltage. A flex sensor is designed such that as sensor is bent, the resistance of sensor alters. Resistance of 45 degree bend is different from that of a 90 degree bend of a sensor.

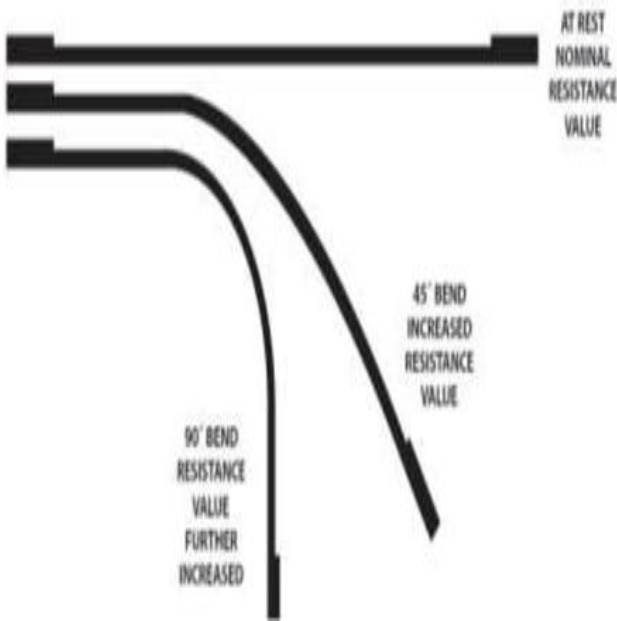


Figure 3.1: Degree of bend of a sensor

Thus as a sensor is bent, the resistance of sensor varies and the output voltage of sensor varies accordingly with the resistance. The most convenient way of obtaining a varying voltage from varying resistance is using a voltage divider circuit.

The output voltage is calculated using the equation:

$$V_{out} = V_{in} * R / (r + R) \dots \dots \dots \text{eqn. (3.1)}$$

The microcontroller described in this paper is PIC16F877. The receiver pin in microcontroller receives data from the sensor and that information is sent to a modem by the transmitter. The GSM modem accepts data from microcontroller and data is sent via antenna. GSM acts like a mobile phone and the predefined messages are sent through modem to a cell phone from distant places. The status of messages which are transmitted can be shown on a LCD.

### 3.2 Flow Of System

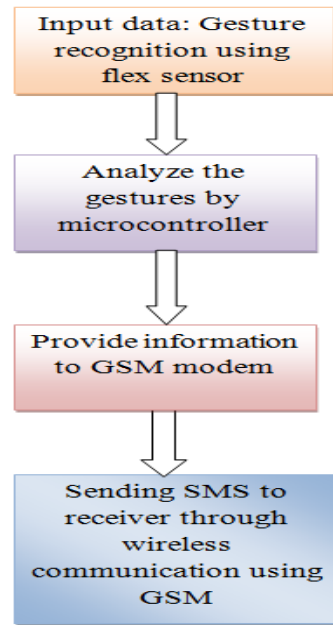


Figure 3.2: Flow of the system

### 4. RESULTS & CONCLUSION

For the first gesture, that is at 45 degree bend of sensor the voltage is 2.6V, the message transmitted is "Call me its urgent" which is written in the code for that voltage of sensor1. Figure 4.1 shows the first gesture of sensor 1 and figure 4.2 shows the output for that gesture on the mobile phone.



Figure 4.1: Gesture of sensor 1 at 45°

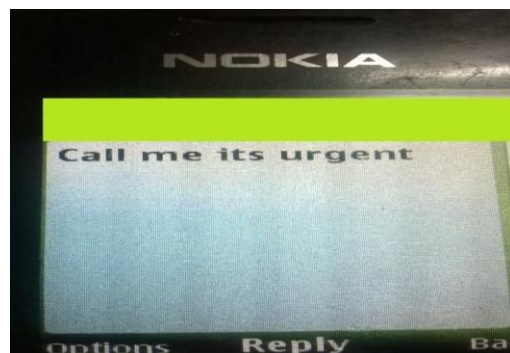


Figure 4.2: Output of gesture 1



Figure 4.3: Gesture of sensor 1 at 90°

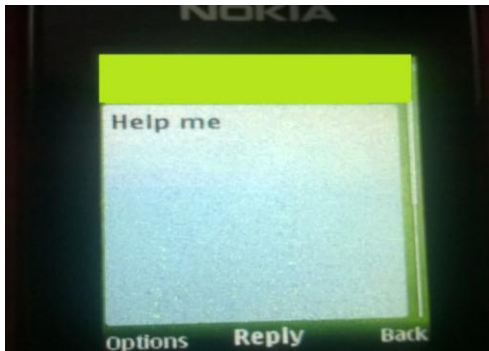


Figure 4.4: Output of gesture 2

The paper here explains review of different gesture recognition system and the types of systems involved in it. One type of such system is implemented and is explained in this report. This system is very helpful for disabled people to interact with each other and normal people. Disabled people make use of sign language which a normal person cannot understand. The system studied here changes the sign language into SMS which is understood easily by normal people and they can communicate easily from far away distances. Thus a flex sensor based recognition system is designed here and the output of that system is obtained as input on cell phone.

## 5. ACKNOWLEDGMENTS

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