CHAPTER 9
NEW JERSEY INSTITUTE OF TECHNOLOGY

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TALK BY NUMBERS

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INTRODUCTION

The purpose of this project was to design a communication aid to enhance the independence of individuals with severe speech impairments in a direct and easy way. The device implements a digital voice recording and playback chip by means of a micro-controller. Talk by Numbers will do the same thing as a language board but the user inputs a series of numbers by switch access or by manual touch and a pre-recorded message corresponding to the chosen number will be played through a small speaker.

SUMMARY OF IMPACT

There are presently a large number of commercially available communication devices, but many people surveyed about their electronic communication devices say that they do not use them anymore because of their complexity and the frequent need for repairs. This device is easy to use both during programming and operation. There are 320 messages available for the user to both record and play back. Each message can last for up to three seconds, with a total recording time of 16 minutes.

TECHNICAL DESCRIPTION

The unit is delivered with empty memory banks. A chart must first be constructed linking each word or phrase to a number (if there are N words or phrases, they are numbered from 1 to N). Each word or phrase is programmed by first entering the corresponding number on the input board (each number can be up to three digits long), push the record button, and speak the word or phrase into the microphone. To activate the machine to speak a word or phrase, the user simply chooses the key with the corresponding number.

The device contains a JM-552 micro-controller, an ISD4004 voice recorder and playback chip and an LM4860M amplifier. The dimensions of the device are 6 inches long by 5 inches wide by 3 inches deep. It weighs 1.5 pounds and is powered by a 9-volt rechargeable battery.

VOICE ACTIVATED WHEELCHAIR CONTROLLER

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INTRODUCTION

Persons with quadriplegia can currently control a motorized wheelchair using a sip and puff or chin operated controls. A method that may be preferred by some would be to utilize voice recognition. While technologies exist for speech recognition in telecommunications and word processing, the purpose of this project was to utilize speech recognition for wheelchair control. The design resulted in a low cost system interfacing a speech recognition system and a micro-controller.

SUMMARY OF IMPACT

Persons with quadriplegia that use wheelchairs often have trouble controlling the motion of their wheelchairs. Those who have good speech patterns can use speech recognition to perform control functions. A device that integrates speech recognition and wheelchair motion control would be a great asset for such individuals.

TECHNICAL DESCRIPTION

The design includes a speaker-dependent voice recognition system with 20K-word capability. The unit is powered by the battery included on the wheelchair. The system is taught by the user to respond to 20 double-word commands. It incorporates a throat microphone.

The unit contains an HM2007 voice recognition unit and a JM-552 micro-controller to decode the information from the voice recognition unit and to generate the signals to drive the wheelchair. The voice recognition unit responds to the following words: go, left, right, stop, and back. These words are combined into two-word phrases, such as go left, to increase security and decrease the probability that the unit will respond to words used in normal conversation. Two dc motors and a control circuit, which will control the forward and reverse motion of the wheelchair, represent the wheelchair motors.

The unit has dimensions of 8x4x4 inches and weighs 2.5 pounds. The cost of the unit was approximately $350.00.

ELECTROCARDIOGRAM DATA ACQUISITION SYSTEM

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INTRODUCTION

Many projects involving patients undergoing rehabilitation involve monitoring their electrocardiograms (ECG). This is particularly true for patients who suffered a neurological problem such as a stroke or a spinal cord injury. Commercial units presently on the market are expensive, not portable, and contain much more than is required for this application. Therefore, it was decided to construct an inexpensive ECG acquisition unit which will also be portable and interface to a laptop computer so that ECG data can be acquired an stored easily, quickly, and at any location.

SUMMARY OF IMPACT

Much research has already been performed on the neurological functioning of rehabilitation patients. This research usually involves monitoring the ECG and, up to now, has required the patient to come to the research laboratory because the equipment was not portable. This project resulted in a portable, inexpensive ECG acquisition unit, which can be interfaced to a laptop PC, and which will provide the researcher with the ability to collect the data at any location.

TECHNICAL DESCRIPTION

The unit allows for up to 12 channels of ECG to be acquired and provides for a fiber optic isolation link between the acquisition unit and the PC. There is also input capability for four additional signals such as respiration or blood pressure. The 12 channels of ECG are amplified and filtered, providing for high input impedance and high common mode rejection, and then are input to a 16 to 1 MUX to produce a single analog signal which is then input to a 12 bit A/D converter. The parallel output of the A/D converter is latched and converted to a single serial data stream, which is then transmitted over a fiber optic link to a fiber optic receiver. At the output of the receiver, the PC through the parallel port converts the signal from serial to parallel to allow for rapid acquisition. There is also handshaking between the unit and the PC to control data transfer.

The cost of materials for this project was about $700.00.