CHAPTER 19
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Voice Activated Door Opener

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INTRODUCTION

A voice activated garage door opener was designed for a quadriplegic to open a garage door without assistance. This project is designed to use speech recognition of one word. The activating word that is chosen is "up". This word activates the transmitter, which then signals the door to go up or down.

SUMMARY OF IMPACT

This device permits a physically disabled individual, without outside assistance, to gain access to a garage by using a simple voice command.

TECHNICAL DESCRIPTION

This device has been designed, without a specific client in mind, at the suggestion of the Wyoming Independent Living Rehabilitation Center, Casper, WY. The design of this device is based on the frequency spectrum of the word "up". My voice was used on a soundboard to capture the spectrum of this word. The idea was to pick out three dominate frequencies in the spectrum and then build a circuit that responds to the combination of those frequencies.

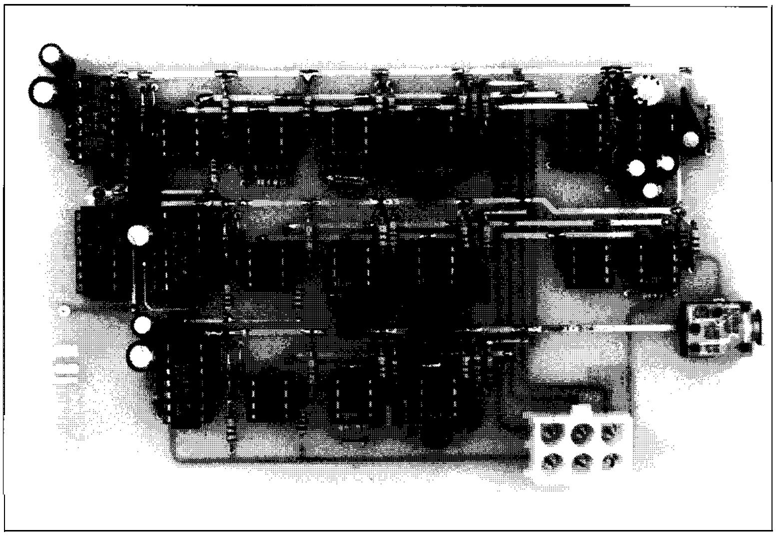

Figure 19.1. Voice Activated Door Opener.

A low-sensitivity microphone was used with a gain controlled microphone preamplifier chip. This chip is the SL6270C made by Plessy Semiconductors. It combines the function of an audio amplifier and voice-operated gain adjusting device (VOGAD). This IC chip is designed to accept signals from a low sensitivity microphone and to provide a constant output. The signal from the VOGAD was again amplified before input to the filters.

The frequency bands that are picked out of the spectrum are at 120-550 Hz, 640 Hz-1000 Hz and 2750 Hz-3250 Hz. These bands correspond to the peaks in the frequency spectrum for the word selected. The output signals from the three parallel filters serve as the inputs into three voltage comparators. Each voltage comparator goes to positive rail when the output from the corresponding filter is above the set threshold voltage. The threshold voltages are set by experimentation.

The outputs from each voltage comparator are the inputs into the monostable multivibrators. The SN74121 monostable multivibrator with Schmitt-trigger inputs is used. The signals from the voltage comparators must be attenuated before they are input into the monostables. This is done by using 4.7V Zener clamping diodes. The pulse widths on each monostable were set at approximately 0.4 seconds. This duration is approximately time it takes to say the word "up". This insures that all three pulses will be high at the same time to trigger the AND gate. The high pulse from the AND gate is lengthened to activate the transmitter to the garage door opener. This device may be operated from two 9 V transistor batteries, or from a ±12V electronic power supply.

Figure 19.1 is a photograph of the finished circuit board, and a full schematic, less power supply, is presented in Figure 19.2. The final cost of this project is approximately $10 to $15, excluding the door controller.

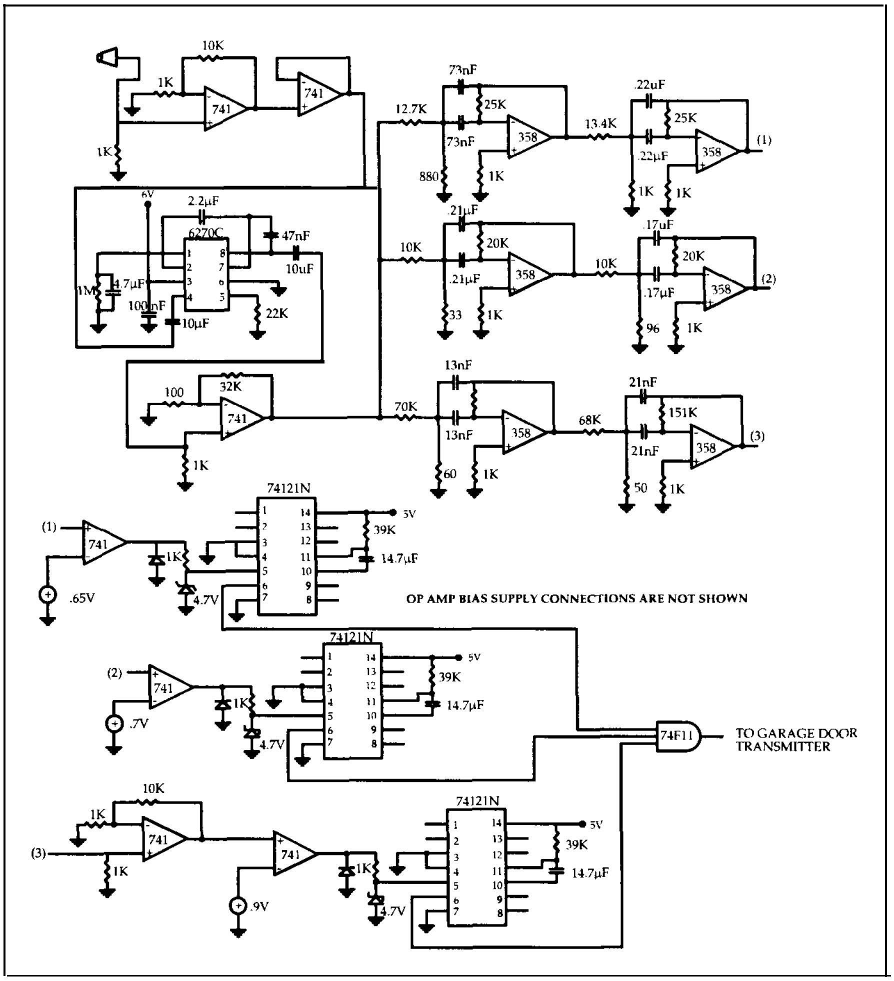

Figure 19.2. Schematic for the Voice Activated Door Opener.

Speech Volume Training Tool

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INTRODUCTION

Many autistic individuals are capable of speech, but their acoustic feedback pathways differ from normal subjects. Consequently, they are insensitive to their elevated voice levels, and draw unwanted attention to themselves. Some autistic training centers have been seeking a device that can be used as a training tool to assist such individuals to speak at normal voice levels. No such commercial device has been found.

SUMMARY OF IMPACT

The voice volume alarm (VVA) device described here permits any user to recognize when he/she is talking at elevated volume levels over a given time period. It incorporates an adjustable time delay circuit, which then triggers an alarm, sensed only by the wearer, following the delay period. The VVA alerts the wearer, either through an audible tone or a vibratory transducer, that his/her voice is too loud. With training, the autistic individual can learn to control voice volume, and can then pursue normal activities without attracting attention because of loud voice levels.

TECHNICAL DESCRIPTION

The VVA is a small, lightweight, and portable unit that operates from a standard 9V transistor radio battery. Voice loudness level is sensed either by a throat microphone hidden in a "choker" necklace, or by a lavalier microphone. The microphone signal is then processed through a high-gain bandpass filter with corners located at 200 Hz and either 1 kHz or 2 kHz. The 1 kHz upper comer is used when the microphone is hidden from view, and the 2 kHz corner is used when the microphone is exposed. The bandpass filter is designed to pass the principal frequencies of the human voice while filtering out extraneous noise. The signal from the filter is processed through a precision full-wave rectifier to generate the input signal for the time-delay circuit. The delay circuit consists of a lossy integrator followed by a simple voltage comparator. The delay time is set by adjusting the reference voltage supplied to the comparator. When the comparator changes state following the delay period, its output signal activates either a piezoelectric alarm (wrist watch type) or an electromechanical shaker alarm worn by the subject. Two quad op amps (LM324) and one dual op amp (MC1458) are used in the circuit design. One op amp is used to produce a bipolar power supply from the battery. A complete circuit schematic is presented in Figure 19.3.

The parts cost was approximately $50.00, with the lavalier microphone as the major item at $38.

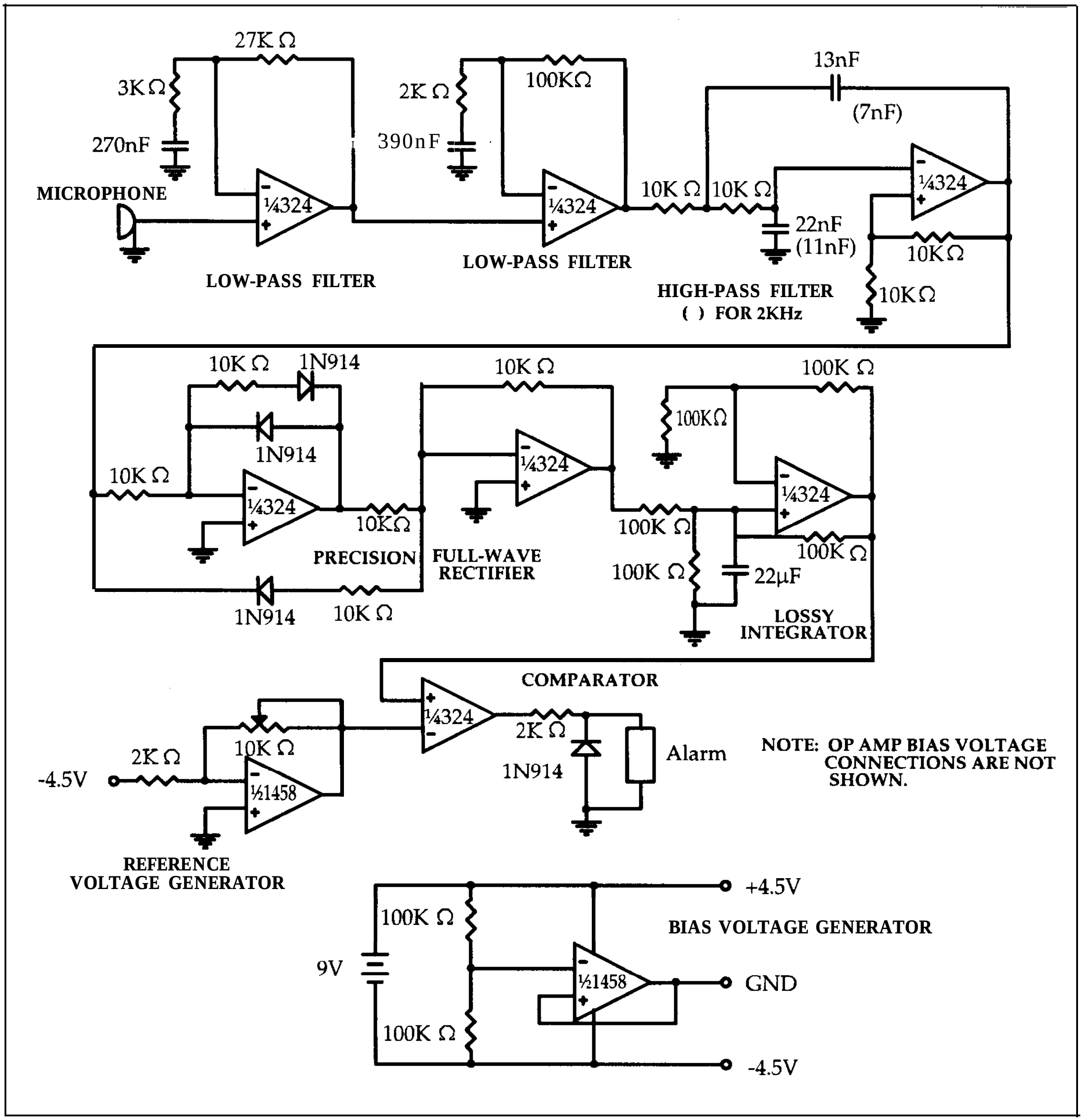
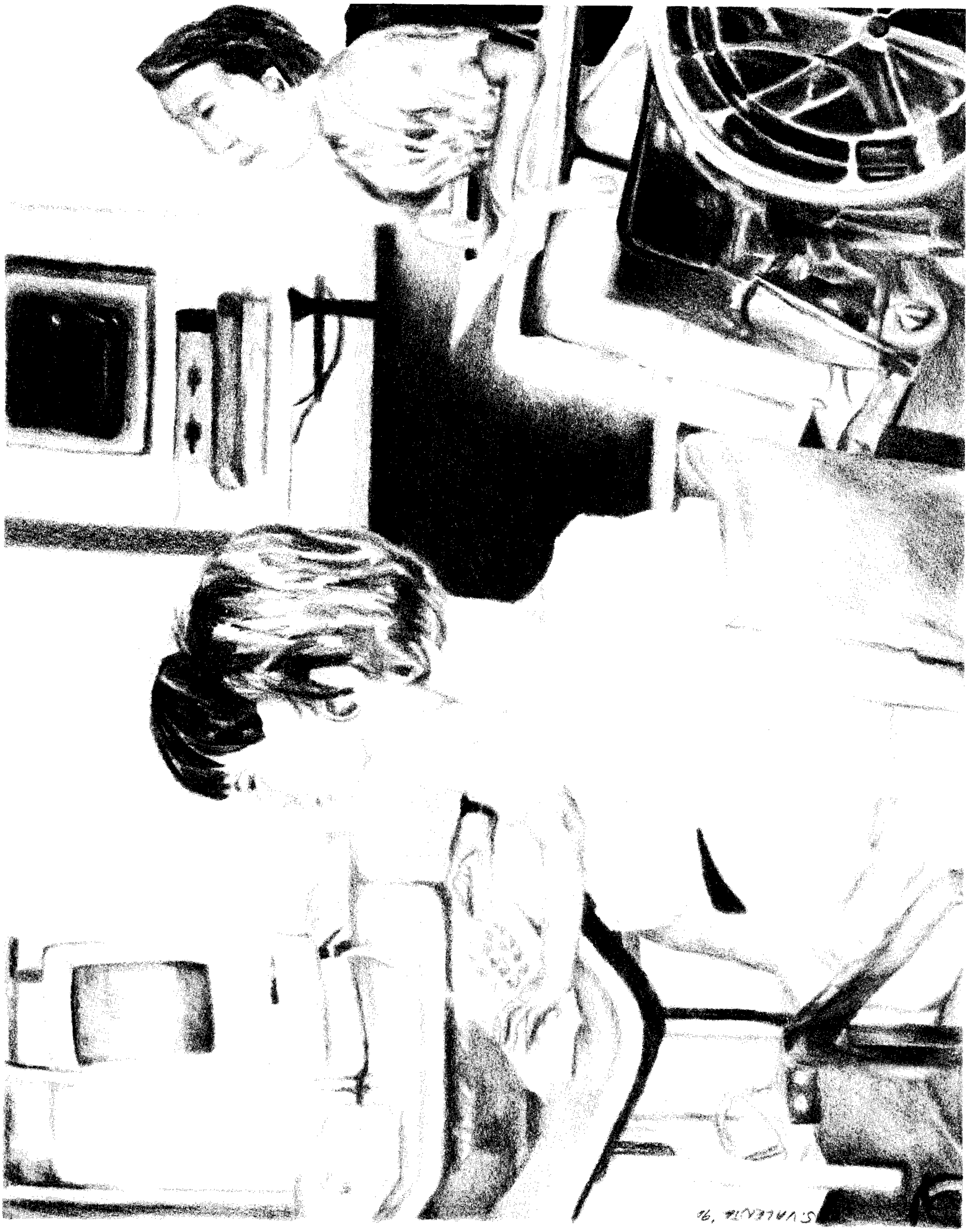


Figure 19.3. Schematic for the Speech Volume Training Tool.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