

CHAPTER 12

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WIRELESS COMMUNICATION DEVICE

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INTRODUCTION

This design is for individuals who have trouble speaking. The device allows the user to press one of four pushbutton switches to play a pre-programmed command to a caretaker in an adjacent room. The device is wireless and mobile. It consists of a FM transmitter and receiver. The transmitting unit transports digital data corresponding to a pushed switch from one MC68HC711 microprocessor to another MC68HC711 on the receiving side. The decoded received command is then displayed on a liquid crystal panel.

SUMMARY OF IMPACT

A portable wireless transmitter-receiver set serves as a convenient means to inform a caretaker in a remote location of a patient's needs. The user selects on or four pre-recorded messages by pushing a button. The receiving device translates the message for display on an LCD panel. The portable wireless transmitter/receiver LCD display unit may meet needs of individuals with speech difficulties. It is especially appropriate for use by those with limited finger movement.

TECHNICAL DESCRIPTION

The main design requirements for this project were that it be:

- Portable and wireless for the patient to communicate pre-selected desired requests to a remote caretaker; and
- Microprocessor-based for programmability such that desired commands could be displayed.

The wireless transmitter system consists of a power supply, a MC68HC11 microprocessor, a MC2833 low power FM transmitter chip, and 4 push button switches. The FM transmitter uses Frequency Shift Keying (FSK) with a carrier frequency of 49.8 MHz. Data from the programmed M68HC711 modulates the carrier at a baud rate of 300 bits/s. A low baud rate is used for improved transmission accuracy.

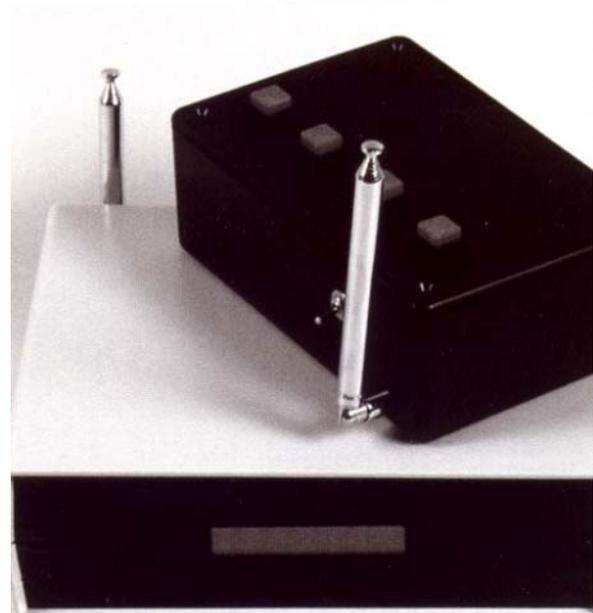


Figure 12.1. Wireless Command Displaying Device.

The micro-controller code is designed to input 128 different possible combinations and sends any combinations serially to the FSK transmitter. The sampling rate is 16 times faster than the input rate. An 8 MHz crystal is used for the micro-controller clock; it can be programmed during initialization of the code for controlling the speed of the controller. A LM317 is used as a voltage adjustable regulator with two external resistor components to range the voltage. This circuit allows a constant 5 volts DC to the system and is powered by a common 9-volt battery. The range of the supply could be adjusted by the potentiometer, which could runs from 0.7 volts to 7.1 volts. The power consumption of both transmitter and receiver systems is 51.6 mA @ 9 volts or 466 mW. The regulator limits the internal current and thermal shutdown so the circuit will not receive unnecessary spikes to cause a blowout.

The FM transmitter chip is a Motorola MC2833 low power transmitter. It contains a microphone amplifier, voltage controlled oscillator, and two

auxiliary transistors. The transmitter unit generates its 49.8 MHz carrier signal using a 16.605 MHz crystal (the circuit triples the crystal frequency at its third harmonic). The desired command data provided by the microprocessor modulates the carrier using an internal variable reactance. This variable reactance shifts the frequency of the oscillator circuit in proportion to the input producing the frequency modulated (FM) signal.

The receiving system consists of:

- A power supply,
- A mc3335 low power narrow-band fm receiver,
- A m68hc711 microprocessor, and a
- A liquid crystal display unit.

The microprocessor code for the receiver accepts an 8-bit signal from the RxD port. The RxD port is at a constant high (IDLE) until a start bit is received. The start bit is a logic 0 bit. The proceeding 8 bits are automatically assumed to be data followed by a stop bit (logic 1). When the receiver data register flag (RDRF) is set, the data are automatically sent to the MC68HC11's SCDR register, where they are subsequently loaded into an accumulator for processing. The accumulator data are then tested to identify which ASCII code needs to be sent to the LCD panel for final display.

The final cost of the project was approximately \$460.

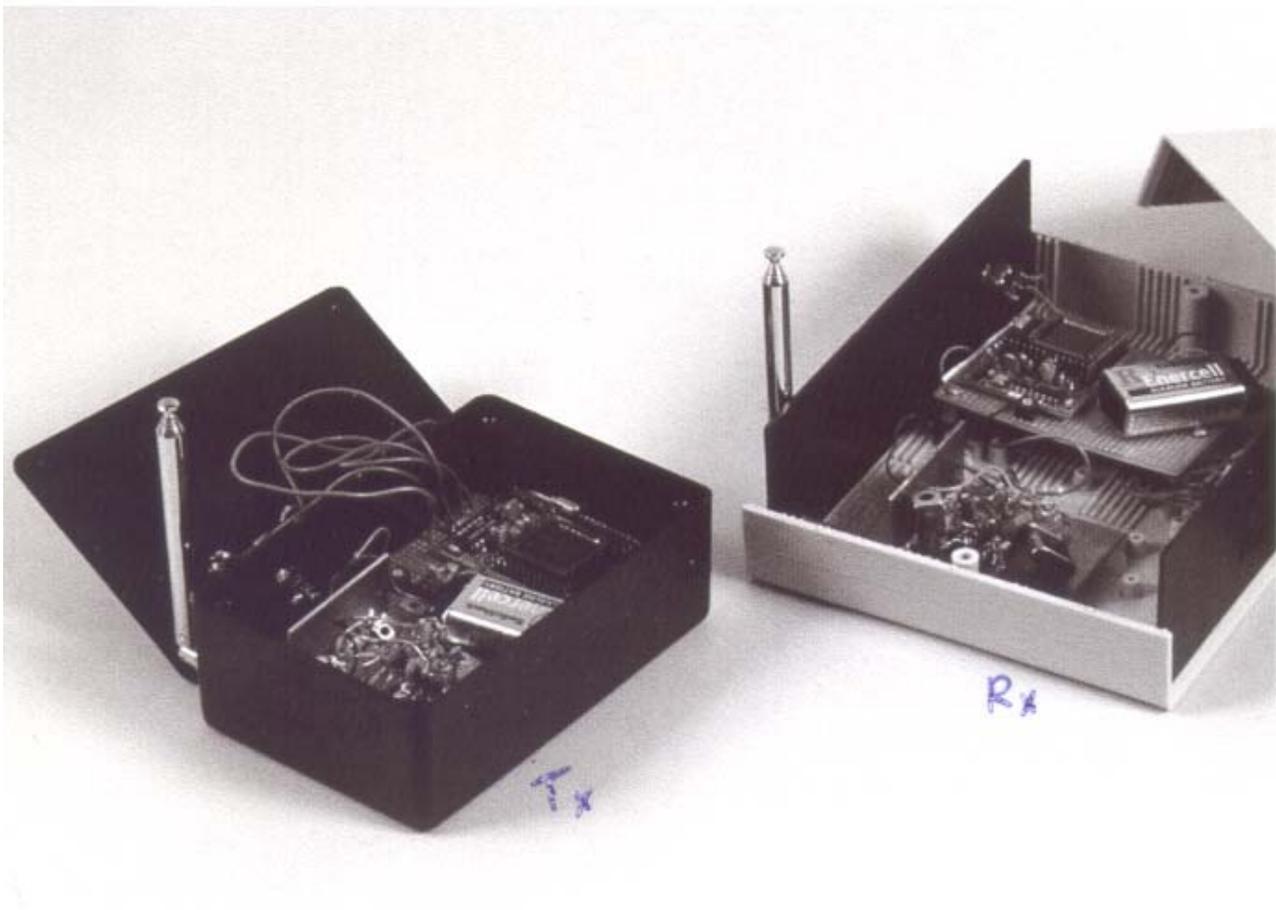


Figure 12.2. Internal View of Transmitter (Tx) and Receiver (Rx) Units.

WIRELESS SMOKE ALARM DETECTOR FOR PERSONS WITH HEARING IMPAIRMENT

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INTRODUCTION

The objective of this project was to provide a convenient means by which a person with a hearing impairment can detect smoke in a household. The device detects smoke and sends a signal to a transmitter, which in turn transmits a signal to a receiver. The receiver then activates a vibrating unit and a light emitting diode. The device works off of both AC and DC. Thus, in the case of a power outage, the DC circuit will take over and keep the system running. The vibrating unit may be placed in a bed or in a chair. A light emitting diode is activated simultaneous with the vibrating action, indicating that smoke is present. The vibrating unit can be made portable so that the user may feel secure in all areas of a building.

SUMMARY OF IMPACT

A smoke detecting device that is able to sense smoke and alert a person by means other than sound is essential for individuals with hearing impairment. Upon detection of smoke, a vibrating unit and a light emitting diode are activated to alert the user of impending fire danger. This enhanced smoke detector may enhance the user's sense of independence and security.

TECHNICAL DISCRIPTION

The main design requirements for this project were that it:

- Be able to alert a hearing impaired individual at all times,
- Be portable,
- Have high reliability, and
- Be low cost.

A smoke alarm is to be activated, sending a signal to a transmitter that produces an RF signal at 300MHz. This frequency would then get picked up by a

receiver that then activates a vibrating unit implemented by a motor. This vibrating unit could be a bed, pillow, chair, bracelet, etc.

The transmitter could be retrofitted to already existing smoke alarms and the receiver/vibrating unit could be placed anywhere in the house or business. This allows the consumer to have a portable detection unit. In order to simplify the design process, the alarm system was divided into component sections. Each section was designed individually while keeping in mind how it would be interfaced with the others. The components are as follows:

- A smoke alarm to detect smoke and send a signal to the transmitter,
- A transmitter which, when activated, sends a 300MHz signal to the receiver,
- A receiver that receives a signal from the transmitter and then activates the vibrating unit, and
- A vibrating unit which, when activated by the receiver, vibrates a motor.

A standard smoke alarm manufactured by First Alert was selected. The transmitter connects to the smoke alarm with positive and negative wires. These connections are made at two points. While one point is at positive 9V at all times, the transmitter waits for the second point to close via a transistor switch. This is accomplished when smoke is detected such that the smoke alarm supplies a signal to the gate of the transistor.

The transmitter and receiver are manufactured by Ming Microsystems. The transmitter consists of a TX01 12 bit encoder mother board and TX-99 300 MHz RF transmitter board. The receiver consists of RE01 12-bit decoder and RE-99 300 MHz AM receiver. TX01 and TX-99 are ideal for almost any

application needing a wireless control system. When used with RE-01 or RE-99 receiver, the TX-01 offers 4 bits of data providing up to 16 different codes. 8 bits of address ensure that data sent from the transmitter/encoder are passed on to the RE-01 data outputs, and all stray data are rejected. The 8-bit address also allows up to 256 individually addressed receivers to be used with a single transmitter.

The vibrating unit is a super small DC motor used in pagers and cell phones; it was supplied by Marlin P. Jones & Assoc. Inc. It is equipped with an off-center weight on the motor shaft, which provides the vibration. The unit is rated at 1.3 VDC with 110mA maximum draw. These parameters produce an output of 6000 RPM, which creates a significantly noticeable vibration.

The transmitter, operating on a 9 V battery, receives a coded signal from the encoder and uses this signal to modulate its 300MHz carrier. The TX-99 has a loop trace antenna on board and does not require the addition of a wire antenna. In the case of the RE-

01, the incoming code is a 12 bit serial format. This code must be checked to ensure that the first 8 bits (address bits) match the address of the decoder I.C. This is the HT12D decoder I.C. found on the RE-01 decoder motherboard. If the incoming 8 bit address is correct, the last 4 bits of the 12 bit code are passed on to the data outputs of the RE-01, and the Valid ID relay closes and remains closed until the incoming signal is no longer present. The 4 data bits latch and remain in the state to which they were set by the last transmission, until they are changed by the next transmission. The RE-99 receiver, powered by a 12 V battery, is an LC-based 300MHz AM RF super-regenerative receiver board. It is ideal for almost any application needing a wireless control system.

The RE-99 requires a wire antenna (using 22 gauge wire cut to 9.36", 1/4 wave) for optimum operating distance in excess of 50 ft. The complete unit consisting of smoke alarm detector, transmitter, receiver, and vibrating pager is shown in Figure 12.4.

The total cost for this project was \$66.

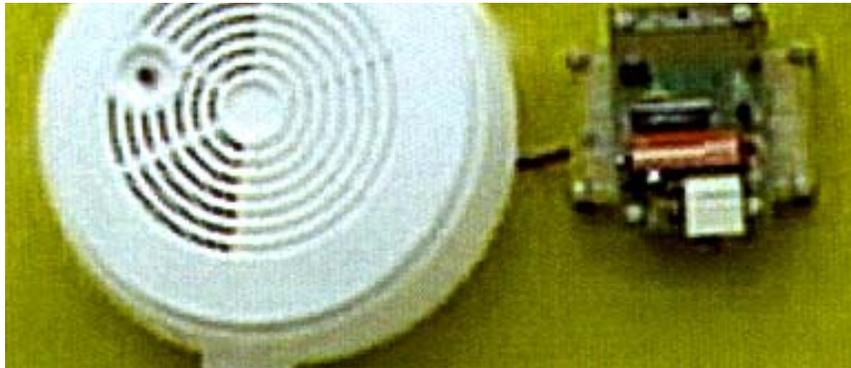


Figure 12.3. Smoke Alarm and Transmitter Unit.

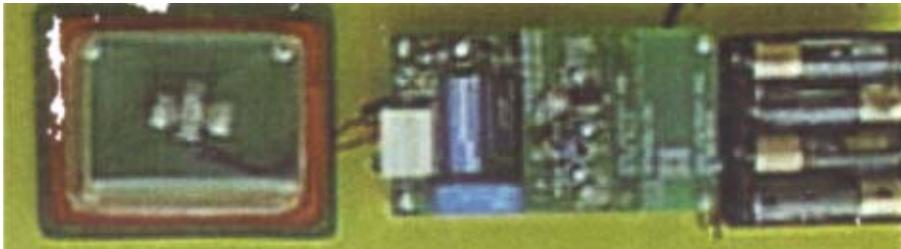


Figure 12.4. Receiver and Vibrating Unit.

