VOICE-ACTUATED CONTROLLER FOR THE HANDICAPPED

Handicapped persons who cannot readily use their hands to turn electrical applicances on or off are in need of a speech-actuated remote control system to help them perform these tasks. Presently available systems depend on matching voice frequency patterns of individual words, such as "telephone" or "radio." Such systems require considerable training and practice for efficient use, they are susceptible to false actuation by background noise, and they cost over $1,000.

A new controller developed at APL uses a low-cost microprocessor that cycles through a number of available performance functions. The user commands a particular function by uttering his voice command when the performance function he desires is offered. The controller provides visual cues to the user to indicate the functions being offered, with a full cycle of choices being completed every 15 seconds.

The demonstration model of the voice actuator consists of a display, a microprocessor, an interface assembly, and a power source. It is connected to an inexpensive ($17), commercially available remote controller that sends ultrasonic signals to a master control unit ($40) powered from a standard AC outlet. Each applicance to be controlled is plugged into a receiver module ($15) that switches the electric power on and off.

A typical system is shown in Fig. 1. The voice-actuated controller and remote control unit can be mounted on a wheelchair for mobile use or set on a table for single room use. Separate master control units can be placed in various rooms to control appliances, lamps, televisions, alarms, or a telephone specially equipped with speaker/microphone and special circuits to automatically dial the operator when the circuits are actuated. The current design provides control of up to seven appliances. A production model could provide up to 16 controls (the maximum capacity of the commerical remote control system).

Operation of the voice-actuated controller requires little training. More than 100 people have been tested on the system. Most of them have been
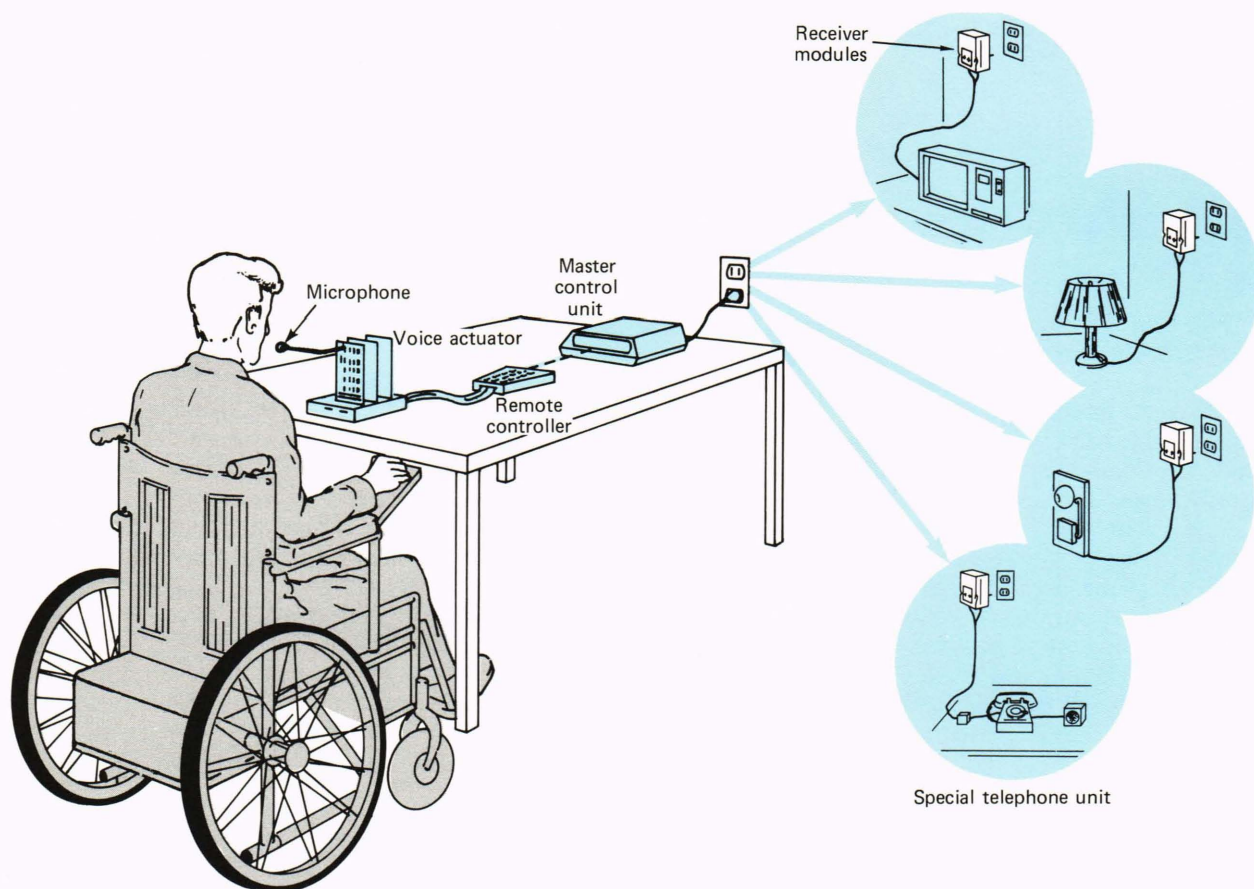

Fig. 1—The user controls his environment by making appropriately timed utterances to activate the remote controller. This information is then ultrasonically sent to the master control unit, which instructs the selected receiver module to perform the requested switch function. Note that the special telephone includes a speaker/microphone unit and special circuits to dial the operator automatically when activated.

able to operate the system properly with less than five minutes of coaching. The control process is shown in Fig. 2. As the system cycles through each display, the user waits until the top bar on the desired display lights and then utters a long syllable. The operator should be quiet while the lower bar is briefly lit. The upper bar then lights again briefly, at which time the operator must quickly utter a short syllable. The operator remains
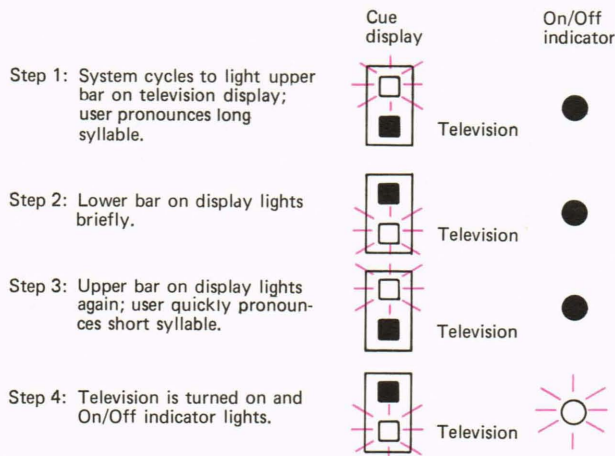

Step 1: System cycles to light upper bar on television display; user pronounces long syllable.

Step 2: Lower bar on display lights briefly.

Step 3: Upper bar on display lights again; user quickly pronounces short syllable.

Step 4: Television is turned on and On/Off indicator lights.

Fig. 2—Four-step process for user activation of a selected function (in this example, the television).

silent for 2.5 seconds, after which a series of beeps sound to indicate correct operation. The system will then resume cycling through all functions. When an attempt to activate an appliance is detected but does not fully meet the requirements, the display pauses at the attempted function. This permits another try at activation of a particular appliance without waiting a full cycle before the position is reached again.

Each appliance being controlled goes through continuing on/off cycles; i.e., if it is on, it will be turned off, and if it is off, it will be turned on.

For operator convenience, a test position for practice is included on the demonstration model with a separate display to indicate sound detection.

False activations with the demonstration model typically occur no more than once a day. It is hoped that a future model will have a standby mode, so as to further reduce the frequency of false activations. When the system is on standby, a normal activation utterance will be used to bring it into full operation. The system will return to standby after five minutes of no use. With this scheme, two false inputs within five minutes would be needed to cause an activation, thus making false activation highly unlikely.

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SUCCESSFUL LAUNCH OF MAGSAT

The National Aeronautics and Space Administration (NASA) Resource Observation Program has as one of its goals the use of space technology to advance our understanding of the processes that formed the present geologic features of the earth and how these dynamic processes relate to the emplacement of resources and to natural hazards.

One technique for achieving this goal is to measure the near-earth geomagnetic field. Before 1958, magnetic data from geographic regions were acquired over periods of years by means of numerous measurement techniques. But for many regions, particularly the oceans and the poles, data were either sparse or nonexistent.

Although measurements of the geomagnetic field from satellites began with the launch of Sputnik 3 in 1958, they have only been performed sporadically since, and only the NASA Polar Orbiting Geophysical Observatories (POGO's) have provided a truly accurate global geomagnetic survey. POGO's -2, -4, -6, operating between October 1965 and June 1971, obtained global measurements of the magnetic field magnitude approximately every 0.5 s over an altitude range of 400 to 1500 km, using

alkali-vapor magnetometers. These measurements were intended to map the main geopotential field originating in the earth's core, to determine the long-term time-related or local variations in that field, and to investigate short-term field perturbations caused by ionospheric currents. Several geomagnetic-field models and crustal anomaly maps based on the POGO data have been published. Their analysis has disclosed that, at lower altitudes, measurable field differences exist because of anomalies in the earth's crust, thus pointing the way to a new class of investigations.

Accordingly, NASA, with close United States Geological Survey (USGS) involvement, has undertaken to obtain measurements for the USGS to use in deriving magnetic-field maps that will be accurate for the 1980 epoch. Directional measurements will resolve ambiguities in field modeling and magnetic anomaly mapping. Increased resolution and higher signal levels from anomalous fields will help overcome shortcomings of the POGO data for making anomaly maps.

APL was selected to design, build, and test the satellite, known as MAGSAT, based on spare com-