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MULTI-PURPOSE EMBEDDED VOICE ASSISTANCE GADGET

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Abstract- One of the important problems that our society faces is that people with disabilities are finding it hard to cope up with the fast growing technology. In the recent years, there has been a rapid increase in the number of hearing impaired and speech disabled victims due to birth defects, oral diseases and accidents. When a deaf-dumb person speaks to a normal person, the normal person seldom understands and asks the deaf-dumb person to show gestures for his/her needs. Dumb persons have their own language to communicate to us; the only thing is that we need to understand their language. So, we need a translator to understand what they speak and communicate to us. In order to achieve this, we have proposed a system that can provide basic communication needs for a deaf-dumb person and also aid him in many ways. In the proposed system, we have used a speech recognition unit along with audio pre recorder and embedded controllers which will be helpful for deaf and dumb persons to express their needs to normal person. The frequently spoken words are stored in audio pre recorder which can be easily retrieved and also displayed using Liquid Crystal Display. The proposed device is also helpful for born deaf children to learn the basics of any language. In addition, voice based home automation system is also proposed for elderly and disabled people. Home automation system is achieved by wireless RF transmission and reception techniques integrated with our Embedded Voice Translator Kit. The proposed system along with text to speech converter and language translators as future enhancements will provide great assistance to deaf and dumb persons to portray their needs to society. Our system can also be incorporated for various applications like personal security, wireless TV remote control etc.

Keywords- *oral diseases, birth defects, Embedded Voice Translator, Home Automation, RF transmission and reception, Speech Recognition Device, children, training*

I. INTRODUCTION

India is a country which has a wide diversity of languages and dialects, people from one state finds difficult to communicate with people of another state. When person having all senses intact stumbles upon portraying his ideas to other persons then how knotty will it be for a person not having any of his sense organs functioning properly? The problems faced by the deaf and dumb people can be broadly classified into categories like social interaction, language and communication, behavioural problems, mental health and education. Their problems have been worsened by the absence of a proper sign language training centre in India. Various kinds of speech recognition systems are available today but there are hardly a few which help the 'deaf-and dumb'. Whatever the cause may be, they are rendered helpless and unable to communicate with the outside world! Hence it's high time that we not only focus on our development, but also theirs! We require a device that can aid them to communicate with normal people like us. Hence, in the view of helping this cause we have proposed a system that can aid deaf and dumb people to express their needs to a naturally gifted person. In addition to this we have also exposed the different fields or applications where our system will be beneficial one such field is Home automation. Home automation integrated along with Embedded Voice Translator Kit will be of great use to elderly and the disabled people. Our proposed system will be handy and also cheap compared to other speech aid systems. We have made use Speech Recognition module, Audio pre recorder and Liquid Crystal Display along with wireless RF transmission and reception techniques to help the ailing class of society.

II. EXISTING SYSTEM

A. Sign Language:

Sign language is one of the traditional techniques in providing aid to deaf and dumb persons to convey their needs. It involves orientation and movement of the hands, arms or body, and facial expressions to fluidly express a speaker's thoughts. This technique focuses mainly on the communication between two deaf and dumb persons but not upon the communication between a common human being without any to disability to a disabled person. The main drawback of sign language is that it is not common all over the place. Basically there are three types of sign languages English, French and Spanish which further adds to the burden of the disabled person as well as the instructor or trainer. In India, their problems have been worsened by the absence of a proper sign language training centre.

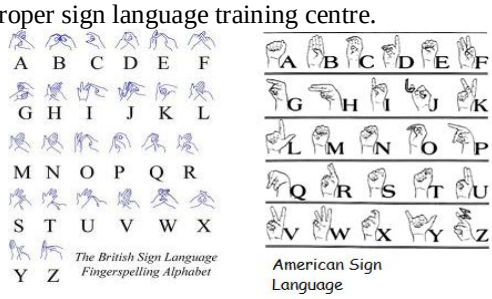

Fig. 1 : British and American Sign Languages

B. Complicated Sensors Aid:

Researchers have found new devices to provide voice to a vocally disabled person. In some cases they have used six Ag-500 Articulograph sensors which has to be fixed over their lips. Various reference points assigned on the mouth as the user moves his lips to talk. Then this is calculated using those six sensors and feeds it to the software part of the. The distance is mapped with its equivalent SAMPA code. The SAMPA code is fed as input to a voice generating software which produces the final voice. But the drawback with this idea is it is not practically possible to a large dimension of society and also not a cost effective solution. It also affects the comfort of the user by placing sensors in the mouth. Many people cannot afford the device.

Fig. 2 : Location of AG-500 sensors in the mouth

a. tongue dorsum
b. midpoint of tongue body
c. tongue tip
d. base of low front incisors
e. lower lip
f. upper lip
g. bridge of the nose
h. base of upper front incisors

III. PROPOSED SYSTEM

To develop an **EMBEDDED VOICE-BOX AID** [EVB]for deaf and dumb persons that can translate their phenotype language to understandable language of a normal person and thereby enabling them to get better understanding of normally spoken words. Our device will be beneficial in teaching and training them with basics of any language depending upon the preference of language in their region. As our device can be used for multipurpose applications we have incorporated voice enabled home automation system using wireless RF transmission and reception techniques which will be handy and useful for a deaf and dumb persons who can be physically challenged and also for elderly persons. The proposed system will be advantageous due to the following reasons.

- The proposed model is quite portable.
- Differently-abled persons can easily be trained.
- The component and implementation cost are quite low.
- The proposed model is affordable to all masses of the society.
- Translation can be made to any language.
- Wide range applications.
- Upgraded easily.

System Overview

In order to achieve the proposed concept we have made use of advanced speech recognition module, audio pre recorder and LCD display along with embedded controller and RF transmitter and receiver ICs with corresponding encoding and decoding functions. The figure2 shows the functional blocks of the proposed system

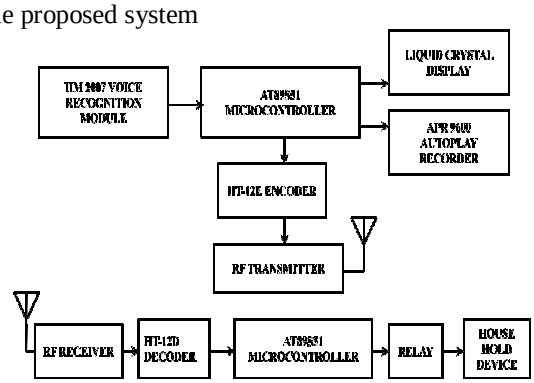

Figure 3. Functional blocks of Embedded Voice Assistance Gadget

III. HARDWARE DESIGN

The system consists of following modules and components in turn to accomplish the requisite functions of the planned device

MOBILE HANDHELD SYSTEM

- Speech Recognizer System.
- Data Abstraction and control Unit.
- Audio Playback Unit
- Display Unit.
- Transmission Unit

APPLIANCE CONTROL SYSTEM

- Reception Unit.
- Data Abstraction and Control Unit 2
- Switching Unit.

A. Speech Recognizer System

The module is used for storing and recognizing the voice of the user. It has HM2007 IC, DTMF keypad, RAM, latches, 7 segment decoder and 7 segment displays. In this module we will first Press “1” (display will show “01” and the LED will turn off) on the keypad, then press the TRAIN key (the LED will turn on) to place circuit in training mode, for word one. As we know that a dumb person will be able to produce phenotype sounds we will use his such as “BAA” ,BO,AB,AK etc as target words. Say the target word into the onboard microphone (near LED) clearly. The circuit signals acceptance of the voice input by blinking the LED off then on. The word (or utterance) is now identified as the“01” word. If the

LED did not flash, start over by pressing "1" and then "TRAIN" keys. Press "2" then TRN to train the second word and so on. The circuit will accept and recognize up to 20 words (numbers 1 through 20).If we want to store a large number of words we can increase the memory of the module by placing extra RAMs or by using other types of voice recognition module like SR06.

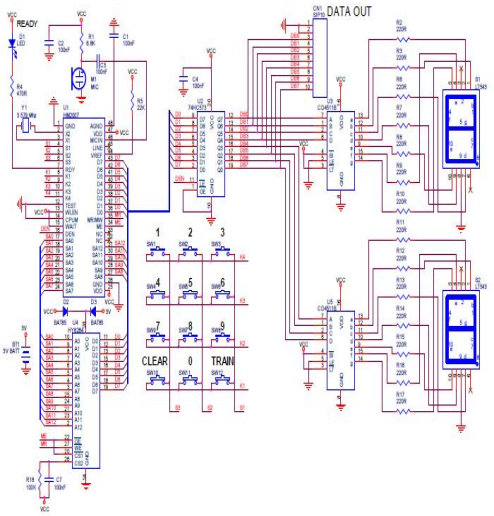

Fig. 4 : Speech Recognizer System

B. Data Abstraction And Control Unit-1(Transmitter Section-AT89S51)

The microcontroller gets particular address of particular word from speech recognition unit and links the address to corresponding words stored in APR9600 and LCD. Microcontroller is the heart of the system where by means of specific coding using embedded C and Keil software all the control operations are carried out. The software codes are simple and can be modified to user's requirements for specific applications. It compares the recognized word's address with the message pins of APR and triggers the matched pin to play the message spontaneously.

C. Playback Unit(APR 9600)

Audio pre Recorder is used to record and playback the recorded voice for some specified duration. APR is also trained in the same way as voice recognition circuit. When the corresponding location of APR is pressed then the recorded character in that location will be played. There are other types of APR like 6016, 6008 etc which have voluminous storage capability of messages which can also be used depending upon the preference of application needed. APR9600 eliminates the need for encoding and compression, which often introduces distortion. The two modes of APR are:

RECORDING MODE: The CE and RE pin is set to low. The corresponding pin for the message to be recorded is selected and recorded with the help of a microphone for a specified duration.

PLAYBACK MODE: The CE pin is set to low and the RE pin is set to high. The corresponding message pin is pressed to play the stored message that is heard through loudspeaker

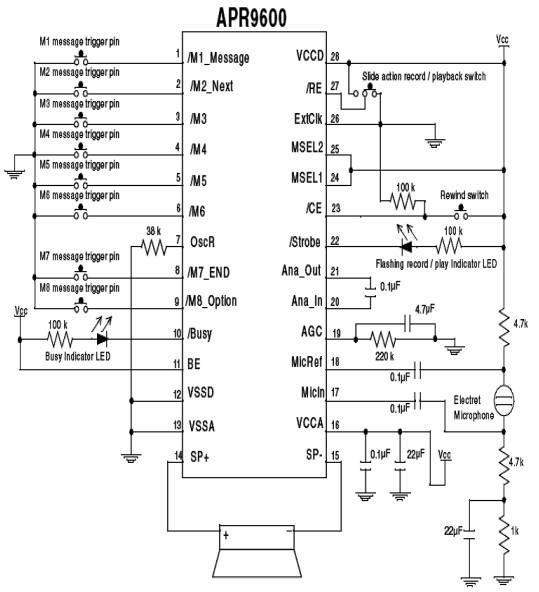

Fig. 5 : APR circuit diagram

D. Display Unit(LCD)

A 16x2 LCD (Liquid Crystal Display) screen is an electronic display module which is used for displaying the words corresponding to those spelt out by APR9600.The display controlled totally by the microcontroller; this is achieved by using internal controller coding using KEIL IDE. We have used HD44780U dot matrix liquid crystal display.

The HD44780U dot-matrix liquid crystal display controller and driver LSI displays alphanumeric, Japanese kana characters, and symbols. It can be configured to drive a dot-matrix liquid crystal display under the control of a 4- or 8-bit microprocessor. A single HD44780U can display up to one 8-character line or two 8-character lines

The low power supply (2.7V to 5.5V) of the HD44780U is suitable for any portable battery-driven product requiring low power dissipation.

E. Transmitter Unit(HT12E Encoder And TWS-434 Transmitter)

Transmitter section comprises of HT12E encoder and TWS 434 transmitter IC's.HT12E is an encoder integrated circuit of 2^{12} series of encoders. HT12E Encoder gets the input command from microcontroller and encodes the parallel data to serial data which is suitable for wireless transmission.HT 12E is an 18 pin Integrated Circuit used mainly in RF and infrared transmission. It has 12 address pins and 4 data pins. In our system we have grounded the address pins and used four data pins for transmission.

The pins are grounded for easy reception at the receiver.

INPUT	OUTPUT	GROUND
• Pins 10,11,12 and 13 • Parallel	• Pin 18 to RF transmitter • Serial	• Pins 1 to9 • Pin 15 and 16 oscillator control

Fig. 6: Pin connections of HT12E

TWS-434 Transmitter modulates encoded serial data with generated carrier, using ASK Modulation at 433.92MHz. RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4.The transmitter output is up to 8mW with a range of approximately few meters, it accepts both linear and digital inputs. It can operate from 1.5 to 12 Volts-DC. The transmission occurs at the rate of 1Kbps -10Kbps.

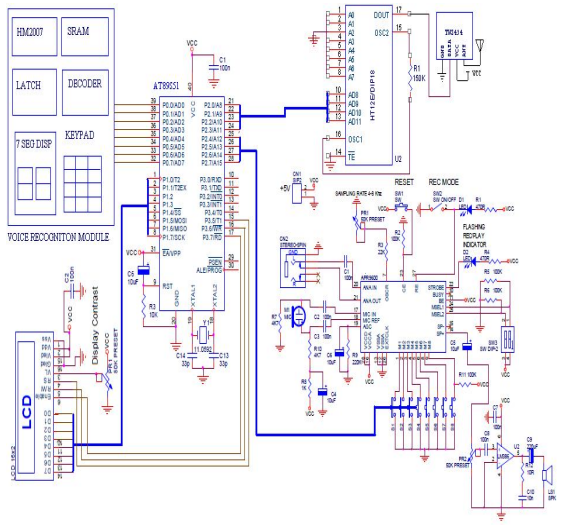

Figure – 7 : Full circuit diagram of Mobile Handheld System

F. *Reception Unit (HT12D Decoder And RWS-434 Receiver)*

The data transmitted from the transmitter section has to be effectively received and decoded to provide control signals to respective devices. In order to receive the coded data we use RWS 434 IC to demodulate the received signal from a carrier of 433.92 MHz and give serial output to a decoder. The RF receiver has a sensitivity of 3uV. It operates from 4.5 to 5.5 volts-DC and provides both linear and digital outputs. The data rate is about 3kbps.

HT12D is an 18 pin DIP which is used to decode the demodulated signal from RWS434.The decoded output is a four bit parallel which is given as input to microcontroller for purpose of switching a device. HT12D converts the serial input into parallel outputs. It decodes the serial addresses and data received by, say, an RF receiver, into parallel data and sends them to output data pins. The serial input data is compared with the local addresses three times continuously. The input data code is decoded when no error or unmatched codes are found. A valid transmission in indicated by a high signal at VT pin. HT12D is capable of decoding 12 bits, of which 8 are address bits and 4 are data bits.

G. *Data Abstraction And Control Unit2 (Receiver Section)*

The microcontroller gets the input from decoder and depending upon the stored command it controls operation of relays connected on different ports. Atmel's AT89s51 microcontroller is used in the receiver section for the purpose of controlling the various household devices. The four control data bits are interfaced to four pins of microcontroller.

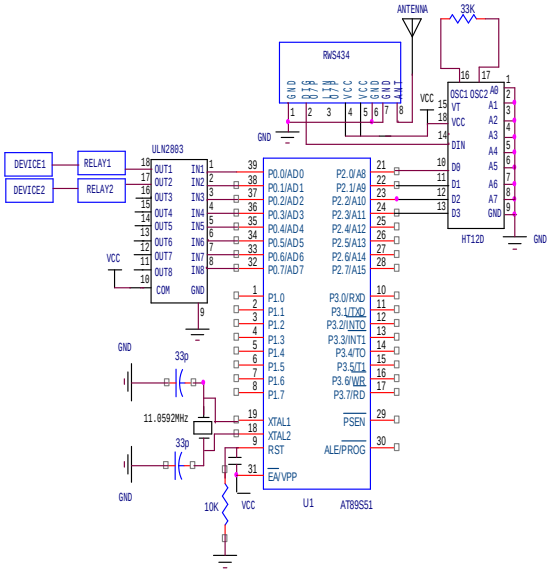

Fig. 8 : Circuit Diagram of Appliance Control System

H. *Switching Unit:*

The relays are electromagnetic switches which are connected to various household devices. These relays either open or close thus switching on and off of various devices. Commonly used relays are available in different configuration of operating voltages like 6 V, 9 V, 12 V, 24 V. In a basic relay there are three contactors: normally open (NO), normally closed (NC) and common (COM). At no input state, the COM is connected to NC. When the operating voltage is applied the relay coil gets energized and the COM changes contact to NO. Different relay configurations are available like SPST, SPDT, and DPDT etc, which have different number of changeover contacts. By using proper combination of contactors, the electrical circuit can be switched on and off.

DRIVER IC ULN2803:

The ULN2803 Integrated Circuit (IC) is an "Eight-way Line Driver". The IC takes small current at its 8 input pins (pins 1 to 8) and allows much larger current (up to one amp) to flow via its output lines .It is a monolithic high voltage and high current Darlington transistor arrays. It consists of eight NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diode for switching

inductive loads. The Darlington pairs may be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED gas Discharge), line drivers, and logic buffers. In the proposed system, the input pins of ULN 2803 are interfaced with the output pins of microcontroller for the purpose of switching device ON and OFF

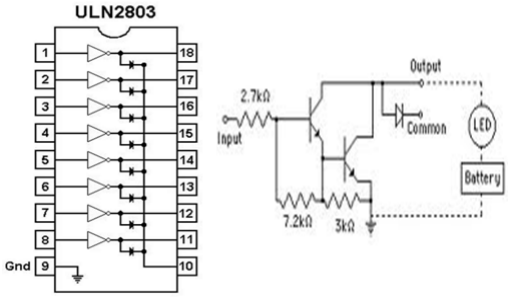

Fig. 9 : ULN 2803 Internal Diagram

I. Power Supply:

The power supply circuit is built using filters, rectifiers, and voltage regulators. The 220 V AC is stepped down to (9-12) V AC voltage, which is then rectified to a variable DC voltage. The DC voltage is then filtered and finally, regulating to obtain a desired fixed DC voltage. The regulation is usually obtained from an IC voltage regulator unit (7805), which takes a DC voltage and provides a somewhat lower DC voltage, which remains the same even if the input DC voltage varies, or the output load connected to the DC voltage changes. We can also go for rechargeable battery sources in order to increase the effectiveness of the system.

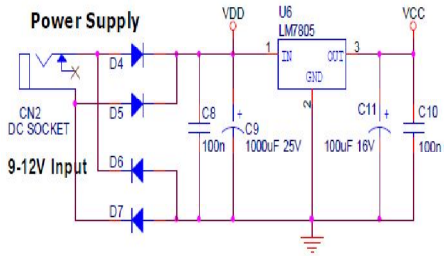

Fig. 10 : Power Supply Circuit

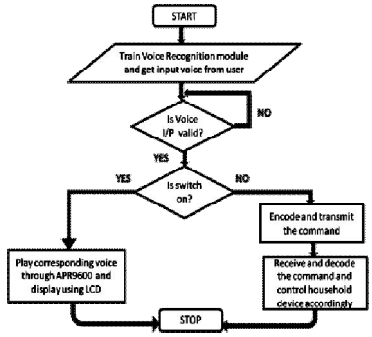

Fig. 11 : Working Flowchart of The Proposed System:

VI. SOFTWARE REQUIREMENT:

KEIL C is an essential requirement to achieve the objective of the proposed system. Programming for the microcontrollers is done in embedded C language using this software. The algorithm for accomplishing the functions of each unit is

STEP 1: Declare the ports of the microcontrollers assign them to various interfaced devices.
STEP 2: Define the control pins
STEP 3: Declare and define LCD delay, command, data and display functions.
STEP 4: Initialize the LCD
STEP 5: Set the ports to default values like P0=0x00 and P2=0xff
STEP 6: Check for device operation mode (VOICE ASSISTANCE or APPLIANCE CONTROL)
STEP 7: If ***VOICE ASSISTANCE MODE*** get the voice input compare with stored address.

```
if (voice==0x01)
{
for(i=0;msg1[i] != '\0';i++)
lcd_disp1(); //Display the message1
RV1=0;      // Play recorded voice1
}
```

STEP 8: If ***APPLIANCE CONTROL MODE*** get the voice input and activate corresponding pins

```
if(voice==0x01)
T_d0=0;
if(voice==0x02)
T_d1=0;
```

STEP 9: At receiver side declare and define pins of controller, on receiving valid data activate the respective devices interface to it through relays and drivers.

```
if(R_d0==0)
{
device1=1;          //Device1 made ON
}
if(R_d1==0)
{
device1=0;          //Device1 made OFF
}
```

STEP 10: Stop

VII. CONCLUSION AND FUTURE WORK

The proposed system is useful in providing voice aid to deaf and dumb persons and also can be upgraded to support a wide range of applications including voice based wireless home automation .As the device utilizes components available in the market at cheaper cost on large scale manufacturing costs will further lower down. The proposed gadget can be modified and be used according to the type of user.

The device can also be used to train and teach born deaf children the basics of any language, for example making them understand alphabets of English and also assist them to practice new words. The device is portable so these children can use them to

communicate their thoughts to a stranger whom they meet.

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