Voice Recognition Based Home Automation System for Paralyzed People

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ABSTRACT

Automation is a trending topic in 21st century making an important role in our daily lives. Automation reduces the human labor, time, effort and some human errors. The key objective of our project is to design a system for physically handicapped persons to control and operate home appliances and their own wheel chair by their own voice. Both these qualities are present in our project which has the capability to replace existing technologies. the design of the low cost voice recognition based home automation system for the physically challenged people suffering from quadriplegia or paraplegia (who cannot move their limbs but can speak and listen) to control the various home appliances just by his/her voice commands according to their need and comfort. We also implemented a messaging concept. In this whenever the patient or the person needs a help, if he/she pronounce as help a message will be sent to their respective represented family member. The resultant system can provide a great assistance to the physically handicapped people without any need of third person.
KEYWORDS: HOME AUTOMATION SYSTEM ARDUIINO-UNO, VOICE RECOGNITION MODULE, RELAY CIRCUIT, GSM MODULE AND ROBOTIC WHEEL CHAIR.

I. INTRODUCTION

The home automation systems are getting more popularity day to day due to their ease of use and wide operational capabilities and more applications. This Integrating voice recognition technology for home automation systems for paralyzed people can make the system more user friendly and easy to operate and control. Some require home automation system to satisfy their needs and comfort while for physically challenged people it can provide great assistance for the patients.

There are several researches and developments on the home automation systems. The voice recognition based home automation system for paralyzed people uses the speech recognition module to recognize the voice commands. The RF trans-receiver is used to send these commands to the controller to control the various electrical devices and robotic wheel chair. Using of the computer makes this system more expensive and difficult to handle it. Intelligent home navigation system for disabled person uses voice recognition module v3 for the speech recognition process. An Arduino controller, a wheel chair and a navigation module. The Arduino receives the command from the voice recognition module and move the wheel chair accordingly thus eliminating the need of any third person's assistance.

This proposed a home automation system uses the voice recognition module v3 for the voice recognition function, a microcontroller and relay

module are used for the controlling functions like switching lights on and off etc. Here RF trancereciever is used which eliminates or reduces the need of additional wiring required for the signal transmission.

We can also control the home appliances by two methods by voice commands or by using android mobile as a remote controller. The voice recognition is done by the android application and thus given to the controller to control the devices. . When the key on remote controller is pressed the controller sends the commands via Bluetooth module to the receiver and corresponding action on the receiver side is taken, of course we didn't implemented in this project.

II. SYSTEM DESIGN

The home automation system which is we proposed is a way to control home appliances that are by using the voice commands. When the given command is recognized this information is transferred to the control circuit through controller serial port and the corresponding device is turned on or off. By using GSM Module we can sends the messages of help to the people. The voice recognition based home automation system is an integrated system to facilitate the elderly and physically challenged people with an easily operated home automation system that operates fully on voice commands. The functional block diagram of the proposed system is shown in below block diagram.

It consists of all theoretical background and literature reviews of voice recognition. In addition, a review of past method and features of svoice recognition is also included. The speech input from microphone is given to the voice recognition module where the speech signal is compared with the previously stored trained voice samples.

Upon successful recognition of voice command the Arduino microcontroller actuates corresponding electrical device using a the relay module like turning on lights using the relay module and it also guides the robotic wheel chair through driver module. The data from the illumination sensor is processed in Arduino controller and based on a set point value the automatic control action is taken to switch off the lights to save energy. The buzzer sounds when disabled person need is calling for help or when he needs somebody's assistance.

III. HARDWARE DESIGN

1. MICRO PHONE

Definition: A microphone is a transducer that converts sound into an electrical signal.it is commonly named as Mic or Mike. Microphones are used in many applications such as telephones, hearing aids, public address systems for concert halls and public production recorded audio engineering, sound recording, two way radios, megaphones, radio and television broadcasting, and in computers for recording voice, speech recognition, VoIP, and for non-acoustic purposes such as ultrasonic sensors or knock sensors.
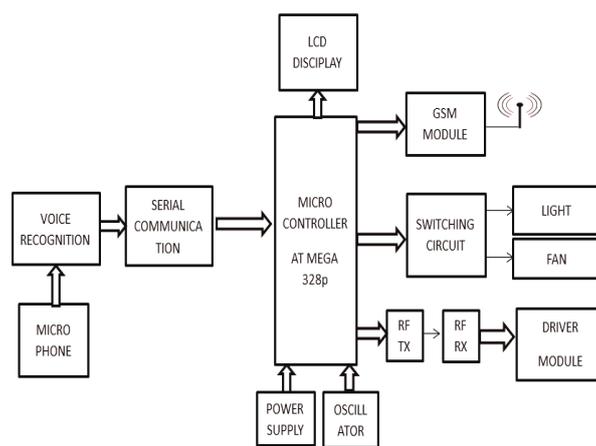

Figure 1: Block Diagram

2. ARDUINO-UNO

ATMega328p is the ATMEL Microcontroller on which Arduino UNO is based circuitry. This product let you to realize your small project without using a full size Arduino boards. To make this microcontroller working with the Arduino IDE you need a 16MHz crystal, a 5 V power supply and a serial connection.

The ATmega328/P controller provides the following features:

32Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 1Kbytes EEPROM, 2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, Real Time Counter (RTC), three flexible

Fig-2: Arduino-Uno

Timer/Counters with compare modes and PWM, it also consists of 1 serial programmable USARTs , 1 byte-oriented 2-wire Serial Interface (I2C), a 6- channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages),a programmable Watchdog Timer with internal Oscillator, an SPI serial port, and it also consists of six software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM; Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or hardware reset. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping.

The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous timer and ADC to minimize or reduce the switching noise during ADC conversions. In Standby mode, the crystal/resonator oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption. In Extended Standby mode, both the main oscillator and the asynchronous timer continue to run.

3. VOICE RECOGNITION MODULE:

Voice controlled devices basically uses the principal of speech recognition. It is the process of electronically converting or transforming a speech waveform (as the realization of a linguistic expression) into words (as a best-decoded sequence of linguistic units). Converting a speech waveform into a sequence of words involves several essential steps, they are:

1. A microphone receives the signal of the speech to be recognized and converts it into an electrical signal. A modern speech recognition system also requires that the electrical signal be represented digitalized by means of an analog-to-digital (A/D) conversion process, so that it can be processed with a digital computer or a microprocessor.
2. This speech signal is then analyzed (in the analysis block) to produce a representation consisting of salient features of the speech. The most prevalent feature of speech is derived from its short-time spectrum, measured successively over short-time windows of length 20–30 milliseconds overlapping at intervals of 10–20ms.Each short-time spectrum is transformed into a feature vector, and the temporal sequence of such feature vectors thus forms a speech pattern.
3. The speech pattern is then compared to a store of phoneme patterns or models through a dynamic programming process in order to generate a hypothesis (or a number of hypotheses) of the phonemic unit sequence. (A phoneme is a basic unit of speech and a phoneme model is a succinct representation of the signal that corresponds to a phoneme, usually embedded in an utterance.) A speech signal inherently has substantial variations along many dimensions.
4. Speaker dependent systems are trained by the individual who will be using the system. These systems are capable of achieving a high command count and better than 95% accuracy for word recognition. The drawback to this approach is that the system only responds accurately only to the individual who trained the system. This is the most common approach employed in software for personal computers.
5. Speaker independent is a system trained to respond to a word regardless of who speaks. Therefore the system must respond to a large variety of speech patterns, inflections and enunciation's of the target word. The command word count is usually lower than the speaker.

Fig-3: voice recognition module

Parameters:

- ✓ Voltage: 4.5-5.5V.
- ✓ Current: <40mA.
- ✓ Digital Interface: 5V TTL level for UART interface and GPIO.
- ✓ Analog Interface: 3.5mm mono-channel microphone connector + microphone pin interface.
- ✓ Size: 31mm x 50mm.
- ✓ Recognition accuracy: 99% (under ideal environment).

Features:

- ✓ Support maximum 80 voice commands, with each voice 1500ms (one or two words speaking).
- ✓ Maximum 7 voice commands effective at same time.
- ✓ Arduino library is supplied
- ✓ Easy Control: UART/GPIO.
- ✓ User-control General Pin Output.

4. GSM MODULE:

GSM (Global System for Mobile Communications, originally Grouped Special Mobile) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones, first deployed in Finland in July 1992.GPRS module is a breakout board and minimum system of SIM900 Quad-band/SIM900A Dual-band GSM/GPRS module. It can communicate with controllers via AT commands (GSM 07.07, 07.05 and SIMCOM enhanced AT Commands). This module supports software power on and reset.

Fig-4: GSM Module

Features:

- ✓ Dual-Band 900/ 1800
- ✓ Status indicator (D5): It will flash continuously whenever the call arrives otherwise it is left ON.
- ✓ Network LED (D6): This led will blink every second

5. POWER SUPPLY

A power supply is an electronic device that supplies electric energy to an electrical load. The primary function of a power supply is to convert one form of electrical energy to another and, as a result, power supplies are sometimes referred to as electric power converters.

Some power supplies are discrete, stand-alone devices, whereas others are built into larger devices along with their loads. Examples of the latter include power supplies found in desktop computers and consumer electronics devices.

6. LCD

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.
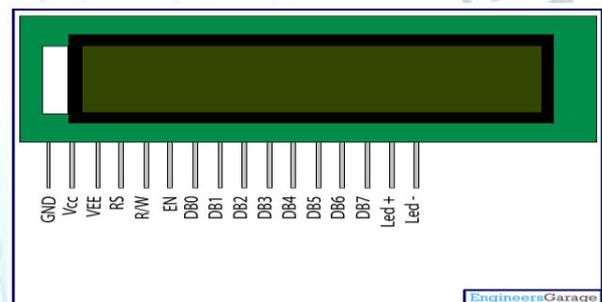

Fig-7: LCD

FEATURES:

- ✓ Built-in controller (KS 0066 or Equivalent)
- ✓ + 5V power supply (Also available for + 3V)
- ✓ 1/16 duty cycle
- ✓ B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
- ✓ N.V. optional for + 3V power supply.

7. RF TRANSMITTER AND RECIVIER

An RF Module is a small electronic circuit which is used to receive, transmit or transceiver radio waves on one of a number of carrier frequencies. A wireless radio frequency (RF) transmitter and receiver can be easily made using HT12D Decoder, HT12E Encoder and ASK RF Module. Wireless transmission can be done by using 433 MHz or 315MHz ASK RF Transmitter and Receiver modules.

A transceiver is a device that contains a transmitter and a receiver which is both combined and share common circuitry. Transceivers combine a significant

amount of the transmitter and receiver handling circuitry. An RF Transceiver utilizes RF modules

for high speed data transmission. It Operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).
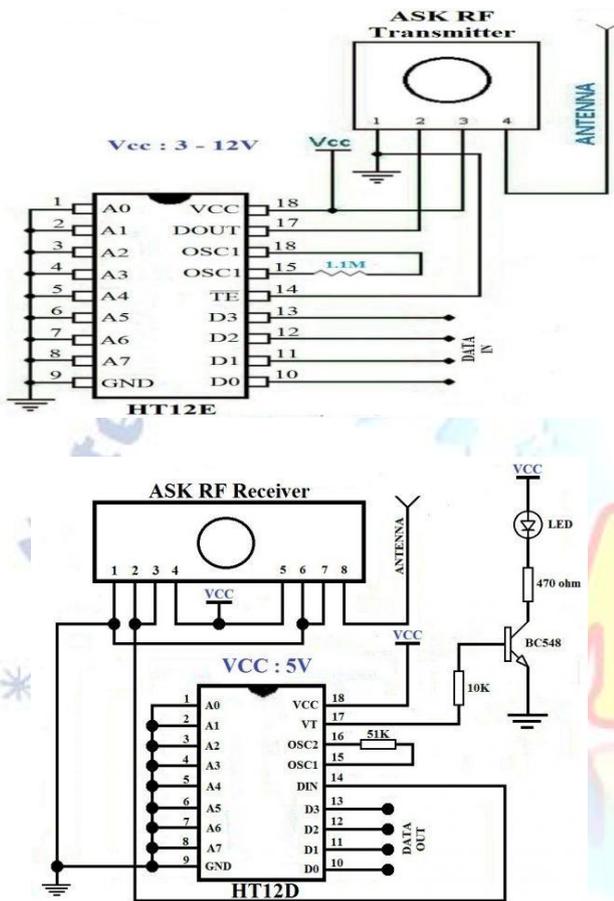
circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.
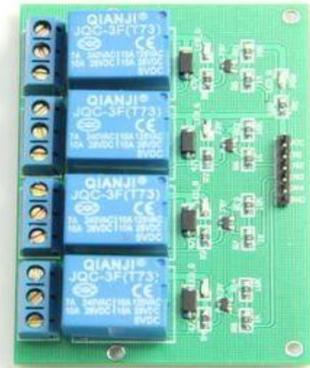

Fig-6: Relay Module

Pin description
Input:
  ✓ Vcc   : positive voltage supply
  ✓ Ground   : ground
  ✓ IN1-IN4   : relay control port
Output:
  ✓ Connect a load.
  ✓ DC 30V/10A.
  ✓ AC 250V/10A.

IV. RESULT

The main objective of this project is to design voice recognition based home automation system for controlling appliances according to the voice commands given by the user. The recognized voice command makes Arduino to switch the relay for ON and OFF, change the direction of driver module .It needs to sends the messages to the neighbors or guardians by using GSM module. There is a LCD to display the given voice commands.

Fig-5: RF TX&RF RX

ASK RF Receiver receives the data which was transmitted by using ASK RF Transmitter. HT12D decoder will convert the received serial data to 4 bit parallel data D0 – D3. The status of these address pins A0-A7 should match with status of address pin in the HT12E at the transmitter for the transmission of data. The LED connected to the above circuit glows when valid data transmission occurs from transmitter to receiver. 51KΩ resistor will provide the necessary resistance required for the internal oscillator of the HT12D.

8. RELAY MODULE

A relay is   an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several
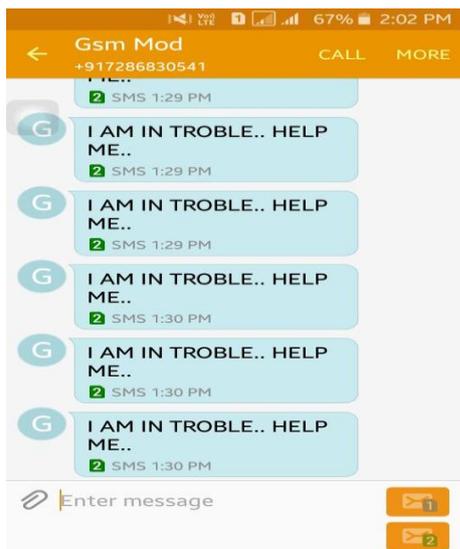
Fig -5: final result
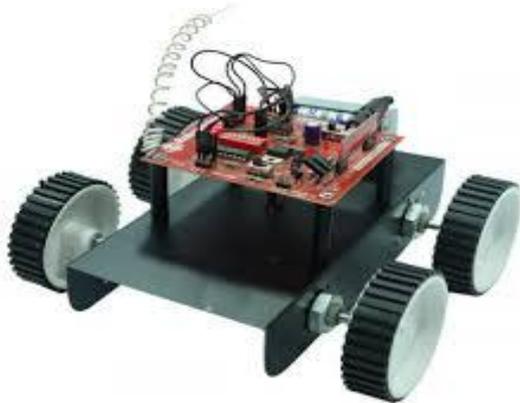

Fig 6: message request

Fig: 7 wheel robot

V. CONCLUSION

The voice recognition based home automation system was built and implemented. The system is specially designed for people suffering from paralysis and also elderly people. The use of voice commands eliminates the need to remote controllers and other electronic device and makes it easy to interact with the system to perform automation and control electrical devices.by using GSM disabled person to notify the guardians whenever the person needs help.

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