Smart Switchboard using Touch and Voice Commands

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ABSTRACT-- *Presently a "Smart Home" technology is increasing day by day therefore designing of low cost Smart Switchboard is become an essential for smart home. This will improve safety to the user, save the energy, and effective usage of electrical appliances and equipments. The proposed system consists of voice recognition, touch screen, microcontroller, and relay drivers to switch the appliances. The voice recognition is done through MATLAB and it needs to be trained first before it can be used to recognize commands. Upon successful recognition of voice command the controller drives the corresponding load with the help of the relay circuit. To improve efficiency and aesthetic look purpose we add touch control feature. This system is most suitable for the elderly and the disabled persons especially those who live alone and since recognize voice so it is secure. This system is intended to control or ON/OFF the lights and electrical appliances in a home or office using voice commands as well as touch control.*

KEYWORD: Switchboard, Voice recognition, Touch screen, Microcontroller, Power supply

I.   INTRODUCTION

The Smart Switchboard using Touch and Voice Commands is a voice as well as touch controlled home automation system which controls home appliances. The paper mainly aims in designing completely automated switch board with the help of voice recognition system and touch sensor to control the house hold appliances to operate the devices effectively. Physically challenged peoples meet barriers of all types, for that technology is helping to reduce these barriers. These peoples are not capable to ON/OFF the switches of the switchboard using their hands also in normal switchboard we have to stand up and push the switch manually so that is waste of time. Here the user operate switchboard by using their voice also we added touch control for efficiency purpose. The overall system is controlled from a microphone which is connected with speech recognition system. This speech recognition system built using MATLAB software. It sends the voice commands in binary sequence to the microcontroller. According to voice commands microcontroller it change the state of the relays which drives the home appliances. The advantage of the smart switchboard is that it can be operate from a safe distance either from inside the room or outside the room. This advantage makes it shock proof.

Figure1: Simple Module

II.   RELATED WORKS

There have been several researches and developments on the home automation systems. The voice recognition based home automation system [1] uses the Microsoft speech API running on PC to recognize the voice commands. The RF transreceiver is used to send these commands to the controller to control the various electrical devices. The use of computer makes this system more expensive and difficult to handle. The voice recognition based home automation system [2] uses Lab VIEW to perform speech recognition and Zigbee module with a controller is used to control the devices wirelessly. The

Limitation of the system [1] [2] is the use of the computer which makes system more expensive. [3] Proposed a home automation system which comprises a DSP processor for the voice recognition function, a microcontroller and relay module for the appliances control function like switching lights on-off etc. Zigbee wireless module is used which eliminates the need of additional wiring required for the signal transmission. [4] Proposed a home automation system for elderly and physically challenged people can control the home appliances by two methods by voice commands or by using mobile as remote controller. The voice recognition is done by the android application and thus given to the controller to control the devices.[5] Proposed a Bluetooth based home automation system which comprises of a remote controller interfaced with microcontroller which is additionally interfaced with the Bluetooth module to provide wireless control of the appliances. When key on the remote controller is pressed the controller sends the command via Bluetooth module to the receiver and corresponding action on the receiver side is taken.

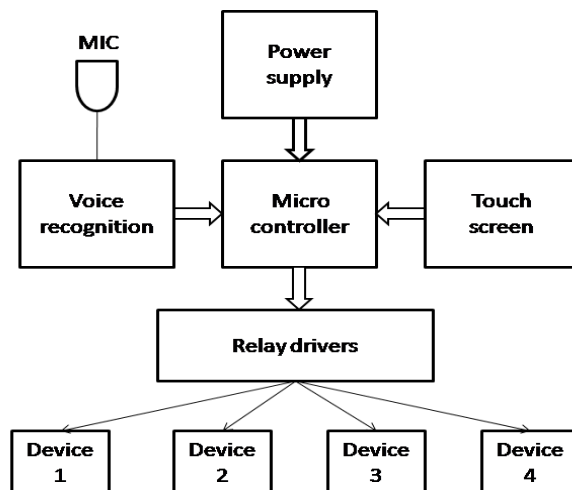### III.   SYSTEM OVERVIEW

Figure 2: System Block Diagram

The basic system operation of smart switchboard is to controlling the home appliances by using voice recognition system as well as touch screen. Initially we need to train the Voice recognition system for that voice commands are first stored into the memory of system. The control unit is interface with voice reorganization system and touch screen to turn ON or OFF the device and control the devices. The microC software can used to program the microcontroller and process the data. First the voice command is captured by a microphone and sent to the voice recognition system. It compares this command with predefined voice commands, after a successful match it gives command in form of digital pulse sequence and sends to the microcontroller. Then the Arduino Uno atmega328 microcontroller processes on this data and responds according to the voice commands either ON or OFF the particular device. Similar way we also uses touch panel made using touch screen to operate relay. A single finger touch sense by the touch screen and it generate the single high pulse, this pulse gives to microcontroller which drives the relay circuit and ON/OFF the particular device.

IV.   Hardware description:

A. *TOUCH SCREEN*

This is a 4-wire analog resistive touch screen. That is by touching the screen at one point, resistance between edges is formed for both the x and y axis. As you move your finger across the screen the resistance changes between opposite sides of each axis. By applying voltage across each axis, a change in resistance results in a change in voltage. Thus a simple ADC with a microcontroller can be used to find x and y positions. Add this touch screen to any LCD of requirement. Readings are taken by applying 5V across two of the pins and performing an analog to digital conversion on the other two pins. The full X and Y position can be achieved by using only 4 GPIOs.
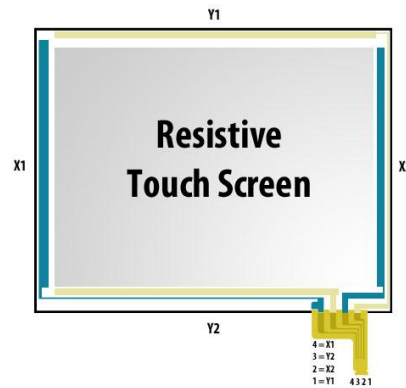
Figure 3: Touch Panel

In this project we are using touch screen as an input device for the system. First we will observe the analog values for different positions on touch screen. Depending on these values complete touch screen module is divided into eight quadrants. Among them four quadrants are used as switching purpose.

B. RELAY

A single relay switch connection to microcontroller is shown below. Any home appliance operating under A.C voltage supply could be connected directly with this relay interface circuit. A buzzer can also be connected by applying +12V at the common terminal of relay. Remaining relays of the interface circuit board could also be configured with the microcontroller in the similar fashion.
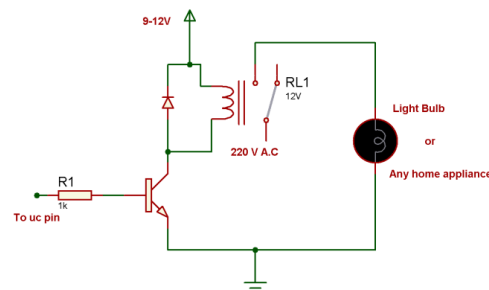

Figure 4: Relay
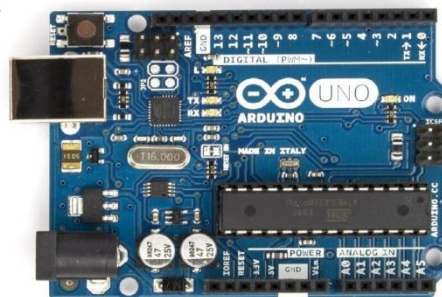
C. Arduino Uno Microcontroller

Figure 5: ArduinoUno Atmega328 microcontroller

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything that supports the microcontroller; simply connect it to a computer with a USB cable with an AC-to-DC adapter or battery to get started. The Uno differs from all existing boards in that it doesn't use the FTDI USB to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to versionR2) programmed as a USB-to-serial converter "Uno" means one in Italian and is

named to indicate the upcoming version of Arduino 1.0.The Uno and version 1.0 will be the reference versions of Arduino. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.
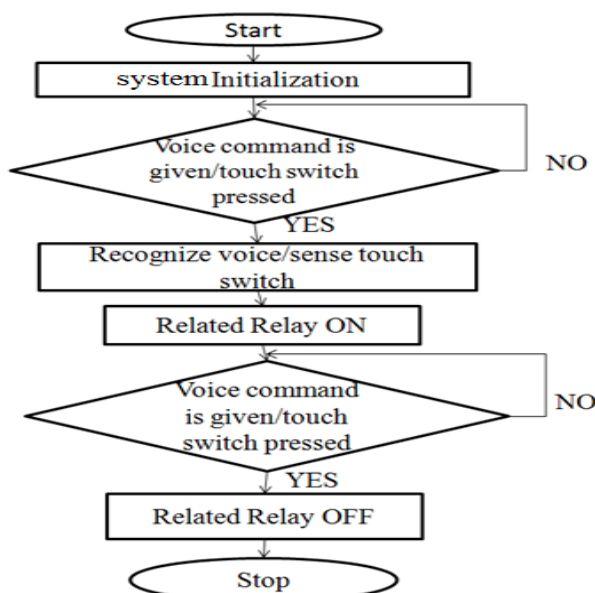
V.   SYSTEM FLOW

Figure 6: Flow Diagram

Step1: Turn ON the Power supply and wait for few seconds for system initialization.
Step2: If any voice command is given or sensor detects the touch, the microcontroller sends high pulse to relay which turn ON the particular device. Otherwise it will continuously sense any voice command or touch tap.
Step3: Secondly when the voice command is given for turn OFF the device then it is detected by microphone and given to voice module and microcontroller change the state of the relay which turns of the particular device. Otherwise it will continuously sense any voice command or touch tap.

VI.   MATLAB VOICE RECOGNIZATION

The name MATLAB stands for MATrixLABoratory. MATLAB was written originally to provide easy access to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects. MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming environment. Furthermore, MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming. These factors make MATLAB an excellent tool for teaching and research.MATLAB has many advantages compared to conventional computer languages (e.g., C, FORTRAN) for solving technical problems. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. The software package has been commercially available since 1984 and is now considered as a standard tool at most universities and industries worldwide.It has powerful built-in routines that enable a very wide variety of computations. It also has easy to use graphics commands that make the visualization of results immediately available. Specific applications are collected in packages referred to as toolbox. There are toolboxes for signal processing, symbolic computation, control theory, simulation, optimization, and several other fields of applied science and engineering.
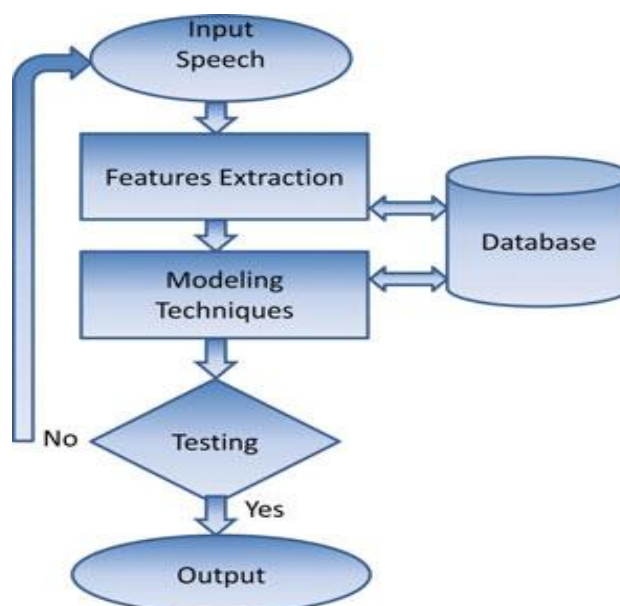
Figure 7: Voice Recognition

A. MFCC

Mel frequency Cepstral Coefficient (MFCC) is used to extract the features from voice and Vector quantization technique to identify the speaker. Voice has an infinitive amount of information, we have to determine who is the person speaking based on the features of the person´s voice. So an analysis in the frequency domain can be a more viable option. Extract the parametric representation of voice signals is a vital process for the recognition performance. MFCC is a technique based on human hearing behavior that cannot recognize frequencies over 1Khz.

B. LPC

The linear predictive coding method was developed, which has four basic processing steps of emphasizing, framing, windowing, and auto correlation. In pre-emphasizing, the digitized speech signal is flattened to make it less susceptible to finite precision effects. In frame blocking, the output signal is blocked into frames of N different samples, where adjacent frames are separated by the number of M samples. In the third step of windowing, each individual frame is multiplied with the windowing function in order to minimize the signal discontinuities by minimizing side lobs of the frame. In autocorrelation analysis, it will auto correlate each windowed frame to give the highest value of autocorrelation. The final step of LPC is the analysis converting each frame autocorrelation into LPC parameters.

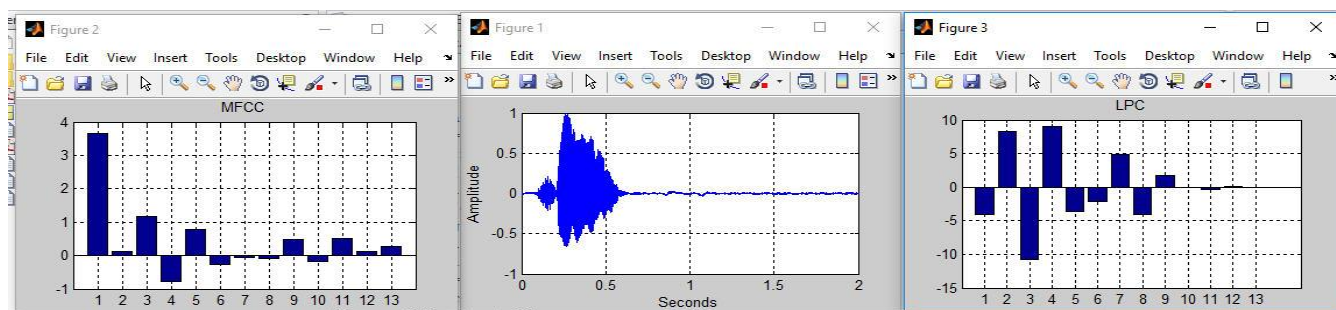## VII.   SIMULATION RESULTS

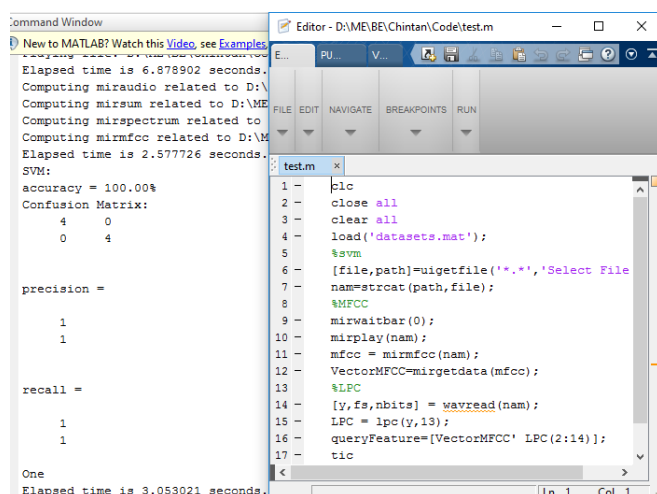Figure 8: MFCC and LPC Feature
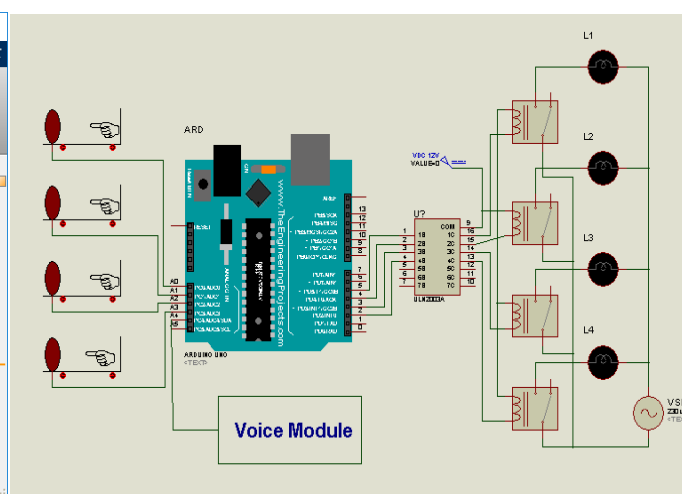
Figure 9: Voice Recognition

Figure 10: Simulation in Proteus

CONCLUSION

Smart Switchboard using Touch and Voice commands is a voice-controlled as well as touch-controlled home automation system which controls home appliances. This system is more useful for physically challenged peoples. This switchboard system is implemented using Arduino atmega328 microcontroller with voice recognition through MATLAB software and it is efficiently working with touch control in noisy environment. It is easy to implement and use this system compare to any other costly and complex home automation systems.

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