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Voice Based Home Automation Using Bitvoicer

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Abstract — This paper presents the design aspects of the voice recognition based home automation system to control various home appliances according to the voice commands via Intel Galileo gen2 using BitVoicer. The proposed system consists of Intel Galileo Gen2, BitVoicer Software, relay circuit and other peripherals which works based on voice commands. Codes are developed using Intel Galileo IDE and hex files are uploaded to the Controller through ICSP. BitVoicer is the speech recognition software that converts speech into commands for control applications. Upon successful recognition of voice commands, the Intel Galileo Gen2 drives the corresponding load. Major advantage of the proposed system is that BitVoicer will ignore recognitions right after a previous recognition by latency period to avoid "false positives", .This improves the accuracy of voice commands for lighting the loads.

Keywords: Home automation, BitVoicer, Intel Galileo gen2, Latency period

I.INTRODUCTION

Home automation system means that allow users to control various electric appliances. Home automation systems are gaining popularity day by day due to their ease of use and wide operational capabilities. Integrating voice recognition technology into the home automation systems makes the system more user friendly and easy to use in home appliances. Normally well-established home automation systems are based on wired and wireless communication. Here the home appliances are controlled through voice commands.

LabVIEW based voice recognition home automation system uses voice commands that eliminates the need for remote controls and other electronic devices [1] which makes it easy to interact with a system to control electrical devices, thus the home automation system is realized.

Intelligent home navigation system for disabled and elderly person [2] proposed a system which uses voice recognition module SR-07 for the speech recognition process and it uses an Arduino controller for issuing commands to wheel chair to move from one place to other place. The Arduino controller receives the command from the voice recognition module and moves the wheel chair accordingly thus eliminating the need of any third person's assistance. A home automation system implemented in [4] for elderly and physically challenged people to control the home appliances by means of voice commands and Bluetooth module in the mobile which act as a remote controller. The voice is recognized by android application and thus issues command to the controller to control the devices.

Bluetooth based home automation system proposed in [5] which uses a remote controller interfaced with microcontroller and a Bluetooth module to provide wireless control of home appliances.

In [3], a home automation system consists of DSP processor for the voice recognition and a microcontroller with relay module to control home appliances like switching lights on-off etc. Zigbee wireless module is used to eliminate the need of additional wirings for signal transmission.

II.SYSTEM OVERVIEW

Voice recognition based home automation system is an enhanced system to simplify the steps involved in control the home appliances which operate fully on voice commands. The block diagram of the proposed system is shown in Fig.1

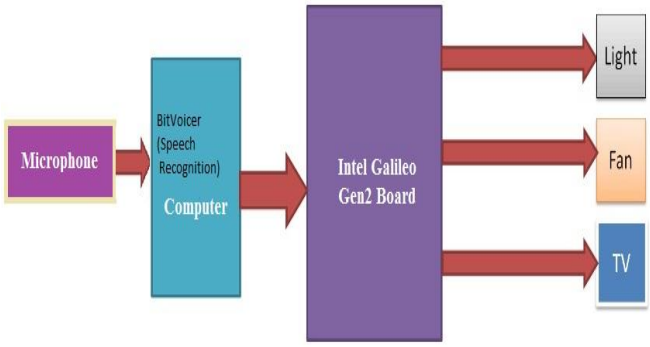

Fig. 1 Block Diagram of Proposed System for Voice Based Home Automation

Speech sensed by a microphone is given to the BitVoicer for voice recognition where the speech anagrams are converted into commands by comparing the equivalent commands provided by the programmer. Based on the confidence level while issuing the sentence anagrams, the BitVoicer provides control signals to the Intel Galileo microcontroller that actuates corresponding electrical device like turning on lights, and adjusting the speed of fan, etc.,

III.HARDWARE OVERVIEW

This section provides the hardware details to control home appliances using voice commands. The schematic diagram of the proposed system is shown in Fig.2. Microphone with Bitvoicer Module are used to get voice anagrams and this voice anagrams are converted into commands using BitVoicer and the recognized voice signal is given to the Intel Galileo Gen2 via serial port.

The voice recognition module needs to be trained before it can be put to recognize the voice commands. The speech input from the microphone is given to the voice recognition module and the input speech is compared with the previously trained voice commands and control action through control circuit is taken place if there is a match between input speech and previously trained voice commands.

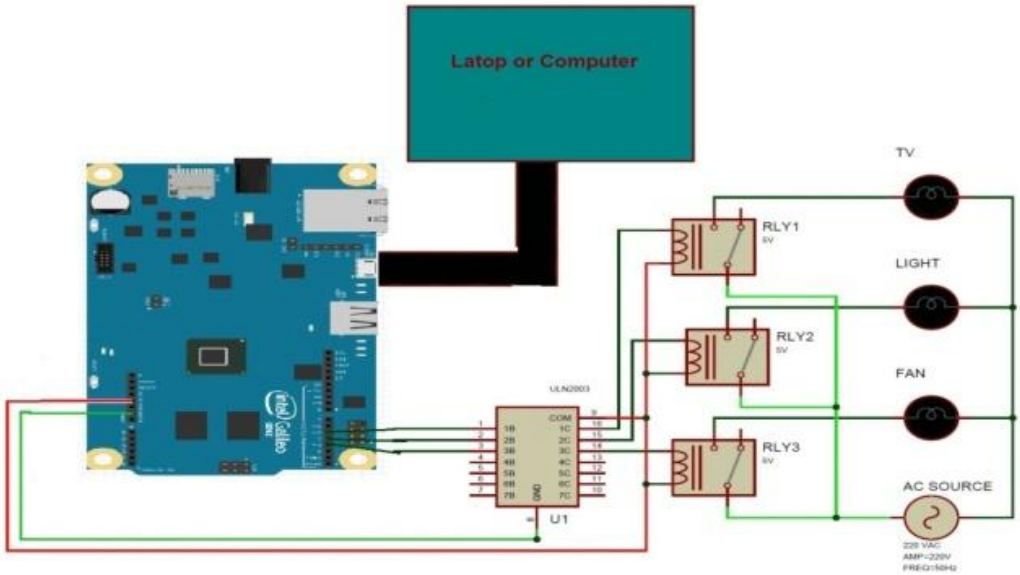

Fig. 2 Schematic diagram for Proposed System

Intel Galileo Gen 2 development board [6] used in the proposed system is a microcontroller board based on the Intel Quark SoC X1000 application processor, a 32-bit Intel Pentium brand system on a chip (SoC) as shown in Fig.3.This is the first board based on Intel architecture designed to be hardware and software pin-compatible with shields designed for Arduino Uno R3.

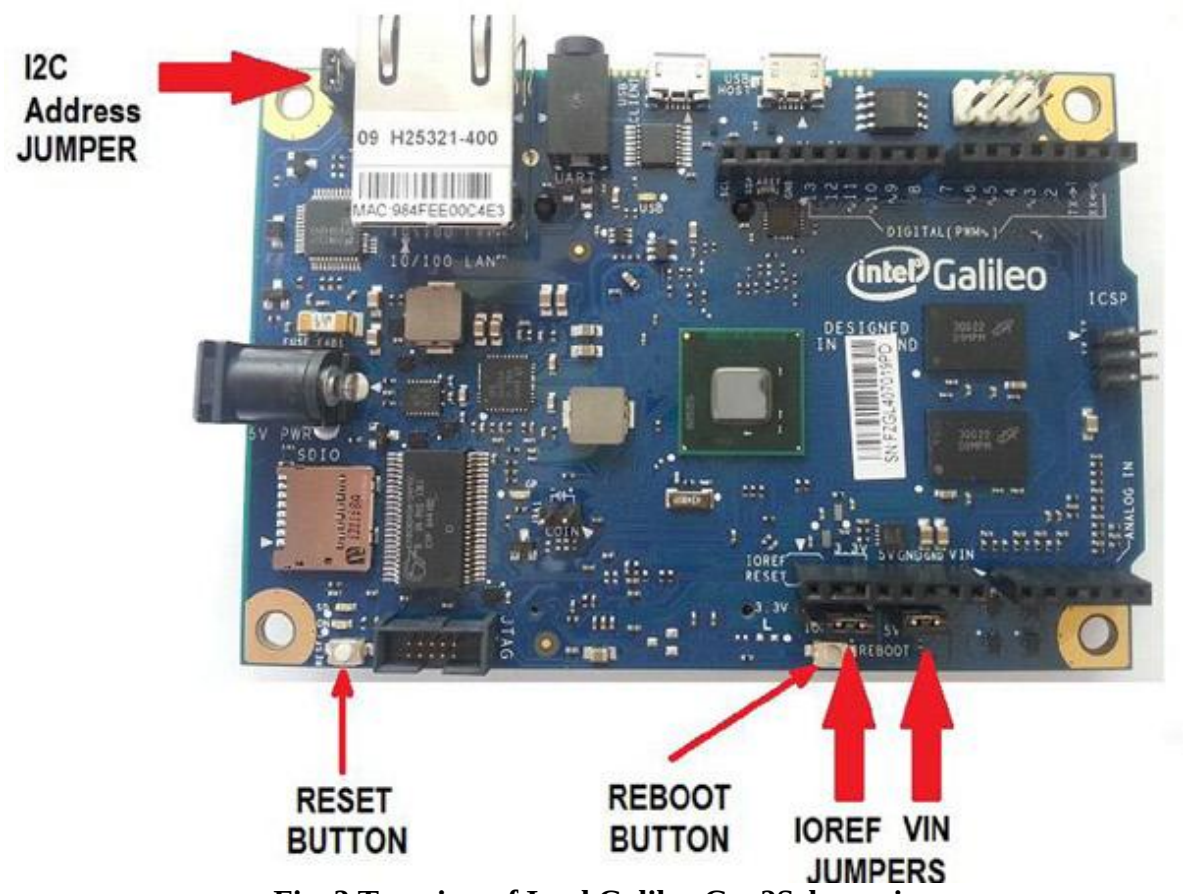

Fig. 3 Top view of Intel Galileo Gen2Schematic

Intel® Quark™ SoC X1000 application processor used in the proposed system has a 32-bit, single-core, single-thread, Intel® Pentium® processor instruction set architecture (ISA)-compatible, operating at speeds up to 400 MHz. Supports for a wide range of industry standard I/O interfaces, including a full-sized mini-PCI express* slot, 100 Mb Ethernet port, microSD* slot, USB host port, and USB client port. 256 MB DDR3, 512 kb embedded SRAM, 8 MB NOR flash, and 8 Kb EEPROM standard on the board and supports for microSD card up to 32 GB.

In this proposed system voice input is given through USB from a personal computer for enabling the commands. Control signals for relay are provided through digital pins of Intel Galileo namely 3, 4, 5 are assigned to TV, light and fan respectively. A 5v relay is connected to operate the high voltage and current devices. When a particular voice command is received, that control signal is transferred to energize the relay. Now the relay switches from NO to NC to create a connection to high voltage devices. Arduino platform provides an inexpensive and easy way of interfacing embedded system to create devices that interact with their environment using sensors and actuators.

IV.SOFTWARE IMPLEMENTATION

BitVoicer is a speech recognition application [7] that enables simple devices, with low processing power, to become voice-operated. BitVoicer uses PC processing power to analyze audio streams, identify the sentences presented in these streams and send commands to a microcontroller connected to it. It processes the audio captured by the microcontroller or by the computer's audio via microphone and thus BitVoicer recognizes the speech.

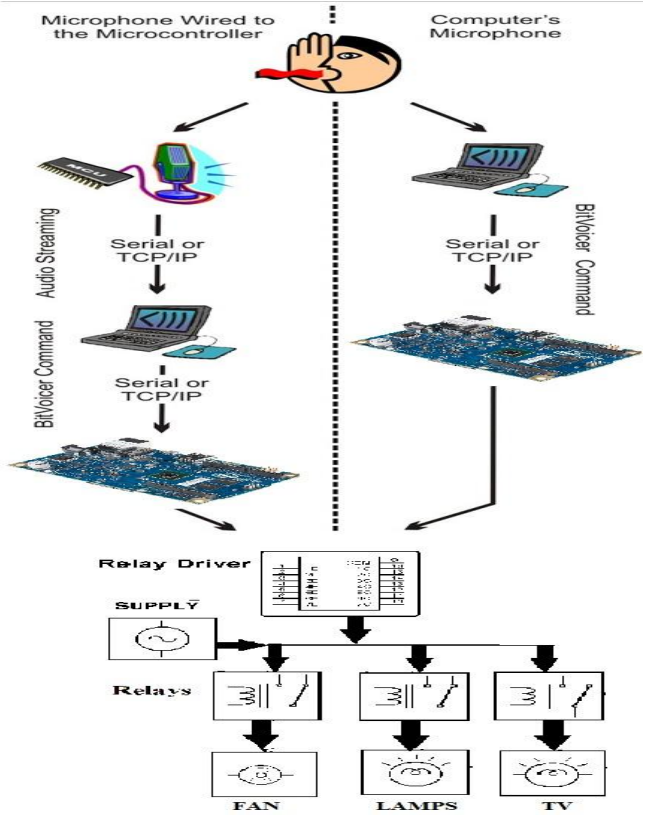

Fig. 4 Flowchart describing proposed System

Speech recognition technology of BitVoicer and the use of communication standards common in the industry (TCP/IP and Serial/UART) make it extremely easy and fast to design complex speech recognition functionalities. Voice Schema works to bind a specific command to a sentence recognized by a speech recognition engine. BitVoicer creates all possible permutations which is called as anagrams, for a given sentence and maps each anagram to the corresponding command. BitVoicer would create the following anagrams in the voice schema as shown in Table 1.

Table 1: Anagrams in voice schema

Anagrams			
turn	on	the	Lamps
turn	off	the	Lamps
turn	on	the	Fan
turn	off	the	Fan
turn	on	the	TV
turn	off	the	TV

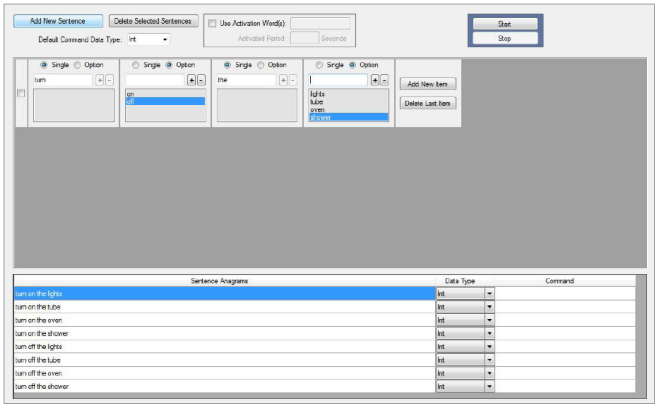

Fig.5 Voice Schema Editor Window

Each sentence in a voice schema consists of a sequence namely single and option. Single items represent a position in a sentence whose content is common to all possible permutations. Option items consist of a set of options that may vary at that specific position. If an option item contains only one option, both single and option will have the same behavior.

Latency period starts after a speech is accepted by the BitVoicer. In a given period, any recognition will be rejected even if it has passed all other filters. Latency period avoids new recognitions from being accepted after a valid recognition. Thus latency period prevents sending commands in sequence which could interfere with the execution of a command previously sent to the microcontroller. BitVoicer communicate with the microcontroller over serial ports or TCP/IP ports

Speech captured by a microphone wired to the microcontroller or the microphone of a computer and sent to BitVoicer as audio streams. Combining audio streaming and wireless communication is possible to implement advanced speech recognition features on any microcontroller and keep the microcontroller physically apart from the computer.

The audio streams sent to BitVoicer is digitalized using 8-bit PCM at 8000 samples per second which converts this reading into an 8-bit value from 0 to 255 as shown in Fig.6 at regular intervals.

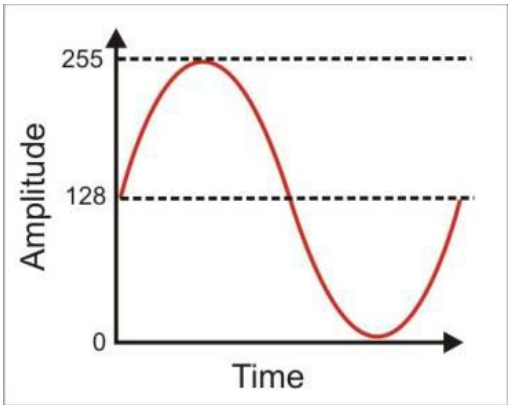

Fig.6 Analog to Digital Conversion Process

V. RESULT AND DISCUSSION

The recognized voice command makes Intel Galileo Gen2 to switch the relay to make specified operations. In the proposed work, fan and lamps are controlled with voice commands.

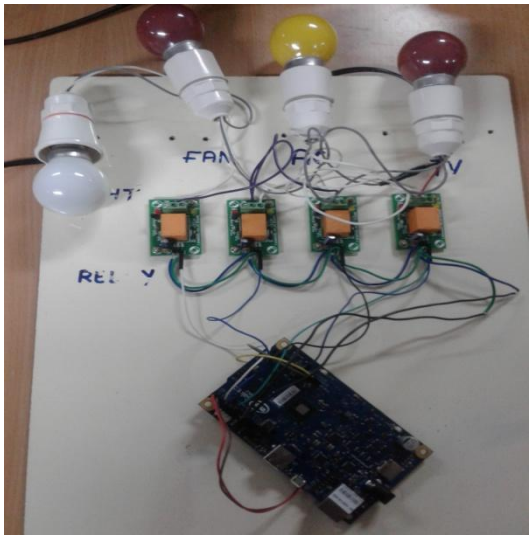

Fig.7 Experimental Setup of the proposed system

When a “TV turn on” anagram is pronounced, the microcontroller turns on the TV and when “TV turn off” is pronounced, the TV is turned off. Likewise, it can be extended for many appliances.
Information panels are located on the right portion of the Voice Schema Editor. These panels remain inactive whereas the speech recognition is started they show valuable information like speech recognition, confidence level of speech, latency period, audio level and errors in recognition if any.
Audio level bar shown in Fig.8, shows the audio level captured by the speech recognition engine in real time. This information is updated ten times per second. An average value is computed based on the period entered in the option audio level activated period of the preferences and the readings are taken each 100 milliseconds.

Information panel displays the information about errors, initialization and disposing of the speech recognition engine, as well as information about the sending commands and the results of speech recognitions as shown in Fig.8.

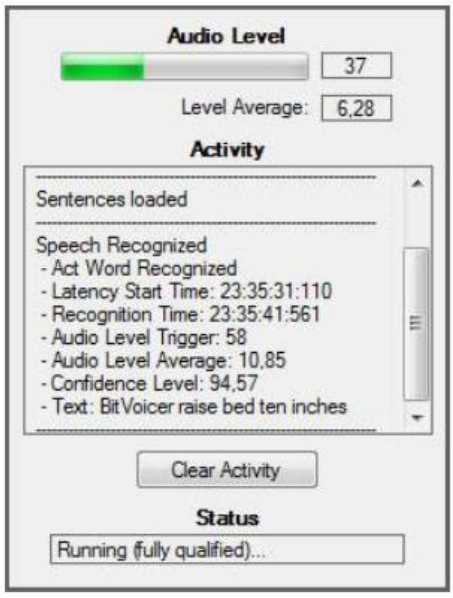

Fig.8 Screen shot of Speech recognition Engine

VI. CONCLUSION
VII.

In the proposed system, voice recognition based home automation system was designed and implemented successfully for controlling home appliances according to the voice commands given by the user. The voice commands are recognized by the Bitvoicer, which eliminates the need for remote controllers and other electronic device and makes it easy to interact with the system to perform automation and control electrical devices. In future, it can be implemented to access the voice commands from any remote location via BitVoicer server

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