TECHNICAL SCIENCES

RESEARCH OF THE SMART HOME CONTROL SYSTEM WITH THE HELP OF SPEECH

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ABSTRACT

This paper proposes an automation system where users can use voice commands to control their electrical appliances such as lights, fans, TVs, heaters, etc. The main goal is to make life more comfortable for everyone, especially the elderly and the disabled. they won't need to be physically near the device to turn it on or off. The system focuses on using a digital signal processor to process voice commands and control the required equipment accordingly. XBee transceivers are used to eliminate the need for large amounts of wire between the processor and the device. The test results show that the system has good responsiveness and economic efficiency. We have concluded that this system provides solutions to the problems that homeowners face in their daily lives and makes their lives easier and more comfortable by offering a solution. reliable and cost-effective solution.

Keywords: voice command, XBee, zero cross, voice recognition.

Introduction

Speech recognition is a broad topic of interest and is regarded as a complex problem. In a practical sense, speech recognition solves problems, improves productivity, and changes the way we live. Reliable speech recognition is a complex task requiring a combination of many techniques; however, modern methods have been able to achieve an impressive degree of accuracy [1]. Real-time digital signal processing has come a long way since the advent of dedicated DSPs. Suitable DSP starter kits with a dedicated DSP processor and related software tools such as assemblers, simulators, and debuggers are available to simplify system design and application development. The digital signal processor TMS320C5535 allows you to design a system with very high computing power and a large amount of memory with a minimum number of components, which saves space on the printed circuit board and simplifies the design [2, p.3].

ZigBee is a low-cost, low-power wireless mesh networking standard. The low cost allows it to be used for wireless monitoring and control applications, while the low power consumption ensures longer battery life. The mesh network provides high reliability and a wider range. The ZigBee standard is based on the IEEE 802.15.4 physical radio specification and uses unlicensed bands including 2.4 GHz, 900 MHz, and 868 MHz. ZigBee uses Carrier Sense Multiple Access (CSMA/CA) collision avoidance to improve reliability. Before transmitting, it listens to the channel and, when the channel is free, starts transmission, preventing data corruption. ZigBee uses a 16-bit CRC for each packet, called the frame checksum (FCS). This ensures that the data bits are correct. Each packet is repeated up to three times. If the packet cannot pass after the fourth transmission, ZigBee informs the sending node about this [4]. XBee is Digi International's brand name for a family of radios. The first XBee radios were based on the 802.15.4 standard for point-to-point and multipoint communication at a data rate of 250 kbps. The rest of the document is organized as follows: Section 2 discusses the work involved in the proposed circuits, and Section 3 deals with the proposed structure, including hardware design and software development along with the algorithm. In Section 4, the results are discussed, and concluding remarks are given in Section 5.

PROPOSED METHOD

The proposed method is aimed at designing a smart home control system with voice control for the following reasons. One of the main problems of modern society is the waste of energy, while energy consumption is constantly increasing from year to year. Nowadays, some people may be too lazy or too busy to get up and turn off this or that appliance. Therefore, a smart home control system will be useful, as it is enough to say a word to turn off the device, thereby saving energy and time. What's more, the elderly or the disabled may have difficulty going around the house to turn their electrical appliances on or off, especially if they live alone. It will be much easier for them to use the voice control system. It will also help blind people as they can turn on a fan or radio without relying on others. The system is designed to be easy to install and use. The proposed method is to use a digital signal processor (DSP) for speech processing and recognition. The DSP output will be sent through the XBee transceivers to the control part, where the microcontroller will select the required device according to the input voice command [3].

The system can be divided into 3 main parts:

1. Sound processing part - microphone and DSP
2. Transmitting part - XBee transceivers
3. Control part - microcontroller and relay

Voice commands will first be captured and processed in the DSP according to the voice recognition method used. Once the commands have been successfully identified, the control characters will be sent wirelessly through the XBee transceivers to the microcontroller, which in turn will activate the appropriate relay. As a result, household appliances could turn on or off depending on the given voice command [6].

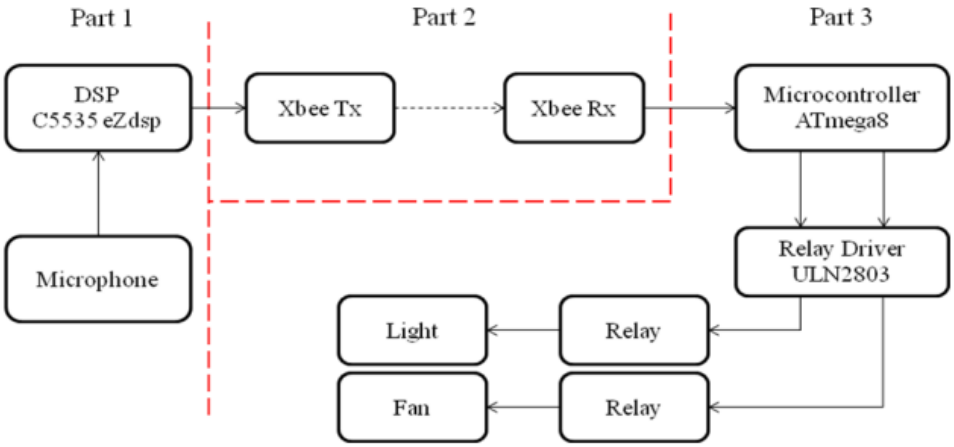


Figure. 1. Proposed block diagram of a smart home control system.

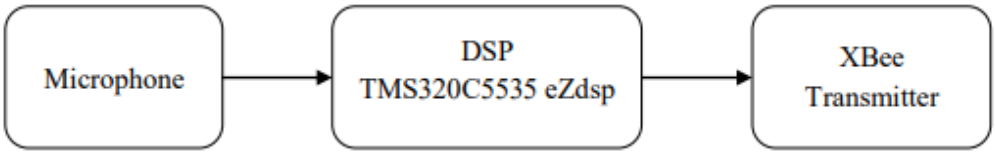


Figure 2. Block diagram of the sound processing part.

Hardware design

In this section, we will present a hardware description of the three main parts that make up our smart home control system.

Audio processing

The first part of the system is shown in Figure 2. The voice is picked up by the microphone and sent to the TMS320C5535 eZdsp for processing to distinguish between voice commands. Speech processing is performed by the zero-crossing peak amplitude (ZCPA) method. If the required conditions are met, i.e. a valid command is recognized, a special signal will be sent using the UART to the XBee transmitter and therefore to the control part. On fig. 3 shows a DSP board on which voice commands are processed and recognized accordingly. The block diagram of the C5535 eZdsp is shown in fig. 4. TMS320C5535 are 16-bit processors with the lowest cost and power consumption, helping save power and extend battery life. With 240 MIPS (millions of operations per second) performance, up to 320 KB onboard memory, and higher integration (including hardware accelerator for FFT calculations), these processors provide the basis for a range of signal processing applications, including voice and audio processing [11].

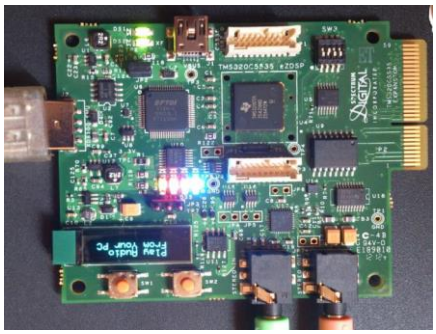


Figure 3. C5535 eZdsp board

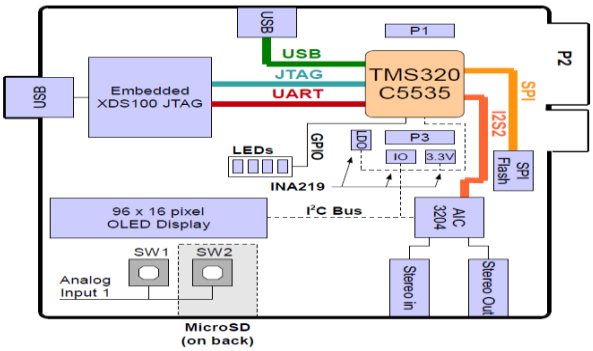


Figure 4. Block diagram C5535 eZdsp

Transmission

The second part of the project concerns wireless signal transmission using XBee transceivers. After the voice commands are recognized, the corresponding control characters are sent through the XBee transmitter at a data rate of 9600 bps. The XBee transceiver and XBee programmer are shown in figures 5 and 6 [1,7].

Figure 5: XBee transceiver

Figure. 6: XBee programmer

The XBee RF modules communicate with the host device through a logic-level asynchronous serial port. Through the serial port, the module can communicate with any logic- and voltage-compatible UART. Devices with a UART interface can be connected directly to the RF module pins, as shown in fig [1].

Figure 7. A range test and a feedback test were performed to verify the functionality of the XBee modules. The results are shown in figures 8 and 9 below [2].

Transmitted data is shown in blue and received data is shown in red in the feedback test. In the range test, the software will repeatedly send data packets and display the signal strength as well as the percentage of correctly returned packets. RSSI is the value of the received signal strength indicator.

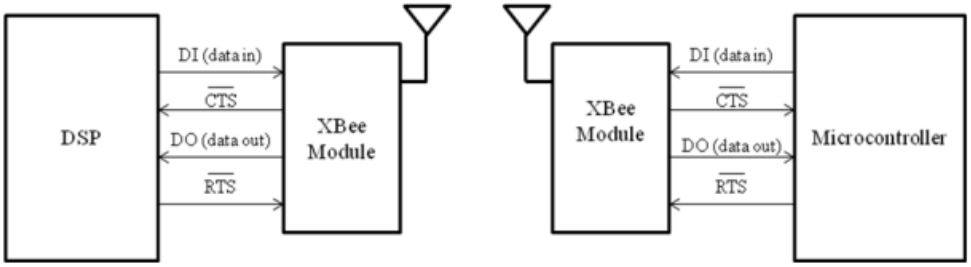
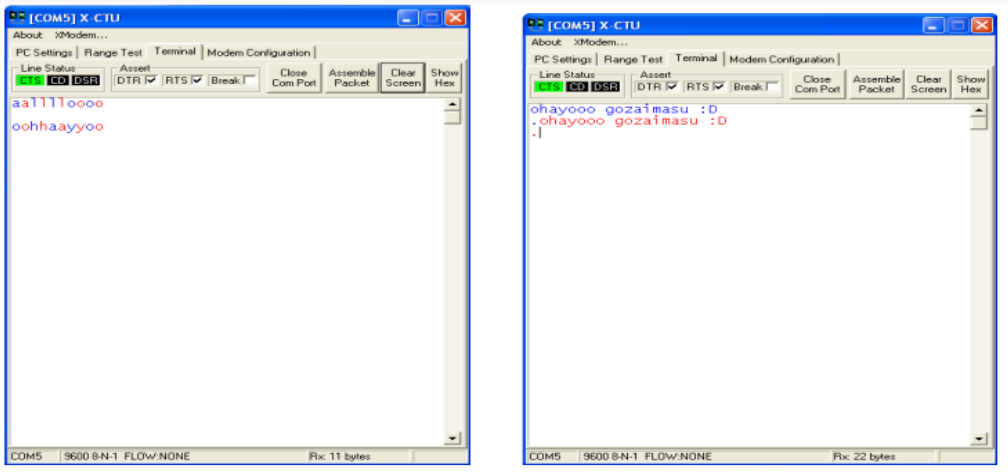


Figure 7. UART environment



(a) Byte transmission (b) Packet transmission

Figure 8. loop test

Control

The transmitted control characters are received by the microcontroller and compared with some predefined characters. If it matches, the microcontroller will switch the corresponding relay and turn on / off the device connected to it. The components of the control part are shown in fig. 10. In fig. Figure 11 shows the microcontroller development board on which the ATmega is installed.

The microcontroller used is ATmega8 from ATMEL. It consists of 3 ports, namely 8-bit port D, 6-bit port B, and another 6-bit port C, and it also has 2 pins for the external crystal oscillator, as well as a reset pin. It has ADC pins multiplexed with port C, as well as "receive" and "transmit" pins on PD0 and PD1 respectively, which are connected to the XBee.

The relay circuit used consists of a ULN2803 relay driver and a 12V relay which are used to control appliances. The relay driver is used to increase the current gain so that the relay can be switched. On fig. 12 shows how the relay is connected to the microcontroller.

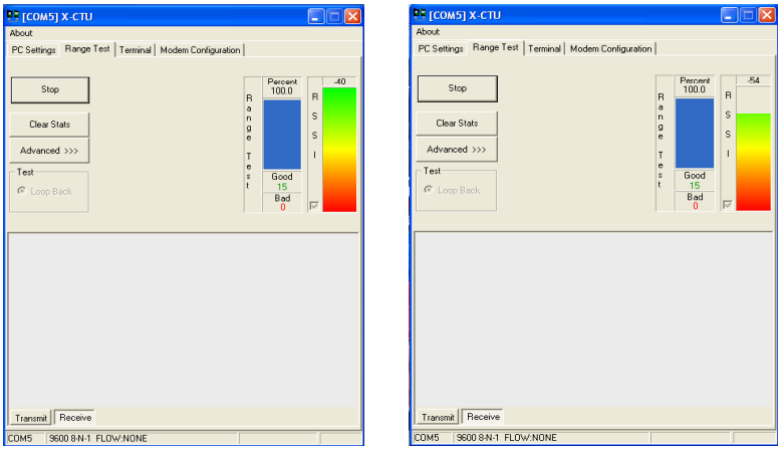


Figure 9: Range test

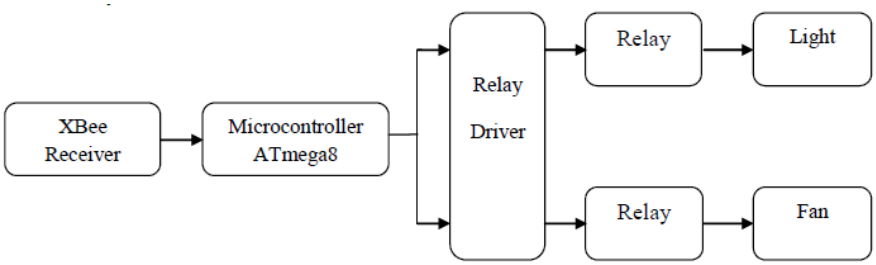


Figure 10: Block diagram of the control unit

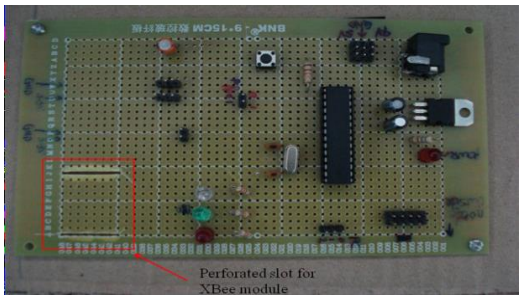


Figure 11. microcontroller development board

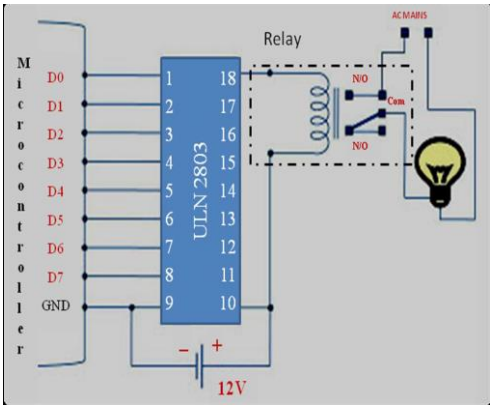


Figure 12: Connecting a relay to a microcontroller

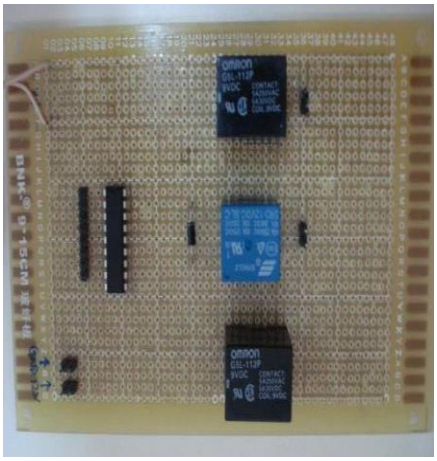


Figure 13: relay board

Software design

Software design consists of a voice recognition section and controls part programming.

Voice recognition

Voice recognition is implemented using a DSP kit. The main program is written in C in Code Composer Studio, which is an integrated development environment for Texas Instruments embedded processors, in this case, the C5535 eZdsp kit. Voice recognition is done using the ZCPA method, which is the simplest reliable method that can be used for this application. This method counts the number of times the signal crosses zero and therefore can determine the approximate frequency of the signal. Here, the intensity information is included in the zero-crossing value using a logarithmic function. The difference in frequency helps the system

to distinguish between different voice commands. On fig. 14 shows a block diagram.

First, the DSP is initialized to set the clock, initialize the codec, etc. Then the audio samples are read from the microphone through the codec. These samples are processed using a transform known as Daubechies wavelets, which reduces the noise in the signal, making it clearer. Next, we must determine if a voice signal is present. For this, a “noise gate” is used, which filters out low-frequency noise signals. In this way, noise is replaced by silence, which helps us to effectively detect the presence of a real voice signal. The system then verifies that the password has been received. If it is valid, all samples that go beyond a certain threshold level are stored in the buffer until the voice signal disappears. The zero-crossing function is then applied to the buffer to determine the approximate frequency of the signal.

Control

On the control side, the microcontroller must be programmed so that it can receive control characters from the XBee receiver module and activate/control the necessary relays accordingly. The program is written in C using AVR Studio and the hex file is loaded into the ATmega8 microcontroller using the ProgISP software. The block diagram of reception and control is shown in fig. 15. A specific microcontroller port is selected as the output port. This port will be used to control the on and off of the relay.

Whenever a control character is received, an interrupt service routine (ISR) is run and these characters are compared with predefined ones. For example, if the character "a" is received from the DSP, the first pin of port C is set high or low; similarly, if the character "b" is received, the second pin of port C is activated or deactivated accordingly. If any other characters are received, no action is taken. After activating/deactivating the corresponding pins, the microcontroller again waits for the next character to be received.

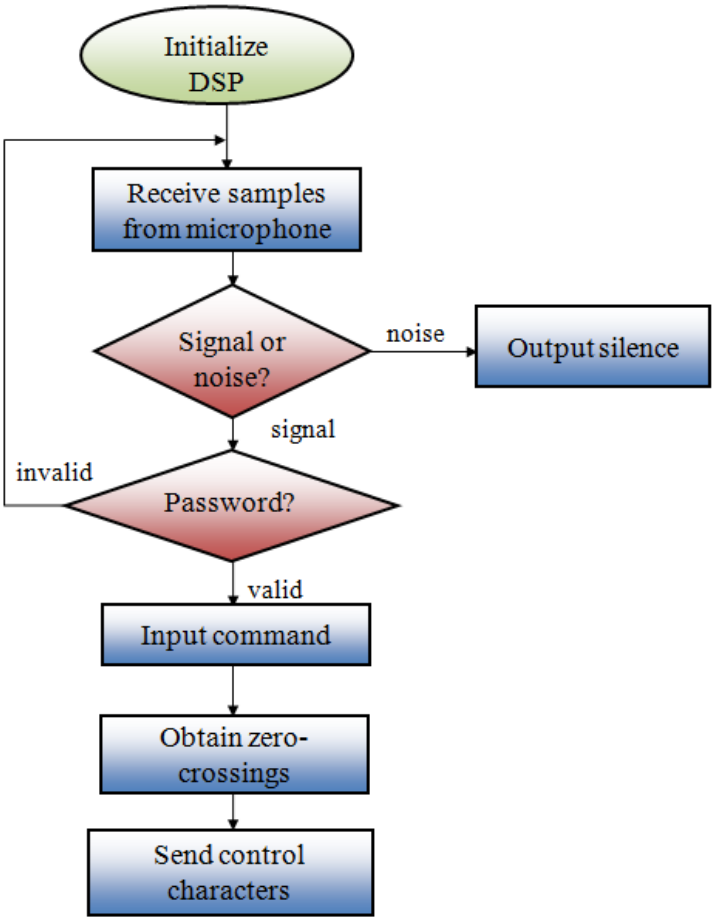


Figure 14: Flowchart of a voice recognition program

Conclusion

Built and implemented a home automation system based on voice recognition. The system is designed for the elderly and people with disabilities to make their lives easier. The developed system can be used to control AC and DC devices using speech. Voice recognition has been successfully implemented using the TMS320C5535 low-power DSP. Wireless communication was achieved using low-power XBee transceiver modules. Finally, a microcontroller chip and a relay controlled power through the appliances. From this, we conclude that the purpose of the proposed system has been achieved and that the system functions as intended. With this system, we were able to control the on and off of two different devices purely through voice commands. Thus, the proposed system provides a solution to the problems faced by the elderly or people with disabilities in daily life, and makes their life easier and more comfortable, offering an economical and reliable solution. Because low-power components were used, this system proved to be energy efficient, saving energy.

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FROM PAPER CONTRACTS TO SMART CONTRACTS

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ABSTRACT

In today's technological world, a large number of different types of agreements are made and electronic data interchange (Electronic Data Interchange - EDI) is an information exchange communication technology and is an alternative to paper-based communication. While the contract is drawn up for the parties involved in the transaction, the information in the "fine print" is provided, the transaction is developed, the software and the confirmation of the transaction make the user partially accessible to the information that may be valuable or confidential to him. Actions carried out through the software can in some cases be potentially dangerous, these reasons can be: improper protection of information, the possibility of evading sanctions due to the interpretation and non-fulfillment of the agreement made by the parties.

Electronic means of payment leave some electronic traces and may become available to the interested party. Most consumers do not know if their names are associated with their purchases in databases, and significant portions of these transactions may be subject to processing and, more importantly, making the information public. Therefore, great importance is attached to data security and anonymity. This approach is offered by the decentralized environment-blockchain technology and the smart-contract computer transaction protocol integrated into it.

Smart contracts are the basis of the Decentralized Finance (DeFi) industry, and because they do not require the involvement of third parties, they become a very cheap, desirable, fast and flexible system. In the NFT industry, they are trying their best to implement smart contracts in projects.

Parties can rely on tamper-proof technology that controls the actions of the smart contract code so that processes are carried out automatically; This is how the contract code is practically enforced. This form of practical enforcement is achieved when all necessary actions are fully implemented in a computer program or technological environment.

Keywords: smart contracts, smart-contracts, blockchain technology.

Introduction

The institution of contract has been known since Roman law (the science that studies the law in ancient Rome and later in the entire Roman Empire). In Rome, the contract was called Contractus and the rules were regulated based on the existing normative system. In order for the agreement-transaction between the parties to become a contract, this agreement should have a certain form. It had to be in writing and had to meet a number of requirements, failure of which would result in the right or liability to file a lawsuit. [1].

From Roman law to the present day, the history of contracts has changed significantly.

Even today, the relationship between the parties is based on equality. The parties are not subject to each other, regardless of who they are: individuals, legal entities, the state, or others. But today, a contract does not always mean a document presented in writing and confirmed with a seal and signature. A contract is any agreement of private persons, by which the parties have rights and obligations. Such as everyday small con-