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A Hybrid Approach to Control Home Area Networks

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Abstract

This paper aims to develop and to design a smart home system by using a Hybrid approach. This approach uses a combination of both Bluetooth and GSM, Sending by short message service (SMS) via global system for mobile communication (GSM modem) to access the devices. The concept of smart home is an emerging issue to the modern technology dependent society. Remote control technologies are widely used to control household electronic appliances without walking up to them. Controlling household appliances through computer can also be a possible solution. However, it cannot fulfil the current demand which is to control them from remote places. The system is activated when user sends the SMS to controller at home. Upon receiving the SMS command, the microcontroller unit then automatically controls the electrical home appliances by switching ON or OFF the device according to the user order. In other word, it read message from the mobile phone and response to control the devices according to the received message. The prototype has been successfully developed and it could provide an effective mechanism in controlling and accessing the devices.

Key words: Home Automation, User Interface, and Smart Home Accessibility.

Introduction

Focusing on the use of home area networks to improve disabled people's autonomy at home, this paper presents a display design for accessible home control.

Smart Home System is a project used to control any devices in home or in office or in other places can switch on or off. The goal of a smart home system is to enable those who live in them to control a large number of electronic devices easily and remotely.

A simple smart home system uses a remote [1] or a smart phone to turn on the kitchen lights and turn off the alarm when the garage door opener activates. Smart homes typically have many more complicated systems, but they all operate via the same principles.

Smart homes work via fairly simple systems: PIC and SMS. Normal home devices such as lights, entertainment systems, heaters, air conditioners, computers, security systems and radios are equipped with receivers. This PIC detects a certain signal initiated by the code SMS, which can be housed in a control device such a light switch or, most commonly, a remote control.

In order to design the smart home system in this project, this system can control by using Short Message Service (SMS). Nowadays, Short Message Service (SMS) is widely used as a form of data communication. It is about 2.4 billion active users which equals to 74% of mobile phone subscribers sending and receiving text messages on their phones.

SMS is a communication application in Global System for Mobile communication (GSM) system. It

allows interchange of short text messages between mobile telephone devices using standardized communication protocols.

Related Work

Analyzing the state of the art, it is possible to notice that the works on user interface for home automation for people disabilities are very specific, usually addressing a single type of impairment.

There are works focusing on elderly, visually impaired people, hearing impaired, people with motor impairment and cognitive disabilities.

In Accessible display design in Home Area Networks [2] presents a display design for accessible interaction in home area networks. Based on a research on the accessible interfaces state of the art, an interface design was proposed.

This interface was implemented over a Tablet that controls domestic devices through a home network controller prototype. In order to evaluate the design, a research was conducted, interviewing people with disabilities in Brazil.

The project Assistive Housing [3] was developed focusing on the elderly comfort, allowing home automation by using the television set and its regular remote control as an interface.

The design strategy used to improve legibility and accessibility of the home automation interface on the television screen was to use few and large graphical icons, with horizontal captions describing their function.

Problem Statement

Nowadays the Bluetooth wireless technology is set to revolutionize the way people perceive digital devices in our homes and office environment. Now they are no longer just the individual devices; instead, with the embedded Bluetooth technology, they form a network in which appliances can communicate with each other. This wireless technology is especially useful in home environment, where there exists hardly any infrastructure to interconnect intelligent appliances.

It could be suitably used for home automation in a cost-effective manner. Operating over unlicensed, universally available frequency of 2.4 GHz, it can link digital devices within a range of 10 m. Along with the Bluetooth; GSM [4] is used to operate the devices via by sending SMS.

The use of electricity is very important as one of the main source of energy that is vital in today modern life. Thus a prototype based on a microcontroller device using SMS and GSM modem is developed. It can automatically control any electrical equipment at home remotely using mobile phone. Hence the electrical energy saving in daily life can be made more efficient and effective.

System Overview

Software Requirements

Software and language used for programming the PIC controller is as follows.

MPLAB IDE version 8.30 is an integrated development environment that provides development engineers with the flexibility to develop and debug firmware for various Microchip devices.

It is a Windows-based Integrated Development Environment for the Microchip Technology Incorporated PIC microcontroller (MCU) and dsPIC digital signal controller (DSC) families.

Hardware Requirements

This project has the following hardware requirements so that all the sensors are connected to the PIC controller through SCU and the driver circuits are connected to the PIC in order to increase the current range. The relays are used to switch ON and OFF the devices.

The Module consists of ANDROID mobile, GSM Modem, Micro-Controller, Relay Driver Circuits, Temperature sensor, Proximity sensor, LDR, Relay, and LCD Display.

Hardware Interface

Communication between appliances and mobile is made wireless via a Bluetooth and GSM Modem. A Modem (modulator-demodulator) is a device that

modulates an analog carrier signal to encode digital information, and also demodulates such a carrier signal to decode the transmitted information.

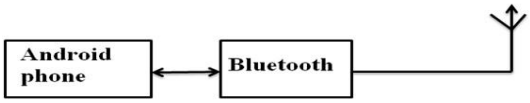

Fig 1. Transmitter block

When the user needs to communicate with the GSM module either he can use the Bluetooth or the SMS service. From the smart phone the command is given to the receiver side.

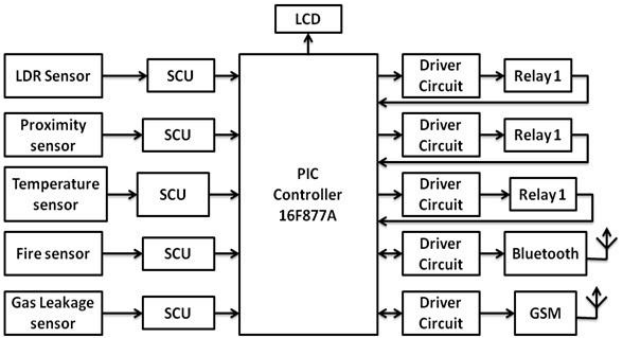

Fig 2. Receiver Block

The receiver part is same as the existing method in addition to that for gas leakage and flame detection two sensors are added.

Microcontrollers are designed for embedded applications [5], in contrast to the microprocessors used in personal computers or other general purpose applications.

A liquid crystal display (LCD) is a flat panel display or electronic visual display that uses the light modulating properties of liquid crystals (LCs).

Temperature sensor is used to find weather the heater is working or not. It senses the heater temperature and gives the corresponding voltage signal to microcontroller through comparator.

The LDR and proximity sensor is used to find the working status of the corresponding appliance light and water pumps respectively. The proximity sensor is used to find the working status of fan is on and off

The fire and gas sensor is used to find the status of fire and gas in home.

PIC 16F877A Microcontroller

Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

PIC Start Plus Programmer

The PIC start plus development system from microchip technology provides the product development engineer with a highly flexible low cost microcontroller design tool set for all microchip PIC micro devices. The picstart plus development system includes PIC start plus development programmer and mplabide.

The PIC start plus programmer gives the product developer ability to program user software in to any of the supported microcontrollers. The PIC start plus software running under mplab provides for full interactive control over the programmer.

The goal is to produce a signal that can be transmitted easily and decoded to reproduce the original digital data. Modems can be used over any means of transmitting analog signals, from light emitting diodes to radio. GSM Modem has quite similar functionality of mobile.

RS-232 is the traditional name for a series of standards for serial binary single-ended data and control signals connecting between a DTE (Data Terminal Equipment) and a DCE (Data Circuit-terminating Equipment).

It is commonly used in computer serial ports. The standard defines the electrical characteristics and timing of signals, the meaning of signals, and the physical size and pin out of connectors.

Thus we are going to control home appliances [6] using a hybrid approach by using android mobile application via a GSM modem to Microcontroller (Coding is dumped in Microcontroller according to needs which does the remaining work) switches relay by driver circuit.

Simulation and Results

The MPLABv 8.30 also includes MPLAB editor v4.30.It has the following additional functions. The procedure has to be followed in order to build the coding in the PIC controller. The MPLABv8.30 tool will be opened and a new project is created.

In the new project the coding is typed and saved. So that the target file with a source file is created.

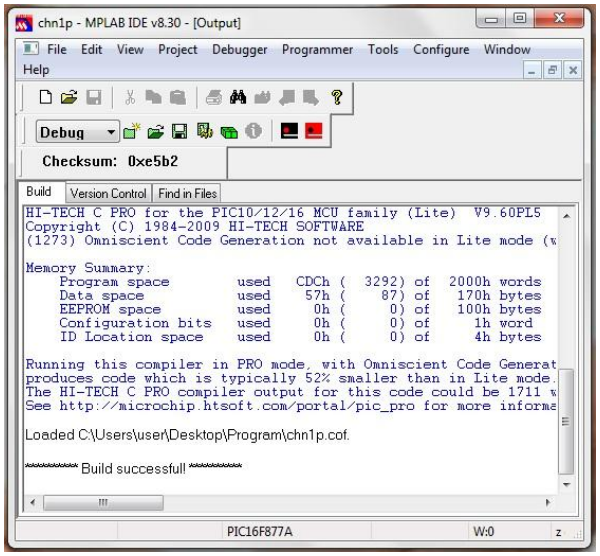

Fig 5. Output window

Finally the 'build' option from the 'project' menu is clicked and again 'rebuild' option is clicked in order to build the coding in the PIC controller

In figure 5, Rebuilding of coding is executed and the building process is completed. Thus the simulation process gets completed in this paper.

Conclusion

With technological advancements in recent decades, Home Based environment incorporate several electronic appliances in order to facilitate activities and improve users' quality of life.

Mobile devices emerge as excellent platforms to enable control over such a range of appliances, providing convenience, flexibility and several interaction possibilities.

However, home control via mobile devices also present some challenges, among others regarding the diversity of users. This paper presents the building of object code in the controller by using MPLAB software. This document presents a mobile controlled and user-friendly approach to the available home automation system.

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Autobiography

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