DESIGN AND DEVELOPMENT AN INTERACTIVE TELEPHONE BASED REMOTE CONTROL AND SECURITY SYSTEM

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BEKC

2009

"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation, and Automation)"

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Date : 17 JUNE 2009

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A report submitted in partial fulfillment of the requirements for the
Bachelor of Electrical Engineering (Control, Instrumentation and Automation)

Faculty of Electrical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

JUNE 2009

DECLARATION

"I hereby declared that this report is the result of my own research except for the excerpts that have been cited clearly in the references."

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Especially dedicated to my beloved family, teachers and lecturers who have encouraged guided and inspired me throughout my journey of education.

ACKNOWLEDGEMENTS

All praise to the Almighty Allah, the Most Gracious, for giving me an opportunity to study for higher education and giving me strength and patience in completing this thesis writing. Without the grace and help of Allah SWT, it would be virtually impossible for me to have the courage, endurance and spirit to do this thesis writing successfully. I would like to express my gratitude to all those who gave me the possibility to complete this thesis writing.

I would like to show my highest gratitude to my supervisor En. Mohd Shahrieel Bin Mohd Aras for his invaluable support, patient, assistance and especially his encouragement to this project. I truly have learnt a lot and all this would not be without his guidance.

I also would like to thank all my fellow friends for their contribution in giving me a moral support throughout my project development period. Last but not least, to all my beloved family members who were always, stand by my side to encourage, advice, and comfort cherish, and support me during complete this project.

Lastly, I really appreciate to have this responsibility to finish this project. This task has taught a lot of lesson and knowledge, which will be much valuable for me in the future.

ABSTRACT

This project describes the design and development of an interactive phone-based remote control and security for homes using telephone fixed lines. The systems were designed based on the DTMF (Dual Tones Multi-frequency) signals that are produced by the telephone system. The system hardware and software were designed based on the telephone standard. The hardware part includes the DTMF transceiver, on / off Hook detector, Ring detector, and (Radio Frequency) RF Transmitter and Receiver, and Alarm security system. The system would contact the users and notify them if any emergency has occurred, using auto dialer system, which act as a security system, where the term emergency refers to magnetic switch when it is triggered or activated. It uses USART (Universal Synchronous Asynchronous Receiver Transmitter) as communication between two PIC16F877A, which combined two advantages found in telephone, and microcontroller unit that will act as the mainframe data processing unit, thus producing a better and more reliable remote control. Some assumptions are made in the prototype system and recommendations or future improvements are suggested.

ABSTRAK

Projek ini menerangkan tentang mereka bentuk dan membangunkan sebuah alat kawalan jauh yang berasakan interaktif telefon dan keselamatan menggunakan talian tetap telefon. Sistem kawalan jauh ini direka berasaskan kepada isyarat DTMF (Dual Tone Multi-Frequency) yang dihasilkan oleh sistem telefon. Perkakasan sistem dan perisian ini telah direka berdasarkan piawai telefon. Perkakasan terdiri daripada dwipenerima dan dwipenghantar DTMF, pengesan on / off Hook, pengesan deringan, pemancar dan penerima frekuensi radio dan sistem keselamatan penggera. Sistem ini juga dapat menghubungi pengguna dan memberi amaran sekiranya berlaku kecemasan, dimana kecemasan ditakrifkan apabila suis magnet (magnetic switch) diaktifkan dan menggunakan sistem pendail otomatik yang bertindak dengan menghubungi pengguna bagi memberi isyarat sebagai sistem keselamatan. Projek ini juga menggunakan USART (Universal Synchronous Asynchronous Receiver Transmitter) sebagai penghubung komunikasi antara dua buah PIC16F877A yang digunakan dan menggabungkan dua kelebihan yang terdapat pada telefon dan juga Mikropengawal yang bertindak sebagai pemproses data bingkai utama bagi menghasilkan alat kawalan juah yang lebih baik dan efektif. Beberapa andaian telah dibuat dalam sistem prototaip ini dan cadangan pembaikan juga dikemukakan.

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LIST OF ABBREVIATIONS

DTMF	-	Dual Tones Multi-frequency
RF	-	Radio Frequency
USART	-	Universal Synchronous Asynchronous Receiver Transmitter
PIC	-	Peripheral Interface Controller
SMS	-	Short Message Service
WAP	-	Wireless Application Protocol
IC	-	Integrated Circuit
DC	-	Direct Current
AC	-	Alternative Current
ROM	-	Read Only Memory
EPROM	-	Erasable Programmable Read-Only Memory
EEPROM	-	Electrically Erasable Programmable Read-Only Memory
RC	-	Resistor-Capacitor
DSP	-	Digital Signal Process
I/O	-	Input / Output
PLL	-	Phase Lock Loop
WDT	-	Watchdog Timer
PWM	-	Pulse-Width Modulation
LIN	-	Local Interconnect Network
BRG	-	Baud Rate Generator
TTL	-	Transistor-Transistor Logic

CMD	-	California Micro Devices
CMOS	-	Complementary metal-oxide-semiconductor
QC	-	Quality Control
TX	-	Transmitter
RX	-	Receiver
MCU	-	Microcontroller Unit
ICSP	-	In Circuit Serial Programming

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Increasingly, home appliances (including televisions, video, stereo equipment, refrigerators, cooker, washing machines, light switches, air conditioner, and factory equipment) have embedded computers and usually come with a remote control, for it makes many aspect of daily life easier and more convenient. This operation may be turned on or off, be it the air conditioner, the cooker, the lights, the video player, or the security system, or even other things that a person forgot to do before leaving the home.

The remote control system provides a couple of handy services to promote easier, comfortable living life of its users. They will have better control on their home appliances and this is especially important if they need such a control when they are far away from the location of their home. It does not only provide better ways to transfer information within homes / offices and between offices / homes; it provides better time management too. In addition, this remote control also can be applied in factories. With a careful and dynamic design, it can help reduce factories' operational cost. The applications introduced in this project also were designed based on the standard telephone system. This means that the system can be installed for public uses widely.

1.2 Project Overview

This project describes the design and development of an interactive phone-based remote control and security system for homes using telephone fixed lines. The system were designed or adapted based on concept of the DTMF (Dual Multi Frequency) signals that are produced by the telephone system. This system would contact the users and notify them if any emergency has occurred, using auto dialer system, which act as a security system.

1.3 Problem Statement

1. The main problem that the user will face is they cannot control their electrical home appliances whenever they were not at home.
2. If they forgot to switch OFF one of the electric home appliances, they have to go back home to switch it.
3. They will not know the condition of their house when they are out for office work or vacation, whether the house is safe or burglary is in action.
4. Most of electrical home appliances of today can be controlled from long distance, but most of them used infrared; which can only be controlled within a one meter radius from the electrical appliances.
5. How users want some of the equipment appliances such as air conditioner or lights to be ready when they back from work / somewhere else?
6. In order to provide access and control of the appliances for the purpose of remotely securing and controlling them, a circuit needs to be designed where it can send correct signals to the remote control device.

1.4 Objective

The objectives for this project are:-

1. To design and develop a remote control system using telephone lines that will enable the user to ON / OFF electrical home appliances by using the main frame of PIC16F877A.

2. To design and develop home-monitoring security and alarm system that will alert the user in case of emergency, using the auto-dialer system. The user will be informed through the phone if something goes wrong in the house and he / she do not has to be near the house.

1.5 Scope of Project

The scope of this project is divided into 3 main parts:

1. First part is construction of the system's main processing unit using PIC16F877A microcontroller that will control a small stand fan which act as a user appliance at home.
2. Second part is development of the telephone circuits that act as an interface between user and the system. The combination with a few suitable circuits is needed so that the analog signal from the telephone can be changed to its digital form. This part is important because the microcontroller can only recognize and process digital signals. This also includes sensor implementation which is a ring detector in this project.
3. Third part is software design to enable the system to operate according to the objectives of this project.

1.6 Summary

This chapter consists of explanations about the basic things about these projects. It will discuss about the background of project, project overview, objective, problem statement, and scope of project in order to complete these projects.

CHAPTER 2

LITERITURE REVIEW

2.1 Previous Project

2.1.1 A Remote Controller for Home and Office Appliances by Telephone by Ismail Coskun and Hamid Ardam [3]

The goal of this project has three parts of point of view, and the first part is to find a solution for some prevailing problems. The equipment, which is supposed to be left either on or off when one is away from home or office such as security alarms, electrical oven, iron etc., may be controlled remotely. Second part from the convenience point of view, the user can easily operate appliance at home in a very convenient manner while he is in the office. For example, the user may turn on the oven just before coming home so that it heats up while he is on the way and this enable him to start cooking immediately. Third part is from the economic point of view; with the advances in telecommunications, telephone lines have reached the most remote places. It would be a pity to use this expensive investment for the purpose of only verbal communication.

This availability of telephone lines drastically reduces the cost of implementing such a system. When one is away from home and he remembers something which has to be done he will either have to go back or ask someone else to do the job. Both of them are time and energy consuming. The main function of this remote controller is to control the power supplied to remote location via telephone line. The remote controller is placed next to the local telephone set.

The system is based on (DTMF) telephone system. The controller makes use of the telephone keypad as input device to direct data and instructional commands. The received commands are detected and sent to drive load.

2.1.2 A Phone-Based Remote Controller for Home and Office Automation by Eddie M. C. Wong [2]

The function of this remote controller is to control the power supplied to a remote location via telephone line. The remote controller is placed next to the local telephone at the remote location. It can be activated and controlled by either the local or external telephone. The remote location could be a home, an office or a container. Typical application is the changing of light pattern for home security purpose when owner is away. The controller is a small system and can be built entirely by hardware logic circuits. It eliminates some unnecessary cost incurred in using microprocessor. The controller makes use of the telephone keypad as input device to direct data and instructional commands. It can also detect user pass code for preventing unauthorized user access to the controller.

Another application is the turn on of a remote computer before sending data and retrieving useful information through telephone line or network. The remote controller may be operated as a stand-alone system. It may be used at home where the owner may remotely turn on his air conditioner, washing machine or water sprinklers before he reaches home. He may on/off any home appliances, such as light or light pattern, at any time he wishes by just dialing up through an external telephone. He may even dial in to leave simple message, which had already been programmed, on the display unit.