SMART HOME AUTOMATION USING VOICE RECOGNITION

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ABSTRACT

The evolution and development in home automation is moving forward toward the future in creating the ideal smart homes environment. Optionally, home automation system design also been develop for certain situation which for those who need a special attention such as elderly person, sick patients, and handicapped person. Thus, providing a suitable control scheme using wireless protocol mode can help them doing their daily routine. Besides, voice control access will be used as command for better purpose. The objective for this project is to design a smart home automation system using voice recognition. The scope of this project will include the control and monitoring system for home appliances from Graphical User Interface (GUI) using Microsoft Visual Basic software that use Microsoft Speech Recognition engine as an input source and being control wirelessly. The research methodology involved is application of knowledge in the field of radio frequency communication, microcontroller and computer programming. Finally, the result will be observed and analyze to obtain better solution in the future.

ABSTRAK

Evolusi dan pembangunan dalam bidang automasi kediaman semakin berkembang dan menuju ke arah menyediakan kediaman pintar yang ideal dan selesa. Selain itu, bidang automasi kediaman juga dibangunkan untuk penguna-pengguna tertentu yang memerlukan perhatian yang lebih seperti warga emas, pesakit, dan juga bagi orang kurang upaya. Maka, dengan menyediakan sistem kawalan menggunakan sistem wayarles ia dapat membantu mereka menjalani kehidupan seharian. Selain itu, sistem pengecaman suara juga digunakan untuk memudahkan pengguna. Objektif bagi projek ini adalah untuk mereka bentuk satu sistem automasi untuk rumah pintar yang menggunakan teknik pengecaman suara. Kawalan dan pemantauan bagi peralatan rumah melalui GUI yand dihasilkan dari aplikasi perisian Microsoft Visual Basic serta penggunaa enjin Pengecaman Suara Microsoft sebagai input dimana ia dikendalikan dalam mod wayarles. Metodologi penyelidikan yang terlibat merangkumi pengetahuan dalam bidang frekuensi radio, mikropengawal, dan pengaturcaraan komputer. Akhir sekali, hasil yang didapati akan direkodkan dan dianalisa untuk penambahbaikan sistem pada masa hadapan.

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LIST OF ABBREVIATIONS

API	:	Application Programming Interface
ASCII	:	American Standard Code for Information Interchange
CPU	:	Central Processor Unit
CSMA-CA	:	Carrier Sense Multiple Access with Collision Avoidance
CSR	:	Continuous Speech Recognition
DSP	:	Digital Signal Processor
GPRS	:	General Packet Radio Service
GUI	:	Graphical User Interface
IEEE	:	Institute of Electrical and Electronics Engineers
IWR	:	Isolated Word Recognition
MCU	:	Micro Controller Unit
PCB	:	Printed Circuit Board
SMA	:	Security, Monitoring and Automation
SMS	:	Short Message Services
USB	:	Universal Serial Bus

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CHAPTER 1

INTRODUCTION

1.1 Introduction of Project

There has been much development in studies and research about home automation system. Home automation, which also known as Domotics and for special need person such as elderly, home automation for them usually called Assistive Domotics. The aim of this project is to develop a device control home appliances via human voice. Microsoft Speech Recognition engine will be used as voice capture device. The Graphical User Interface (GUI) will be create using Visual Basic.

1.2 Objective

There are several objectives involved in this project that should be focused in order to achieve the design of the project.

- **To design a smart home automation system using voice recognition.**

  The idea is to create smart home systems that use biometric method such as human voice as directive to activate electrical appliances. Hence, voice will be used as input to the system.

- **To provide a friendly user interface for smart home automation system especially for disabled and elderly.**

  The idea is to design a simple, yet friendly Graphical User Interface (GUI) to aid users especially disabilities and elderly person to do their daily home routine. The system should be using a simple understanding language for easy guidance.

- **To design an embedded wireless controller system for the project**
  The idea is using the wireless system to control home appliances wirelessly, which provide easy installment rather than heavy reconstruction by using wired system.
- **Improve the percentage of recognition accuracy to activate the appliances.**

  The idea is to analyze the training procedure and overcome the inaccuracy to achieve higher percentage.

1.3 Problem Statement

Generally conventional home using simple latching switch that being connected to the power supply for controlling electrical appliances such as lighting. This switch usually located at wall in sight of the controlled appliances.

Nowadays new technologies create new solution for home system. This improvisation called home automation. There have been several commercial and research projects on smart homes. Many of the commercial products use remote control whether it has button or fully touch screen.

Still, monitoring and controlling the appliances need some movement and physical contact. Thus, this will be a burden to disable person especially for the disabled and elderly people.

As for this project, the proposed solution is to develop a wireless remote control for the home appliances which can be controlled using voice. This system include Graphical User Interface (GUI) features to guide the user which also using voice.

1.4 Scope of Project

In order to achieve the objective of the project, several scopes need to be identified. The scope of the project includes:

- Meant to control and monitor house appliances using voice. For voice recognition, Microsoft Speech Recognition engine will be use.
- Build friendly user GUI using Visual Basic software for monitoring and to link Microsoft Speech Recognition engine by command to hardware for execution.
- The system controlled wirelessly using computer based on wireless protocol.

1.5 Project Methodology

Phase 1: Software Development

This development is to build Graphical User Interface (GUI) for control and monitoring the system using Visual Basic.

Phase 2: Hardware testing and debugging

Testing and debugging at this moment not using permanent circuitry but only using software. Implementation of circuit will be design in Proteus software.

Phase 3: Software and Hardware Testing

This phase involving testing the program by only using circuit in Proteus and GUI design. Both will be connected using serial communication port in order to test them.

Phase 4: Hardware Implementation

At this moment, the permanent circuitry will be design. Once again, this circuit will be linked to GUI to test the functionality.

Phase 5: Analysis Data

Finally, data will be collected for analysis and suggestion will be discuss in order to overcome the weakness of the project in the future.

CHAPTER II

LITERATURE REVIEW

2.1 Overview

This chapter includes the background study regarding home automation concept, journal, and related previous projects and thesis. It also discusses on the component that are used in the project.

2.2 Home Automation

The demography of the world population shows a trend that elderly population worldwide is increasing rapidly as a result of the increase of the average life expectancy of people [1]. Home automation is one of the fast growing industries that keep promising and satisfy the world population in such many ways. It been created due to many aspect such for those who seeking luxury modern lifestyle while others being offers to those with special needs like elderly and disable person.

"*Home automation is a very promising area. Its main benefits range from increased comfort and greater safety and security, to a more rational use of energy and other resources, allowing for significant savings. It also offers powerful means for helping and supporting the special needs of people with disabilities and, in particular, the elderly. This application domain is very important and will steadily increase in the future* [2]."

According to Khusvinder Gill, Shuang-Hua Yang, Fang Yao, and Xin Lu, in recent years the introduction of network enabled devices into the home improvement has proceed at an unprecedented rate [3].

In other word, home automation also known as domotics. Domotics is defined as "*A set of element that, when installed, interconnected and controlled automatically in a building, save the users worrying about routine everyday actions, providing improvement in their comfort, in energy consumption, in security and in communication as well*" [4]. As for disable and elderly, home automation are called assistive domotics.

Due to its potential, several products has been commercial and further development has been carry out to create more smart design. As in Figure 2.1, this is the an integrated platform for security, monitoring and automation (SMA) from uControl [5]. The system provide user a 7 inch touch screen panel with wireless controlling ability that connected to security alarm and other home appliances. uControl also provide user an ability to control their appliances from any browser or cell phone, alert via email or SMS, WiFi, GPRS, and cameras. With friendly GUI system, it also can manage video, photos, web content and social networking application.

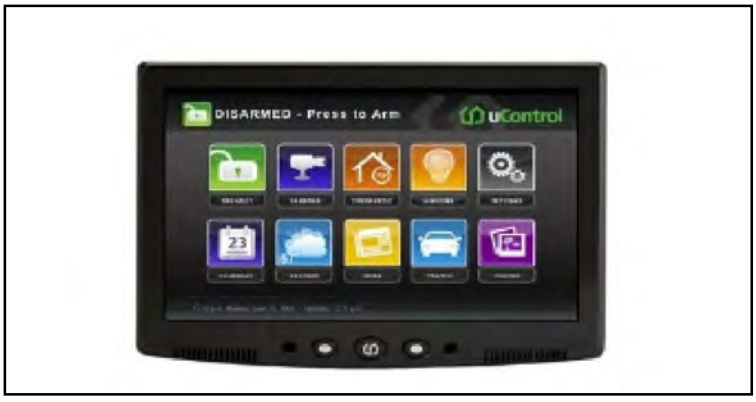

Figure 2.1: uControl Touch Screen Panel (www.thetechjournal.com)

uControl, a leading provider of next-generation home security and automation solutions and industry-changing software platform that allows service providers to deploy cutting edge Home Security, Monitoring and Automation (SMA) services. The uControl SMA Platform and accompanying TouchScreen combine to create an open, technology-agnostic infrastructure that works equally well for all homes whether they have an existing wired alarm system or require a new wireless alarm system to be installed. Beyond home security, the uControl SMA Platform delivers the next generation of digital home services that customers will demand.

.2.3 Microcontroller

Microcontroller has been a major revolution in the field of electronics engineering. It has such a capability of input and output control as well as data processing incorporated into a single chip. It a best choice for application that involve embedded applications and system which require less processing capabilities, thus reducing the cost and complexity in the process of product design.

Microcontroller is defined as a "*a self contained computer on a chip consisting of a central processing unit, non volatile program memory, random access memory for data storage, with various input-output capabilities*" [6].

However, it is important to choose the suitable microcontroller for the design. Basically, several features need to be considered before choosing the suitable microcontroller such as:

- Speed
- Memory
- Number of input/ output port
- Packaging
- Cost per unit

2.3.1 Speed

High speed performance is needed for time critical system such as digital signal processor (DSP) which can perform fast calculation. Also it is important for data to be process in real time function.

2.3.2 Memory

Memory use will depend on how critical the designs are, usually use for complex situation. Based on the complexity of the design, microcontroller should have suitable data space to store the program data. However, the price of microcontroller will cost higher based on memory capacity. Thus, using the suitable microcontroller is advisable.

2.3.3 Number of Input/ Output Ports

Selecting the suitable microcontroller depending on input and output port is really important since it determine the number of sensors, input or output actuator that can be connected to. The input and output of the microcontroller can be analog or digital based on the design.

2.3.4 Packaging

The selection of microcontroller package is essential in product design. A suitable packaging is necessary because it could affect the physical presentation of the finished product. Usually it comes with anti static box that cover up the unit.

2.3.5 Cost per Unit

Microcontroller unit used in embedded system target simple system and application are cost sensitive, hence the price may be worth considering in developing a marketable product.

2.4 Microcontroller PIC 16F877A

As for PIC16F877A, it provides a basic feature and cheap solution, where it enough to work as receiver [8]. Figure 2.3 shows the detail of PIC16F family features:

- High performance RICS CPU
- Operating speed: DC-20Mhz clock input DC- 200ns instruction cycle
- Up to 8K x 14 words of FLASH Program Memory, Up to 368 x 8 bytes of Data Memory (RAM), Up to 256 x 8 bytes of EEPROM Data Memory
- Pinout compatible to PIC16C73B/ 74B/ 77
- Interrupt capability (up to 14 sources)
- Eight level deep hardware stack