

SMART HOMES

PROJECT WORK DONE AT
EMBED TECHNOLOGIES PVT.LTD.,
WILSON GARDENS,
BANGALORE - 641 004. P-820

PROJECT REPORT

SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF THE DEGREE OF
M.Sc [APPLIED SCIENCE] SOFTWARE ENGINEERING
OF BHARATHIAR UNIVERSITY, COIMBATORE.

SUBMITTED BY

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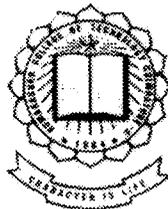
UNDER THE GUIDENECCE OF

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COIMBATORE - 641 006
MAY 2002 - AUG 2002

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
KUMARAGURU COLLEGE OF TECHNOLOGY

(Affiliated to Bharathiar University)

COIMBATORE - 641 002

SEPTEMBER - 2002

CERTIFICATE

This is to certify that the project entitled

SMART HOMES

DONE BY

BALAJI.D

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FOR THE AWARD OF THE DEGREE OF
M.Sc [Applied science] SOFTWARE ENGINEERING
OF BHARATHIYAR UNIVERSITY


Professor and HOD 26/9/02


Internal Guide

Submitted to University Examination held on 26/09/2002


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The duration of the project was from JUNE 2002 to SEPTEMBER 2002. His
performance during this period was good and we wish him good luck for his future.

Embed Technologies Pvt. Ltd.

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I hereby declare that the project titled “Smart Homes” submitted in partial fulfillment for the award of M.Sc. Software Engineering degree is my original work and that has not previously formed the basis for the award of my degree or any other similar title.

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ACKNOWLEDGEMENT

ACKNOWLEDGEMENT

I extend my profound gratitude to **Dr. K.K.Padmanabhan B.Sc. (Eng.), M.Tech, Ph.D.**, Principal, Kumaraguru College of Technology, Coimbatore for providing me an opportunity to do the project work as part of the curriculum.

I am greatly thankful to **Mr.Anand, Managing director** of Embed Technologies Pvt (India) Limited for permitting me to take up the project work.

I express my sincere thanks to **Prof. Dr. S.Thangasamy B.E. (Hons), Ph.D.**, and Head of the Department, Computer Science and Engineering for his valuable suggestions and advice.

I am immensely thankful to my course coordinator and my guide **Mrs.S.Devaki B.E., M.S.**, for the valuable guidance and support throughout my project.

I express my sincere thanks to **Mr. Zaheer**, Software Engineer for the advice, suggestions and encouragement throughout the course of this project.

ABSTRACT

Smart Homes

Abstract

Home automation must be a system for housekeeping, entertainment, care, and mainly for security. It can only be successful when it is pointed out in the direction of the advantages for the end user.

This is a technology that presents promising possibilities for improving the features offered by the “stand-alone” domestic appliances by their integration in a domestic system process and supporting the Product Divisions for the. This document presents an overview in the Home Automation approach and involvement.

The specific needs of market segment are presented to introduce then the key question: which are the real advantages for the final customer offered by this technology? An effective answer to this fundamental question is mandatory to define a concrete strategy for the introduction of Home Automation in white goods.

The document completes the analysis describing which actions should be taken by the actors involved in Home Automation to help the transformation process of a technological opportunity into a market opportunity.

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INTRODUCTION

1.INTRODUCTION

1.1 About The Organization

Embed technologies (p) Ltd have been in the microprocessor technology for last 15 years providing development and debug solutions to varied customers. They excel in providing services in areas like DEVELOPMENT, TRAINING and DISTRIBUTORSHIP.

Embed technologies (p) Ltd have their areas of activity in DSP And DIGITAL Communications, RTOS And Embedded Systems And MICROCONTROLLERS. Their focus area in communication technology is in both telecom and wireless.

Embed technologies (p) Ltd is proud to initiate the state of art training centre in ban galore cater to the engineers and IT professionals belonging to this domain.

Embed technologies (p) Ltd represent some of the world leaders in some of the Real Time Embedded Systems Applications for distributing their hardware and software development and debugging tools, real time operating systems, DSP development systems, PCI and PCI Bus analyzers, Adaptors, Extenders etc.

Embed technologies (p) Ltd has a great esteem list of customers like Motorola India Electronics Ltd, WIPRO, Infosys, L&T, ADE, NPOL, BHEL, ADA, BEL and many more.

Embed technologies commitment to Excellence

- Maintenance of the highest quality standards, best and adherence of schedules and deliverables.
- Continuous skill upgrading of the Organization and its intellectual resources keeping abreast of Internet Technology.
- Maintenance of a congenial work environment, opportunities for and growth and the best compensation package in the industry for employees.
- Maintenance of the highest ethical standards in all its transaction in creating corporate and employee's wealth.

1.2 Purpose

The smart house really differs from other houses is that a communications infrastructure is installed that allows the various systems and devices in the home to communicate with each other.

The modern home contains a variety of systems, such as central heating, fire and security alarms, that usually exist in total isolation from each other. In the smart house, these systems and devices are able to pass information and commands between them.

The role of smart homes in a domestic environment is very important: they are fundamental tools to improve the quality of life. According to the different cultures and life styles represented in daily help in the domestic activities. Their use has become familiar to a large percentage of people and their presence is part of the normal house furniture.

Home Automation is a technology that offers challenging possibilities to improve the quality of life in domestic environments by means of the integration of the domestic appliances in domestic systems. The fundamental part of the domestic devices and their integration appears an attractive opportunity to improve their "stand-alone" functionality through a co-operation in an integrated system. An approach to this field to verify the potentialities of this information technology in order to address a new generation of products.

1.3 Scope Of The System

The system mainly focuses on bringing the technology to the user which the user can really depend on for the security of their homes which is to be protected and warn from the elements of nature and from the human disturbances.

SYSTEM STUDY

2 System Study

2.1 Introduction

As the system study is an integral part of every project, this project also demands a profound and profuse study of networking field. a detailed study on the devices of how they communicate with each other is necessary and also the basic requirement of the user is also very important which pertains to the development of any system in the field of embedded field.

2.2 Existing System

The main problem with the existing security systems was that they couldn't take care of the integration of functions as a total fixing off all existent appliances in the home that remained a stand alone oriented device and which to be implemented again was cost effective

2.3 Proposed System

Integration of functions

- Housekeeping such as food conservation and preparation, care of clothes
- Home Office and Communication
- Entertainment like audio, video, radio, tv
- Supply of electricity, heating, water, light, or ventilation
- Security and Safety in relation to burglary, fire, flood or weather

More importantly, the results of the analysis identified the real requirements for a home automation system from point of view of the end user. These items are describing the most important user needs ranked in the following priorities:

SYSTEM MODEL

3 System model

3.1 Overview of the system

Over the last 15 years, computerised controls have become more and more common in our homes. Computers control our washing machines and microwaves, they turn our heating on and off, and they have provided new ways to monitor the safety and security of our homes. The smart home looks at expanding the use of these computers into other parts of the home, creating a single network that can be easily and conveniently controlled. The use of computer controls removes the need to actually flick a switch or turn a knob to make something work and allows elements of the home to be controlled remotely by, or to respond automatically to, the people living in it. The smart home relies on a number of small computers distributed around the house that are either used to turn devices and appliances on and off or to send and receive information. These computers are linked together using either a dedicated cable or by sending a special signal through the mains electricity cables.

What is embedded technology?

Writing programs or software into micro controllers (or) microprocessors to take decisive actions (or) perform functions depending upon the events that the system was devised to monitor.

Examples : washers, micro ovens, video games, elevators, irons, toys etc

3.2 Why micro controller?

Micro controller does not differ much from the micro-processors ,except it has the usual features of the processors and it also has ROM ,RAM,parallel I/O,serial I/O,counters

Well the prime use of micro controller is to control the operation of a machine using a fixed program that is stored in ROM.

- Micro controller(8051)
- Four 8-bit input/output ports .
- Two 16-bit timers/counters .
- Serial peripheral interface in full duplex mode.
- Five interrupt sources .
- Internal clock.
- 256 bytes of read/write data memory .
- All the devices interface through the 8051 micro controller.

3.3 Devices controlled using the 8051 micro controller

、 The following section looks in detail at the major devices in the home and how they can be operated.

LCD

- character-type dot matrix LCD modules can be used with any of our micro controllers.
- The available LCD module configurations include a 16x2 (16 character by 2 line) dimensions, on either of these modules.
- Both of these LCD modules use a standardized interface that is identical to the type found on most other commonly available displays.

Matrix keyboard

- The KP-02 keypad is an economical 16 button matrix. It is a front panel mount keypad.
- The individual keys are rubber buttons mounted in a black ABS plastic housing.
- The KP-01 keypad is a 16 button matrix designed with versatility in mind.

Analog to Digital converters

- The ADC-1 data acquisition and control peripheral is an external device that connects to virtually any computer via RS-232 serial communications.
- It contains the necessary hardware to convert voltages output by most commercially available sensors into digital signals a computer can understand.

The ADC-1 enables computers to collect, display and record measurements from environmental and process control sensors and the results are used to control variety of external devices by the ADC.

Infrared controllers

A wide variety of handheld devices are available that can be used to operate the house. These controllers can be programmed to operate any device or group of devices that you wish. They can be taught to operate your television, video and stereo, providing a single control point for a room or the whole house. The person who designs and installs the system, the systems integrator, will be able to advise you which controller is the most appropriate for your needs.

Lighting

All of the lights in the house can be switched on and off using the conventional light switches or any remote control device. Using the light switches in the room will bring the bulb on fully. Using a remote control unit will allow dimming. Other systems in the house can operate lights in the following ways:

The doorbell and telephone can be made to flash the lights .

The fire alarm can switch lights on to guide you towards an exit.

The security alarm can use the lights to make the house look like it is occupied.

Movement detectors can turn lights on or off when you enter or leave a room.

Detection devices

Externally there is a detector that measures wind speed and light level. Internally each room has a multi-function detector head, which looks similar to a smoke detector. The detector measures smoke, temperature (for fire and heating), light level, movement (using passive infrared), and carbon monoxide. This detector also has an infrared receiver, emergency light, siren, and microphone. A 360o digital camera can also be fitted. These detectors are used to allow the house to respond to changing conditions and to remote control devices.

P-820



Alarms and security

Fire alarm

The fire alarm detects fire by rapid increases in temperature or by sensing smoke.

If a fire is detected, the alarm will sound a siren, flash all the lights in the house eight times and then leave all the lights on in the house to aid escape. At the same time, the alarm can call the care centre and notify them that the alarm has gone off. The system can be configured to unlock the front door automatically if someone is in the house.

Security alarm

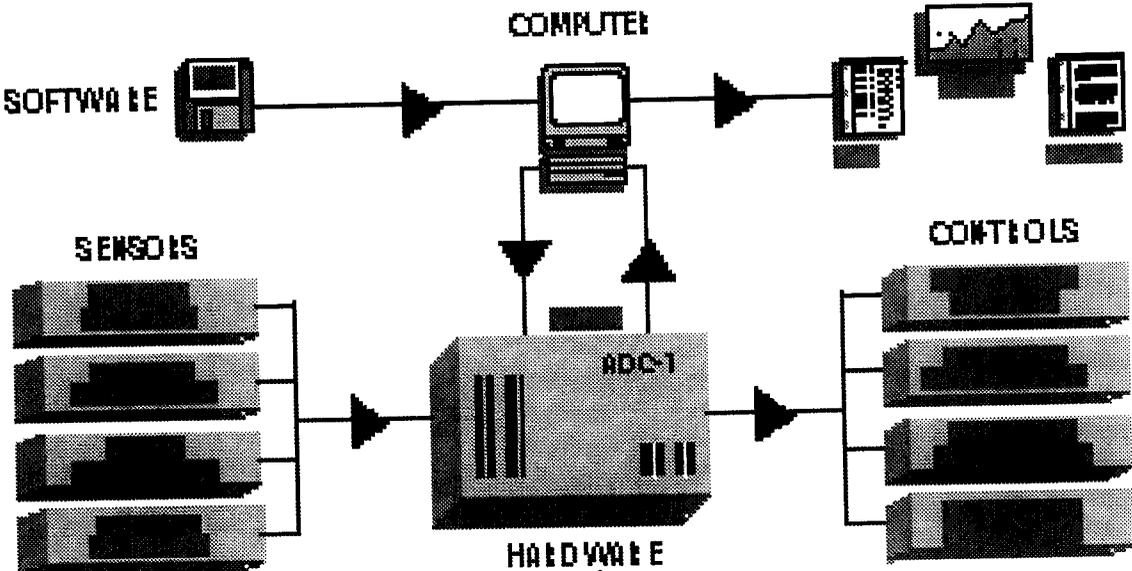
The security system is controlled from a panel in the hallway. This panel also acts as the answering machine for the house. There are a series of voice prompts on the alarm panel that will lead you through its operation. These are summarized in the diagram below.

Setting the alarm will activate the central locking system. This will close all windows and doors and can switch off any devices. For example, you may want it to turn off any lights left on during the daytime. The security system can also be operated through the internal telephone or by dialing into the house from an outside line. In these instances, the voice commands work in the same way as using the panel directly. Any of the remote control devices can also be used to operate the alarm system.

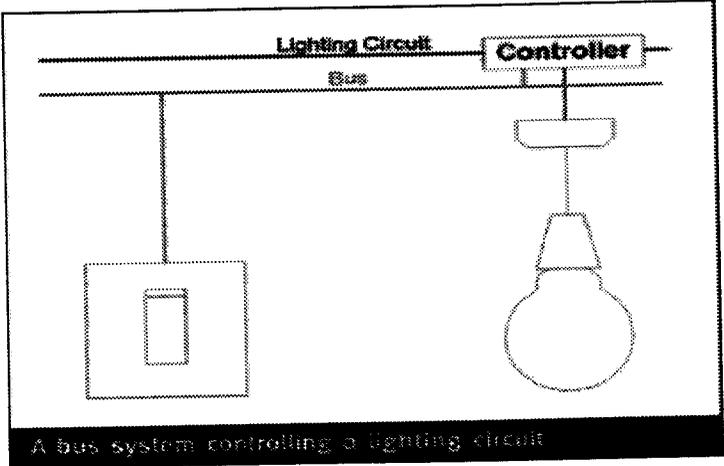
Existing appliances

Some of your existing electrical products can also be linked into the smart home. Special replacement plugs can be fitted that will allow remote control of the appliance. These adaptors can be turned on or off from buttons on the plug, or through any of the remote control devices.

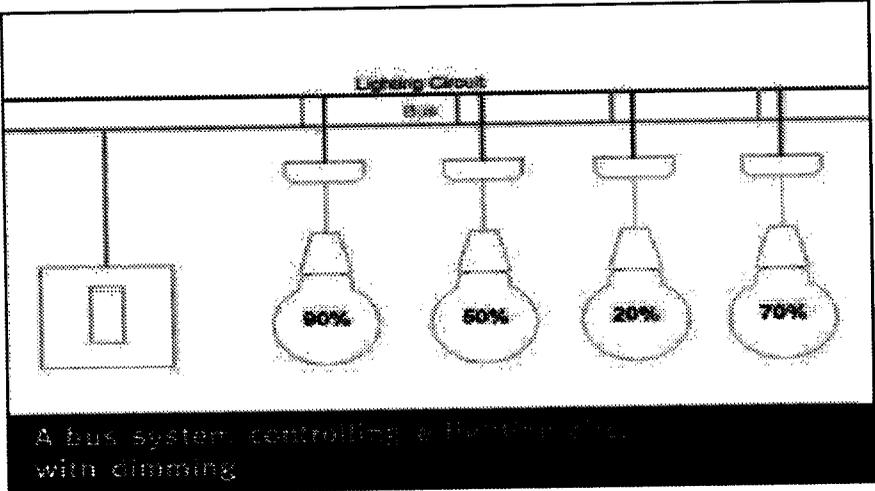
Interface Of The Whole System



3.4 Overview of how the system works

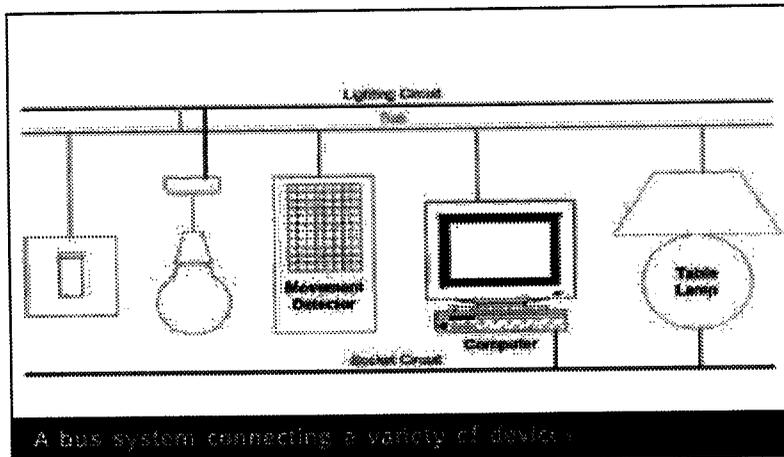


The majority of commands in current homes are passed on to the device in question through the use of a physically operated switch. Generally pressing a switch or turning a dial directly alters the supply of electricity to a device. The switch opens or closes an electrical connection or varies the resistance of that connection. The lights in the circuit are linked into a separate switch that is able to interrupt the flow of electricity to the light fittings.



In the smart home the switch takes on a different function. Rather than regulating the flow of electricity, the switch merely sends a signal to a communication network, called a bus system, informing the network of the new position of the switch. A controller fitted to a single light fitting, or a number of light fittings, receives this signal, recognizes that the message is intended for it and responds, in this example by turning on the light. The regulation of electrical flow takes place at the controller rather than at the switch.

The example of controlling light fittings gives little added utility to conventional methods of control. Flicking a light switch turns the light on or off as appropriate. However, if the bus system connects more than just lights, it is possible to radically change the way the home is controlled. The switch is no longer directly related to any particular device so it can operate any device on the network that has been told to respond to the signal from the switch. So multiple lights, possibly in different rooms, could be controlled and even dimmed to different levels.



Devices in the home are now able to change status in response to a signal on a network and so commands no longer need to come from a physical switch - or a variety of devices could react to the same switch. Other pieces of equipment connected to the network are able to send messages that may tell a device to turn on or off. The lounge lights can be programmed to response to a light level sensor signaling that it has gone dark and a movement detector saying that there is someone in the lounge.

3.5 Passing information around the home

Smart homes rely on the ability to distribute information and commands around the home as described above. There are a variety of ways that this can be achieved. Broadly these can be divided into wired or wireless methods. Wireless communication involves a more emergent set of technologies that have great potential but little demonstration usage in smart homes.

Dedicated wiring bus

A wiring bus is a dedicated wiring system installed purely for the purposes of distributing information. Typically a communications bus will rely on an unshielded twisted pair cable (UTP), which is a cable with at least two separate wires insulated from each other but without any sheathing to prevent interference from radio waves. The most common form in an existing home is the telephone cabling. In the smart home a better quality of cable than this is required.

REQUIREMENTS

4 .Requirements

THE REQUIREMENTS FOR THE INTRODUCTION OF HOME AUTOMATION TECHNOLOGY

The role in a domestic environment is very important: they are fundamental tools to improve the quality of life. According to the different cultures and life styles the white goods represent a daily help in the domestic activities. Their use has become familiar to a large percentage of people and their presence is part of the normal house furniture.

FROM "STAND-ALONE" TO "SYSTEM-ORIENTED"

The development of appliances has followed until now an approach dedicated to the cost/performance optimization of the single stand-alone device. The actual white goods optimize the results of their activity by saving energy and chemicals, operating without noise and offering a more user-friendly operation for the customer. The concept of integration is relatively new and implies for the white goods manufacturers a sort of revolution both in terms of organisation and in the approach for the conception, design, manufacturing and commercialisation of the new system-oriented appliances. It is necessary to move from a local, dedicated view to a system-oriented view, where the benefits have to be reached by an adequate co-operation among the devices.

In the Home Automation systems that already have been present on the market the role of white goods is in general secondary: they are playing a passive role and, often, are connected just to an intelligent plug that implements, more or less, only an ON/OFF functionality.

The advantages for the manufacturers in this case are minimal: no way to show the specific functionality of the devices and no changes to improve the already available stand-alone capabilities. All traditional and advanced models of all brands are treated in the same way with limited advantages for the consumer.

For the above reasons the main effort of the Group is to investigate the characteristics and potential of the Home Automation technology to define the proper role of the white goods inside the domestic systems and all new possible functions that can be implemented in an integrated system. The main objective is to introduce these devices with a recognized perception of the valuable advantages by the final customer.

The result of this activity will be a set of requirements for the new domestic appliances and for their integration in domestic systems in order to guarantee mutual advantages.

4.1 Things to consider when specifying smart homes equipment

Levels of specification

The design of a smart home needs to take into account not only the form of the house itself but also the requirements, both generic and specific, of the people who may live in and visit the house. Three levels of specification can therefore be considered:

Basic infrastructure

What are the underlying technologies that will be used to provide interoperability in the home? JRF has used Echelon's LonWorks communication protocol in the development of its smart homes, but this is only one of the potential ways of achieving interoperability. The underlying technology or technologies used will determine some of the subsequent specification decisions.

Context specific requirements

The design and structure of the building in which they will be installed will influence the technologies decided on. As discussed in the 'How does it work?' section there are a variety of ways in which communications data can be sent

around the house, from dedicated cabling to wireless techniques. The choice of the most appropriate transmission media will depend on the house in which they will be installed. The homes developed by the Joseph Rowntree Foundation have so far been retrofitted with smart homes equipment and so have relied heavily on the use of the existing power cabling as a transmission medium. In a new build or major refurbishment project, a dedicated wiring bus system may prove more appropriate.

User specific function

The infrastructure and basic set of equipment can be customised by the addition of devices to meet the specific needs and preferences of the residents of the home. This will involve the installation of user specific pieces of equipment as well as the configuration of the overall system.

From these three levels of specification it can be seen that the decision on the basic infrastructure determines any subsequent decisions. The selection of communications protocols will influence the choice of installers of equipment or the training required to commission the system. Most of the current protocols are suitable for new build and refurbishment applications and for almost any size of home. Differing house types will affect only the way that the installation is carried out.

Recommendations

An appropriate understanding of the user and their needs will form an essential part of any specification. In developing its demonstration homes, JRF installed a wide variety of devices, each of which may be appropriate to specific users. It is extremely unlikely that anybody would need all the devices fitted. Motorised devices tend to be an expensive element of any installation and so the cost/benefit of their usage must be carefully considered.

As it will not always be possible to understand the specific needs of users at the time of specification, it may be beneficial to consider a basic set of devices and functions that are universally applicable. Once the end user of the home has been identified, additional requirements can be specified and installed as appropriate.

The distributed nature of most smart homes systems means that the failure of a single device is unlikely to disrupt the whole system. However, any such failure should not affect a user's ability to live in the house or, in the worst-case scenario, cause a danger to users. With this in mind, care should be taken to ensure that devices could be manually overridden. This is particularly important in areas such as entry and exit routes. The use of battery back-up systems, which are often incorporated in low voltage devices, should also be considered in case of power failure.

4.2 BASIC REQUIREMENTS

The basic requirements for a market successful introduction of domestic systems that integrate goods are:

- Standard communication system
- Low cost components
- Minimal impact on the house infrastructure
- Plug & play approach

Standard communication system

The domestic communication platform has to be clearly defined, stable in terms of characteristics and widely accepted. The needs for a standard platform is a fundamental requirement for, at least, two reasons: the first reason is for the consumer appliances manufacturers to ensure optimal results of their development costs and investments using a widely accepted and stable standard, the second is to allow a progressive development of numerous different devices that can be easily integrated in standard-based domestic systems. The possibility to increase progressively the number of devices that can be integrated in the system, thus improving the new potential system functionality, is a really attractive feature for a customer that is going to buy a Home Automation system.

Low cost components

The specific requirement of the consumer market is the optimisation of the proposed systems in terms of cost.

This natural requirement should have the right trade-off between communication components characteristics and the potential large volume of them. This requirement is directly connected with the previous one: to have a widely accepted standard as reference allows to reach large volumes of components which is the natural way leading to reductions of the component's costs.

Minimal impact on the house infrastructure

The communication infrastructure should require no or limited changes in the houses. The potential market for Home Automation systems has in the existing houses a relevant condition: the costs of retrofitting should be limited as much as possible to make this technology attractive.

The use of a transmission medium that does not require extra wiring in the house appears to be the natural solution: for this reason much attention is put on power line communication and radio frequency links.

For the white goods, the power line communication is less critical in terms of product adaptation: no extra wires come out from the appliance and no changes are required to the metallic chassis. This condition allows, even after sales, the enhancement of a stand-alone appliance to a system-integrated one. Without any external changing in the metallic box this operation could be easily and safely made by the service people directly at home by adding, inside the appliance, the domestic communication components.

It has to be noted that the introduction of extra-connectors on the metallic box requires a restructuring of the manufacturing process to guarantee the safety and compliance with the EMI/EMC regulations.

Plug & play approach

The introduction of a new appliance in the system should not require the need for a professional installer.

The white goods are usually installed with some simple operations: often they are directly installed by the consumer. For this reason it is important to maintain a simple approach for the installation of domestic appliances in a Home Automation system: ideally, the system should support an automatic identification and enrolment of the new devices. The operations that are necessary to upgrade the control units with the new and dedicated functions should be possible for the support and service organisation of the white goods manufacturer.

4.3 SPECIFIC REQUIREMENTS

The specific requirements that can decisively help the integration of white goods in a domestic system is summarized in the following points:

- Active role,
- Added functionality,
- Dedicated functionality.

Active role

The integrated appliances have to communicate directly with the domestic controllers.

The white goods have to be considered as "intelligent units" able to exchange information autonomously with other system units. It is important that the white goods can adequately verify the contents of all messages to avoid undesirable operations.

This guarantees a real co-operation between the domestic appliances and the system controllers with positive consequences for the overall results.

The use of Intelligent Plugs is advantageous to control simple appliances where it is sufficient to have a pure ON/OFF system control. On the other hand, the specific nature of the white goods and their capability to provide exceptional functionality require a different approach for system integration that allows a co-operative and active role of them. A simple ON/OFF system control without any active involvement of the white goods can significantly limit the performances of these devices (*i.e.*; *to stop a washing machine just after a heating phase will result in a loss of energy and, if it is washing delicate fabrics, the clothes may be damaged if they stay for a long time in the water*).

It is important to note that with an anonymous role of the appliances there are no chances for brand diversification and a vivid competition between white goods manufacturers in providing new helpful integrated functionality.

Added functionality

The integration of the appliances in a domestic system has to offer added functionality compared to the ones already available in the stand-alone version. It is not the correct approach to offer a "general remote control" that transforms the domestic appliances into dummy electro-mechanical boxes with only sensors and actuators. It is better to start from the already available features, to integrate system functionality that improve the overall device's functionality. This is important also to guarantee that the appliances can operate with all the functionality available in their stand-alone versions if the domestic communication system is temporarily out of service.

Dedicated functionality

An important aspect to create a market advantage is to provide to each potential white goods brand the possibilities to differentiate the functionality offered to the consumer.

A general purpose domestic system should offer, besides the general interoperable functions, the possibility to implement and integrate specific "private" functionality. According to its market segment, each white goods manufacturer can integrate special features dedicated to their own customers by using the common structures and devices of the integrated system.

An example of "private functionality" could be the Customer Assistance Service: from its "Assistance Offices" a company may check the appliances of its brand in a house using the common telephone link made available by the Central Controller.

In this way it is possible to offer special exclusive services to the customer using a common infrastructure with evident benefits both for the appliance's company and for the Domestic System provider.

SYSTEM ANALYSIS

5. System Analysis

In the analysis phase, the project is divided into many stages or phases and each phase is carried out in a sequential fashion.

5.1 Project phases

PROJECT PHASES
SRS Documentation
Project Coding
Testing
Implementation
Detailed Design Documentation

5.2 Software Process Model

Linear Sequential Model

The software process model followed by us to develop the project is linear sequential model. Sometimes called the classic life cycle model or waterfall model, the linear sequential model suggests a systematic, sequential approach to software development that begins at the system level and progresses through analysis, design, coding, testing and support. The following figure illustrates the linear sequential model for software engineering.

The classic life cycle paradigm has a definite and simple structure. It provides a template into which methods for analysis, design, coding, testing, and support can be placed.

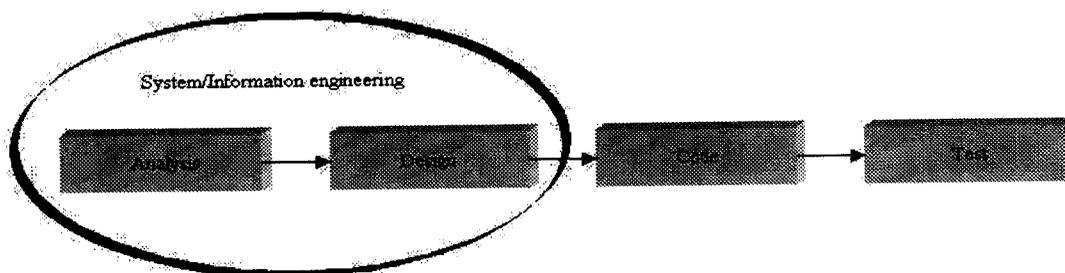


Fig 4.1 Linear Sequential Model

SYSTEM DESIGN

6. System Design

6.1 Design Constraints

Portability:

The project has to be designed in such a way that it is flexible to all security options required by the user.

Reliability:

The project has to be designed in such a way that it works for all sorts of input from the system environment. For example, if the client want to call his house to be warm before he comes back home ,he can call his house to switch on the heater .

Performance:

The system performance is measured by its execution time and accuracy . Hence in order to ensure performance, the system has to be designed efficiently.

Scalability:

Any number of stand alone oriented devises must be allowed to be added to the system .

6.2 System Architecture

The 8051- microcontroller generic part number actually includes whole family of microcontrollers that have numbers ranging from 8031 to 8751 and are available in N – Channel Metal Oxide Silicon (NMOS) and Complementary Metal Oxide Silicon (CMOS) construction in a variety of package types. An enhanced version of the 8051, the 8052, also exists with its own family of variations and even includes one members that can be programmed in BASIC. This galaxy of parts, the results of desires by the manufacturers to leave no market niche unfilled, would require many chapters to cover. In this chapter, we will study a “generic” 8051, housed in a 40-pin DIP. The block diagram of the 8051 in figure 3.1 shows all of the features unique to Microcontrollers.

Internal ROM and RAM

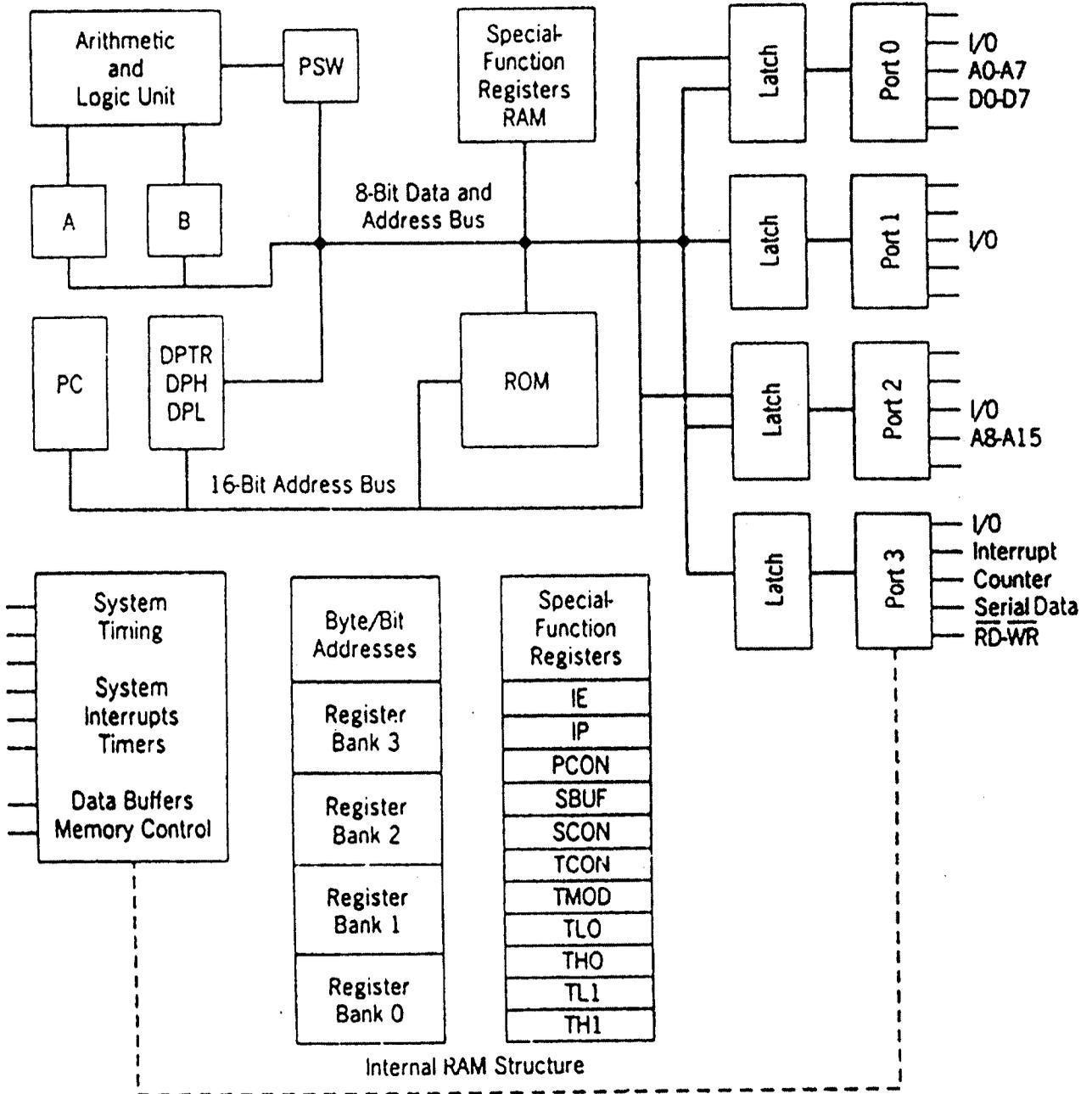
I/O ports with programmable pins

Timers and Counters

Serial data communication

The fig also shows the usual CPU components: Program counter, ALU, Working registers, and clock circuits.

Block Diagram



The 8051 architecture of these specific features:

- ❖ Eight – bit CPU with registers A (the accumulator) and B
- ❖ Sixteen- bit program counter (PC) and data pointer (DPTR)
- ❖ Eight – bit program status work (PSW)
- ❖ Eight –bit stack pointer(SP)
- ❖ Internal ROM or EPROM (8751) of (8031) to 4k (8051)
 - ❖ Internal RAM of 128 bytes
 - ❖ Four Register banks, each containing eight registers
 - ❖ Sixteen bytes, which may be addressed at the bit level
- ❖ Eight bytes of general – purpose data memory
- ❖ Thirty-two input/output pins arranged as four 8-bit ports: PO – P3
- ❖ Two 16-bit timer/ Counters: T0 and T1
- ❖ Full duplex serial data receiver / transmitter: SBUF
- ❖ Control registers: TCON, TMOD, SCON, PCON, IP and IE.
- ❖ Two external and three internal interrupt sources.
- ❖ Oscillator and clock circuits.

6.3 Communication Between the 8051 and 8255

HARDWARE INTERFACE

8255 Pin Features:

The 8255 is a 40 pin DIP chip. It has three separately accessible ports. The ports are each 8-bit and are named A,B and C. The individual ports of the 8255 can be programmed to be input or output and can be changed dynamically.

PA0 – PA7 :

The 8 bit port A can be programmed as input or as output or all bits as bi-directional Input/Output.

PB0 – PB7 :

The 8 bit port A can be programmed as input or as output or all bits as bi-directional Input/Output.

PC0 – PC7 :

The 8 bit port A can be programmed as input or as output or all bits as bi-directional Input/Output. It can also be split into two part , CU(upper bits PC4-PC7) and CL(lower bits PC0-PC3). Each can be used for input or output. In addition, any oif the bits PC0 to PC7 can be programmed individually.

— —
RD and WR :

These two active low control signals are inputs to the 8255. The RD and The WR signals from the 8051 are connected to the se pins.

D0 – D7 data pins:

The data pins of the 8255 are connected to the data pins of the Microcontroller allowing it to send data to and fro between the controller and the 8255 chip.

RESET:

This is an active high signal input into the 8255 used to clear the control register. When RESET is activated, all ports are initialized as input ports.

—
A0, A1 and CS:

While Cs (Chip select) selects the entire chip, it is A0 and A1 that select the specific ports. These three pins are used to access ports A, B and C. or the control register as shown in the table.

CS	A1	A0	Selection
0	0	0	Port A
0	0	1	Port B
0	1	0	Port C
0	1	1	Control Register

Mode Selection of 8255 :

While ports A,B, and c are used to input or output data, it is the control register that must be programmed to select the operation mode of the three ports. The ports of the 8255 can be programmed in any of the following modes.

1. Mode 0, simple I/O mode, any of the ports A, B, CL, and CU can be programmed as input or output. In this mode, all bits are out or all are in. In other words, there is no such thing as single-bit control as we have seen in P0 –P3 of the 8051. Since the vast majority of application involving the 8255 use this simple I/O mode, we will concentrate on this mode in this chapter.
2. Mode I.. In this mode, ports A and B can be used as input or output ports with handshaking capabilities. Handshaking signals are provided by the bits of port C. The details of this mode are discussed in the third section of this chapter.
3. Mode 2. In this mode, Port Acan be used as a bi-directional I/O port with handshaking capabilities whose signals are provided by port c. Port B can be used either in simple I/O mode or handshaking mode1. This mode will not be explored further in this book.
4. BSR (bit set/reset) mode. In this mode, only the individual bits of port C can be programmed. This mode is discussed in the third section of this chapter.

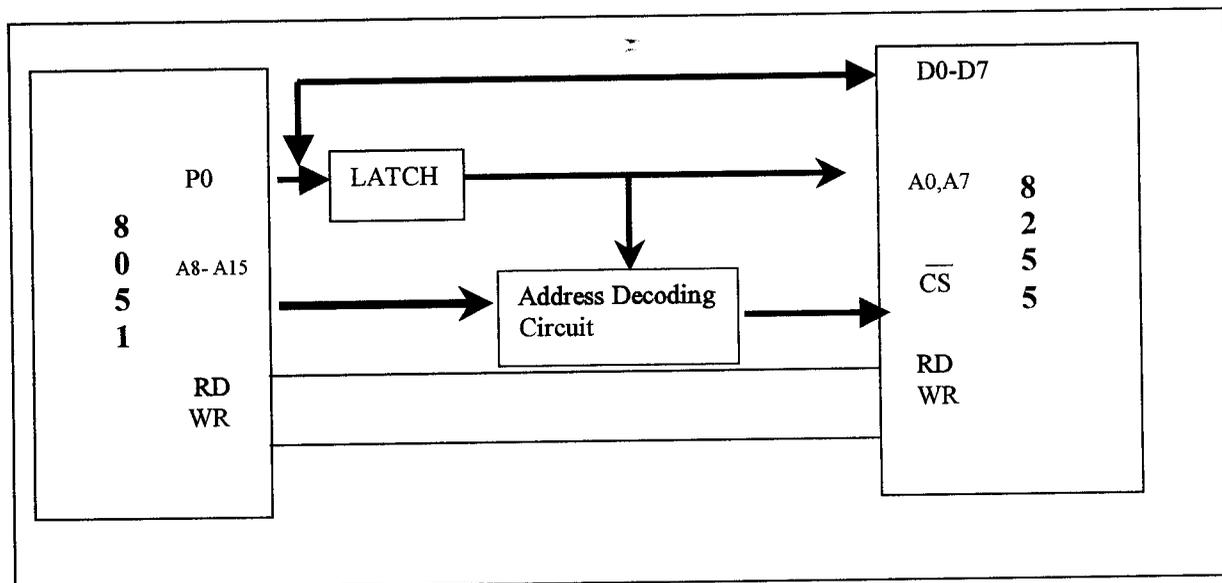
INTERFACING THE 8255 TO THE MICROCONTROLLER:

Memory Map:

A15.....	A2	A1	A0	Selection
0.....	0	0	0	0000 (Port A)
0.....	0	0	1	0001 (Port B)
0.....	0	1	0	0002 (Port C)
0.....	0	1	1	0003 (Control Register)

Given to CS via the address decoding circuit

INTERFACE OF 8051 AND 8255



TESTING

7. TESTING TECHNIQUES:

Good software testing ensures the reliability of the software. The testing techniques that were followed when testing this software are as follows:

Software was tested from two different perspectives. They were:

Good software testing ensures the reliability of the software. The testing techniques that were followed when testing this software are as follows:

Software was tested from two different perspectives. They were:

- ❖ Internal program logic was exercised using “white-box” test case design techniques.
- ❖ Software requirements were exercised using “black-box” test case design techniques.

When the testing phase of the project began, the point of view on the software had been changed to “break” the software design test cases in a disciplined fashion and review the test cases that were created for thoroughness. White-box and black box testing was done to test the software.

FUTURE ENHANCEMENTS

8. Future Enhancements

The use of computer controls allows the home to be operated in a variety of ways. Some of these will be more appropriate to some people than others. Below are a number of examples of the way the home can operate. **Telephone control**

The security alarm panel fitted in the hall also operates as an answering machine and can be used to dial into the house and tell it to do certain things. This system relies on a PIN number, similar to the one used at a cash point, to ensure that only you can control the house in this way. It has a series of voice prompts that will guide you through the operation of the house. If you are late coming home one evening, you can call the house and get it to close the curtains, as it gets dark.

If you have been away from the house for a few days and want to be sure the house is warm on your return, you can call the house and switch the central heating back on.

This system can also be used to call you at work or on a mobile phone, if somebody rings the doorbell when you are not in the house. Friends can speak to you and find out when you will be back so they can arrange to visit again.

Delivery people can be let into the hallway to drop off parcels. The security alarm will prevent them from going any further into the house.

Integrated security

The home security system can be enhanced because the security alarm is able to communicate with other devices in the home.

- When leaving the house, a single signal from a key fob, similar to those used for car alarms, can turn on the security alarm, close any open windows, and make sure all the doors are locked.
- When coming home, the same key fob can turn off the security alarm, open the front (or back) door, and switch on the hallway light.
- If you are away from home for a few days, the security alarm can tell the curtains to open or close in the morning and evening and also turn some of the lights on and off during the night to make it look as if the house is still occupied.

CONCLUSION

9.CONCLUSIONS

As announced in the introduction, the main purpose of this document is to present a point of view that can contribute in the definition of the strategy for a concrete and successful application of Home Automation technology.

The main aspects emerged from the above analysis can be summarized in the following points:

- need to define a clear and stable communication standard and low cost multi-source components,
- need of an inter-operability board to harmonize the applications in order to guarantee an effective, synergetic integration of devices,
- need to concentrate the analysis on the real needs of the customers and on a components cost optimization,
- need of alliances of complementary partners to offer a global system that covers many different aspects of the domestic live with mutual advantage for the partners,
- incremental approach starting from a basic infrastructure with simple but effective applications. The basic infrastructure has to be conceived as an open platform ready for successive integration both in terms of new devices and new functionality.
- Integration of domestic systems into the global communication networks to transform the house in an active node of these networks.

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