UNIVERSITI PUTRA MALAYSIA

DESIGN AND DEVELOPMENT OF A HANDHELD BLUETOOTH-BASED APPLICATION SYSTEM FRAMEWORK FOR CONTROLLING AND MONITORING REMOTE DEVICES

MD. NAZMUS SAADAT

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DESIGN AND DEVELOPMENT OF A HANDHELD BLUETOOTH-BASED APPLICATION SYSTEM FRAMEWORK FOR CONTROLLING AND MONITORING REMOTE DEVICES

By

MD. NAZMUS SAADAT

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Partial Fulfillment of the Requirement for the Degree of Master of Science

June 2006
DEDICATED TO

My Mother Mrs. Rabeya Khatun, my Father Md. Borhan Uddin, my Brother Md. Robiul Hasanat and his family, my loving little sister Iffat Ara Chaity, my Father in Law Sk. Afzal Hossain, My Mother in Law Mrs. Laila Parveen, my soulmate and beloved wife Fariah Afzal Tuli and all teachers and friends throughout my life.

May Allah reward you the best.
Abstract of thesis presented to the Senate of Universiti Putra Malaysia in partial fulfilment of the requirement for the degree of Master of Science

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MD. NAZMUS SAADAT

June 2006

Chairman : Professor Borhanuddin Mohd. Ali, PhD
Faculty : Engineering

For short range wireless communication, Bluetooth technology is well known standard while competing with other short range wireless standard like Infrared, WiFi, and UWB. Bluetooth is being used worldwide today. Its point to multipoint and no line of sight facility has removed the obstacles that some other hugely used technology like IrDA had. This work focuses on designing and developing an application system framework for controlling and monitoring remote devices wirelessly using Bluetooth within its standard range. For example, any Bluetooth enabled PDA, laptop or mobile phone can be used for controlling the household devices like lights, air con or digital audio systems in room environment or this can be used for industrial machine controls and office environment for various purposes starting from switching devices to acquiring real-time data from working systems or from sensors. Also the system can be used for robotic aspects in short range distance.
The system design went through number of different tests and real time simulations to assure performance issues. The results show that it provides the standard features of system services with acceptable quality in data transmission and reception and controlling remote devices and the user application and interfaces are very much convenient to interact with.

Finally, a prototype has been developed according to the design. The test results measured using the prototype verify the system design and confirm the standard performance of services.
Abstrak tesis yang dikemukakan kepada senat Universiti Putra Malaysia untuk memenuhi sebahagian daripada keperluan Ijazah Master Sains

PEMBANGUNAN SISTEM PENJANAAN DAN PEMANTAUAN BERASASKAN PERANTI PEGANGAN TANGAN BLUETOOTH

Oleh

MD. NAZMUS SAADAT

Jun 2006

Pengerusi : Profesor Borhanuddin Mohd. Ali, PhD
Fakulti : Kejuruteraan

Untuk komunikasi tanpa wayar jarak dekat, teknologi Bluetooth adalah piawaian yang diketahui umum bersaing dengan piawaian tanpa wayar jarak dekat yang lain seperti Inframerah, WiFi, UWB dan sebagainya. Hari ini, Bluetooth digunakan di seluruh dunia dalam peranti-peranti mudah alih. Bercirikan satu titik ke pelbagai titik dan ketidakperluan kepada garis nampak menjadikan ia lebih baik berbanding teknologi yang telah meluas penggunaannya seperti IrDA. Kerja ini tertumpu kepada rekabentuk dan pembangunan kerangka kerja satu sistem aplikasi untuk mengawal dan mengawasi satu peranti kawalan jauh tanpa wayar menggunakan Bluetooth di dalam lingkungan jarak piawaiannya. Sebagai contoh, sebarang PDA, komputer riba atau telefon mudah alih yang memiliki Bluetooth boleh digunakan untuk mengawal peralatan-peralatan rumah seperti lampu, pendingin hawa, sistem audio digital dan sebagainya di dalam sesebuah bilik atau ia juga boleh digunakan untuk mengawal mesin kilang atau di pejabat untuk pelbagai tujuan dari menghidupkan peranti hingga kepada pemerolehan data masa nyata daripada sistem kerja atau daripada sensor. Ia juga boleh digunakan untuk kawalan robotik dalam lingkungan jarak dekat.
Sistem ini melalui beberapa ujian yang berbeza dan simulasi masa nyata untuk memastikan prestasinya yang positif. Keputusan menunjukkan ia memberikan ciri-ciri piawaian perkhidmatan sesuatu sistem dengan kualiti yang boleh diterima dalam penghantaran dan penerimaan data dan mengawal peranti kawalan jauh dan di mana aplikasi pengguna dan antaramuka mudah digunakan.

Akhir sekali, satu prototaip berdasarkan reka bentuk telah dihasilkan. Keputusan ujian ke atas prototaip mengesahkan reka bentuk mematuhi piawaian prestasi servis yang dikehendaki.
ACKNOWLEDGEMENT

Bismillahir Rahmanir Rahim- everything goes by the mercy of Allah, the most gracious the most merciful. I am grateful to him to give me the chance for higher studies and everything. Then I am grateful to my parents and family who are always by my side.

I would like to express my respect and thanks to my supervisor, Prof. Dr. Borhanuddin Mohd. Ali for his invaluable guidance, patience, encouragement and advices that made this work possible. I am grateful to Dr. Sabira Khatun and Mr. Hanif Yaacob for being my committee members. I extend my gratitude and thanks to Mrs. Ratna Kalos and Mr. Hanif Yaacob who had been supporting me for the full duration. I am grateful to RMC of Universiti Putra Malaysia for establishing the scope of this research work.

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I certify that an Examination Committee has met on 9th June 2006 to conduct the final examination of Md. Nazmus Saadat on his Master of Science thesis entitled “Design And Development Of A Handheld Bluetooth-Based Application System Framework For Controlling And Monitoring Remote Devices” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded a relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or currently submitted for any other degree at UPM or other institutions.

______________________
MD. NAZMUS SAADAT

Date:
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEDICAT TO</td>
<td>II</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>v</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>VII</td>
</tr>
<tr>
<td>APPROVAL</td>
<td>viii</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>x</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>xi</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xiv</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xv</td>
</tr>
<tr>
<td>LIST OF ABBREVIATION</td>
<td>XIX</td>
</tr>
</tbody>
</table>

## 1 INTRODUCTION

1.1 Introduction and Problem Statement | 1
1.2 Objectives | 2
1.3 Scope of work: | 2
1.4 Thesis arrangement | 3

## 2 LITERATURE REVIEW

2.0 Bluetooth Based Wireless Remote Device Controlling System | 4
2.1 Bluetooth Technology | 8
2.1.2 Competitors | 10
2.1.3 Core System Architecture: | 12
2.1.4 Core Architectural Blocks | 13
2.1.4.1 Channel manager | 13
2.1.4.2 L2CAP resource manager | 13
2.1.4.3 Device manager | 14
2.1.4.4 Link manager | 15
2.1.4.5 Baseband resource manager | 15
2.1.4.6 Link controller | 16
2.1.4.7 RF | 16
2.1.4.8 Basic Protocol Classification | 17
2.1.4.9 Bluetooth Generic Packet Structure | 18
2.1.5 Communication and Operational Procedures and Modes: | 20
2.1.6 Inquiry (Discovering) Procedure | 20
2.1.6.1 Paging (Connecting) Procedure | 21
2.1.6.2 Connected mode | 21
2.1.6.3 Hold mode | 23
2.1.6.4 Sniff mode | 23
2.1.6.5 Parked state | 24
2.1.6.6 Role switch procedure | 24
2.1.7 Bluetooth networking | 25
2.1.8 Slave and Master: | 26
2.1.9 WinCE: | 26
2.1.10 MPLAB: | 27
2.1.11 Microchip C18 Compiler: | 27
2.1.12    Flexipanel Designer Services 27
2.1.13    PIC18LF6720 Microcontroller 28
2.1.14    AT Command Set 31
2.1.15    Golden receive power range 32
2.1.16    Conclusion 33

3          DEVELOPMENT METHODOLOGIES 34
3.1    Design Approach and System Specification 34
3.1.1    Master Unit (MU) 37
3.1.2    Slave Unit (SU) 38
3.1.2.1    Bluetooth Module Specification 39
3.1.2.2    Bluetooth Radio with Antenna Specification 40
3.1.2.3    Integrated Microcontroller Module 41
3.2    System Architecture 41
3.2.1    MU Functionalities for the Proposed System 43
3.2.2    Device Discovery, Connection Setup and Data Handling Operations 44
3.2.3    GUI Development for Master Unit: 50
3.2.3.1    Wireless Field Programming/ Uploading 55
3.2.4    SU Architecture 57
3.2.4.1    SU Hardware: 57
3.2.4.2    SU Software 62
3.2.4.3    SU Application Development 63
3.2.5    MU and SU Interaction 70
3.3    The Prototype and Performance Evaluation Entities 73
3.3.1    Device Discovery Delay 73
3.3.2    Connection Duration 74
3.3.3    Connection Delay 74
3.3.4    Data (Bytes) Reception Delay 75
3.3.5    Throughput 75
3.3.6    BER 75
3.3.7    Summary 76

4          PROTOTYPE EVALUATION, RESULTS AND DISCUSSION 77
4.1    The Prototype Evaluation 77
4.2    Prototyping MU Framework 77
4.3    Prototyping SU Framework 88
4.3.1    Temperature Sensor Operation Monitoring 98
4.4    Simulation & Test Results 102
4.4.1    Connection Delay 104
4.4.2    Link Quality And Bit Error Rate 106
4.4.3    Connection Duration 109
4.4.4    Delay/Latency for MU Display 109
4.4.5    Data Value Variation for Analog Inputs 110
4.4.6    Throughput 111
4.5    Discussions 116
4.6    Summary 116

5  CONCLUSION 117
5.0    Limitations 117
5.1 Conclusion 117
5.2 Future Work 118

REFERENCES 119
APPENDICES 122
BIODATA OF THE AUTHOR 130
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Protocol Classes in Brief</td>
<td></td>
</tr>
<tr>
<td>3.1 General Specification for the system</td>
<td>36</td>
</tr>
<tr>
<td>3.2 Physical Specification of the BT Module</td>
<td>36</td>
</tr>
<tr>
<td>3.3 Bluetooth radio specification for the System</td>
<td>36</td>
</tr>
<tr>
<td>3.4 Electrical Specification for the Bluetooth module</td>
<td>36</td>
</tr>
<tr>
<td>3.5 Pins and I/Os of the Bluetooth PIC module used in the system</td>
<td>58</td>
</tr>
<tr>
<td>3.6 Important connections to be made between ICD 2 and Bluetooth PIC</td>
<td>64</td>
</tr>
<tr>
<td>4.1 Link Quality and Corresponding BER</td>
<td>107</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Bluetooth Core System Architecture</td>
<td>12</td>
</tr>
<tr>
<td>2.2</td>
<td>Conceptual Protocol stack diagram</td>
<td>17</td>
</tr>
<tr>
<td>2.3</td>
<td>Piconet and scatternet formation scenario.</td>
<td>26</td>
</tr>
<tr>
<td>2.4</td>
<td>Pin diagram for PIC18F6720 used with the Bluetooth module.</td>
<td>30</td>
</tr>
<tr>
<td>2.5</td>
<td>Block diagram of the PIC18F6720 series microcontroller.</td>
<td>31</td>
</tr>
<tr>
<td>2.6</td>
<td>Golden Received Power Range.</td>
<td>33</td>
</tr>
<tr>
<td>3.1</td>
<td>Modular Approach for the development of the proposed system.</td>
<td>35</td>
</tr>
<tr>
<td>3.2</td>
<td>Proposed wireless triggering and monitoring system.</td>
<td>38</td>
</tr>
<tr>
<td>3.3</td>
<td>Bluetooth Enabled Slave Unit for the Proposed System</td>
<td>40</td>
</tr>
<tr>
<td>3.4</td>
<td>Architecture of Wireless Device Triggering and Monitoring System.</td>
<td>42</td>
</tr>
<tr>
<td>3.5</td>
<td>Bluetooth Protocol stack with Flexipanel system services</td>
<td>43</td>
</tr>
<tr>
<td>3.6</td>
<td>MU functionalities developed for the proposed system</td>
<td>44</td>
</tr>
<tr>
<td>3.7</td>
<td>Producing C code from GUI for MU.</td>
<td>52</td>
</tr>
<tr>
<td>3.8</td>
<td>Screen shot of Control Properties for Analog to Digital Conversion.</td>
<td>53</td>
</tr>
<tr>
<td>3.9</td>
<td>Screen shot of Designing of the MU GUI Application.</td>
<td>54</td>
</tr>
<tr>
<td>3.10</td>
<td>Screen shot of Designing of the MU GUI Application.</td>
<td>54</td>
</tr>
<tr>
<td>3.11</td>
<td>Screen shot of MU GUI for Pocket PC for motor control button.</td>
<td>55</td>
</tr>
<tr>
<td>3.12</td>
<td>Screen shot-I of the wireless uploading test of the SU application.</td>
<td>56</td>
</tr>
<tr>
<td>3.13</td>
<td>Screen shot-II of the wireless uploading test.</td>
<td>56</td>
</tr>
<tr>
<td>3.14</td>
<td>Basic circuit diagram of SU to connect with external circuitries.</td>
<td>59</td>
</tr>
<tr>
<td>3.15</td>
<td>Components and pin configurations of BT PIC.</td>
<td>60</td>
</tr>
<tr>
<td>3.16</td>
<td>SU with BT PIC on PCB with external circuitry arrangement</td>
<td>61</td>
</tr>
<tr>
<td>3.17</td>
<td>Schematic of the Sample Implementation circuitry connected to SU.</td>
<td>62</td>
</tr>
</tbody>
</table>
3.18 Internal design with protocol stack of the SU system development.
3.19 The adapter and the Bluetooth PIC module used in this thesis.
3.20 ICD 2 connected to the adapter and wired adapter.
3.21 The file list in the project and selecting processor.
3.22 The MPLAB VDI to set up initialization code.
3.23 Initializing and monitoring the processor parameters.
3.24 Selecting the Oscillator type and its configurations.
3.25 Configuring the A/D input pins and its respective other settings.
3.26 Settings in the visual ‘Configuration Bits’ window.
3.27 Programming .hex file to the PIC via the ICD and adapter.
3.28 Flow chart for MU and SU system interaction.
3.29 Testing and simulation environment setup.
4.1 Initiate the device discovery to discover and be discovered.
4.2 Showing the busy mode after starting the device discovery.
4.3 The SU is found and user may connect to this device.
4.4 A shortcut would be created on the PDA to handle it easily.
4.5 The available services/profiles with/(out) secure connection.
4.6 The signal strength is shown visually.
4.7 Shows the full strength of the signal with the service name.
<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.8</td>
<td>83</td>
</tr>
<tr>
<td>4.9</td>
<td>83</td>
</tr>
<tr>
<td>4.10</td>
<td>84</td>
</tr>
<tr>
<td>4.11</td>
<td>84</td>
</tr>
<tr>
<td>4.12</td>
<td>85</td>
</tr>
<tr>
<td>4.13</td>
<td>85</td>
</tr>
<tr>
<td>4.14</td>
<td>86</td>
</tr>
<tr>
<td>4.15</td>
<td>86</td>
</tr>
<tr>
<td>4.16</td>
<td>87</td>
</tr>
<tr>
<td>4.17</td>
<td>87</td>
</tr>
<tr>
<td>4.18</td>
<td>90</td>
</tr>
<tr>
<td>4.19</td>
<td>91</td>
</tr>
<tr>
<td>4.20</td>
<td>91</td>
</tr>
<tr>
<td>4.21</td>
<td>92</td>
</tr>
<tr>
<td>4.22</td>
<td>93</td>
</tr>
<tr>
<td>4.23</td>
<td>93</td>
</tr>
<tr>
<td>4.24</td>
<td>94</td>
</tr>
<tr>
<td>4.25</td>
<td>94</td>
</tr>
<tr>
<td>4.26</td>
<td>95</td>
</tr>
<tr>
<td>4.27</td>
<td>95</td>
</tr>
<tr>
<td>4.28</td>
<td>96</td>
</tr>
<tr>
<td>4.29</td>
<td>96</td>
</tr>
<tr>
<td>4.30</td>
<td>97</td>
</tr>
</tbody>
</table>

4.8 The MU application GUI is located here.
4.9 The MU application is a click away.
4.10 The MU application starts with this Connect button.
4.11 The connection with the SU is in progress.
4.12 MU Functionalities list. User may choose one at a time.
4.13 This screen is to test/run the Digital Triggering.
4.15 Screen shot of the Parallel Output Test
4.16 Screen shot of the Parallel Inputs
4.17 Screen shot for AD conversion of analog voltages applied.
4.18 Preliminary prototype of SU with all the arrangement.
4.19 Close view of the Laboratory prototype.
4.20 Initial SU circuit board implementation.
4.21 Next stage of the prototype with Handheld/MU shown.
4.22 Preliminary Construction of the SU.
4.23 Complete circuit board implementation -Top view.
4.24 Part of the circuitries with oval and square mark.
4.25 The backside of the circuit board with a hole.
4.26 One end of the Bluetooth module with PIC.
4.27 One sensor (LM35 series) is shown at the left for sample.
4.28 Sample DC 12 voltage load and other connecting points.
4.29 This PDA has been used as MU to connect to the SU.
4.30 SU is ready to be operated by MU for a 220V load switching.
4.31 The bulb is switched on, also the 12 volt DC fan from MU.

4.32 Temperature Sensor circuitry on breadboard

4.33 LM35 series Temperature Sensor with general circuitry.

4.34 Showing the corrected format design to be shown on the MU

4.35 The GUI to be formatted to show the temperature reading.

4.36 Monitoring temperature sensor data on PDA.

4.37 Capturing data into files from simulation with desktop PC.

4.38 One of the Test and Simulation Setup.

4.39 MU is Discovering SUs and 5 SUs are discovered.

4.40 PDA Connecting to the remote device via the serial port.

4.41 Total delay for establishing connection.

4.42 Distance Vs RSSI graph for 10 different trials

4.43 Delay for analog data display on PDA.

4.44 Difference in values for different input values and distance.

4.45 Throughput at Baudrate of 115200 bps.

4.46 Throughput at Baudrate of 230400 bps.

4.47 Throughput at Baudrate of 460800 bps.
**LIST OF ABBREVIATION**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDA</td>
<td>Personal Digital Assistant</td>
</tr>
<tr>
<td>WLAN</td>
<td>Wireless LAN</td>
</tr>
<tr>
<td>IrDA</td>
<td>Infrared</td>
</tr>
<tr>
<td>WAP</td>
<td>Wireless Access Protocol</td>
</tr>
<tr>
<td>PIC</td>
<td>Peripheral Interface Controller</td>
</tr>
<tr>
<td>ADC</td>
<td>Analog to Digital Converter</td>
</tr>
<tr>
<td>SU</td>
<td>Slave Unit</td>
</tr>
<tr>
<td>MU</td>
<td>Master Unit</td>
</tr>
<tr>
<td>L2CAP</td>
<td>Logical Link Control &amp; Adaptation Protocol</td>
</tr>
<tr>
<td>VDI</td>
<td>Visual Device Initializer</td>
</tr>
<tr>
<td>BER</td>
<td>Bit Error Rate</td>
</tr>
<tr>
<td>SPP</td>
<td>Serial Port Profile</td>
</tr>
<tr>
<td>RSSI</td>
<td>Received Signal Strength Indication</td>
</tr>
</tbody>
</table>
CHAPTER 1
INTRODUCTION

1.1 Introduction and Problem Statement

Along side the growth of computing power, recent times have seen large advances in the area of networking and communications, mainly by the explosion of the wireless and Internet technology. These developments are now seeing smaller mobile devices such as PDAs and mobile phones empowered with the WLAN, BLUETOOTH, IrDA, and Wireless Access Protocol (WAP) providing users with the convenience of access to information on the connected devices and networks.

Wireless control over remote devices is a great challenge for current time while everything wired is turning to wireless and of course without line of sight is important to take into consideration. Till now many remote device controlling systems are using Infrared. Bluetooth has some advantages over IrDA like it uses radio frequency and does not have line of sight problem. Moreover, it is available in most of the standard handheld devices like PDA, Mobile phone and also in form of dongles that can enable any desktop or laptop to use Bluetooth. This work focuses on developing and implementing systems that can be used for controlling and monitoring remote devices wirelessly using Bluetooth technology with handheld devices. The system can use any Bluetooth enabled PDA or Mobile Phone or Laptop to control remote slave devices at home, office and industry within the standard range.
1.2 Objectives

The objectives of this thesis are:

1. To develop functionalities to communicate and use Bluetooth chip for accessing the in built vendor supplied radio services and independent services.
2. To control the Bluetooth radio services by programming high performance Peripheral Interface Controller (PIC).
3. To develop user interface program for the user device or master device (such as for PDA, mobile Phone, desktop or laptop).
4. To develop circuitry for practical implementation of the wireless control and monitoring systems.
5. To test the total implementation for stable performances and prototyping and converting the prototype to a product prototype.
6. To test the performance of the developed system and its critical points of data handling.

1.3 Scope of work:

This research work will present a design and a prototype according to the design, which will be able to achieve the objectives stated in section 1.2. This work does not develop any integrated Bluetooth radio module rather it uses off the shelf radio module and Microchip’s PIC18FL6720 together to develop the wireless remote control and monitoring system. C18 compiler and MPLAB, Win CE 3.0 and Flexipanel Interface Designer are used for software development.
1.4 Thesis arrangement

Chapter 1 describes introduction, objectives and scope of the work mainly. Chapter 2 makes a critical and useful literature review. Chapter 3 will discuss the design and development methodologies and will describe the performance entities for the evaluation of the system prototype. Chapter 4 will show the developed system, its real time implementation with test and simulation results. Finally Chapter 5 will conclude.
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