



**UNIVERSITI PUTRA MALAYSIA**

**TOKEN BASED AUTHENTICATA METHOD USING BLUETOOTH-  
ENABLED MOBILE PHONE**

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**TOKEN BASED AUTHENTICATION METHOD USING BLUETOOTH-  
ENABLED MOBILE PHONE**

**By**

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**Thesis submitted to the School of Graduate Studies, Universiti Putra  
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Science**

**October 2004**



## DEDICATION

To *My husband Rashid, and my daughter Shahd*



Abstract of thesis present to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

**TOKEN BASED AUTHENTICATION METHOD USING BLUETOOTH-ENABLED MOBILE PHONE**

By

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**June 2004**

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Authentication is a mechanism to establish proof of identities; it ensures the right identification of a particular user or a particular system or device. Authentication is the first step in any cryptography solution, because unless the device knows who is using it, there is no point in encrypting device's contents. Current PC, laptop user authentication systems are always done once and held until it is explicitly revoked by the user, or frequently asking the user to reestablish his identity which encourages him to disable the authentication. In this thesis we propose a new model of authentication for laptop devices using a Bluetooth-enabled mobile phone. In this model the Bluetooth-enabled mobile phone works as an authentication token that provides the authentication for laptop over a Bluetooth short-range wireless link. The user doesn't need to authenticate frequently. Instead, the mobile phone continuously authenticate with the laptop by means of the short-range wireless link. This model ensures that a non-legitimate user's mobile phone cannot provide authentication services to other user's laptops, and it uses an



authenticated and encrypted Bluetooth wireless link to ensure that there is no eavesdropping, modification, and insertion of messages traveled over the link.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**PENGGUNAAN “TOKEN” BAGI PENENTUSAHAN KOMPUTER  
MENGUNAKAN TELEFON BERGERAK DENGAN BLUETOOTH**

**Oleh**

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Penentusahan adalah mekanisma untuk membuktikan sesuatu identiti; ia memastikan kesahihan pengguna, sesuatu sistem atau peralatan itu. Penentusahan adalah langkah pertama di dalam penyelesaian kriptografi kerana kecuali sesuatu peranti itu mengetahui siapa penggunanya, tiada makna dalam mengkriptografi kandungan peranti tersebut. Sistem penentusahan pengguna PC komputer riba kini selalunya dilakukan sekali dan kekal sehingga ianya secara jelasnya di batalkan oleh pengguna atau dengan kerap meminta pengguna untuk memperkenalkan semula identitinya yang mana menggalakkannya untuk memberhentikan penentusahan. Di dalam tesis ini kami mencadangkan model baru penentusahan bagi peranti komputer riba menggunakan telefon bimbit dengan Bluetooth. Di dalam model ini telefon bimbit berfungsi Bluetooth menjadi sebagai token penentusah yang menyediakan penentusahan kepada komputer riba melalui jarak pendek hubungan tanpa wayar Bluetooth. Pengguna tidak perlu menentusah secara kerap, sebaliknya telefon bergerak akan melakukannya secara berterusan dengan

komputer riba melalui hubungan tanpa wayar jarak pendek. Model ini memastikan telefon bergerak pengguna lain yang tidak sah tidak boleh menyediakan perkhidmatan penentusahan kepada pengguna komputer riba lain dan ia menggunakan hubungan tanpa wayar bertentusahan dan berinkripsi untuk memastikan tiada pencuri-dengar, pengubahsuaian dan kemasukan mesej melalui hubungan tersebut.

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I certify that an Examination Committee met on 14<sup>th</sup> March 2005 to conduct the final examination of Rania Abdelhameed Mokhtar on her Master of Science thesis entitled "Token Based Authentication Method Using Bluetooth-Enabled Mobile Phone" 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 the relevant degree. Members of the Examination Committee are as follows:

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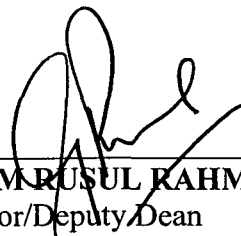
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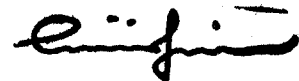
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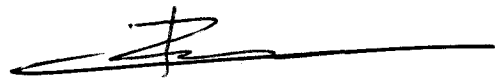
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## DECLARATION

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 concurrently submitted for any other degree at UPM or other institutions.



**RANIA ABDELHAMEED MOKHTAR**

Date: 17/6/05

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## LIST OF ABBREVIATIONS

<b>Acronym</b>	<b>Meaning</b>
ACL	Asynchronous Connection Less
AES	Advanced Encryption Standard
API	Application Programming Interface
APIs	Application Programming Interfaces
ARQ	Automatic Repeat Request
ATM	Automatic Teller Machine
BCC	Bluetooth Control Center
BIOS	Basic Input Output System
BPSK	Binary Phase-Shift Keying
CBS	Cell Broadcast Service
CFS	Cryptography File System
CLDC	Connected Limited Device Configuration
CPU	Central Processing Unit
ESS	Embedded Security Subsystem
FEC	Forward Error Check
FHSS	Frequency Hopping Spread Spectrum
GCF	Generic Connection Framework
HCI	Hardware Controller Interface
HEX	Hexadecimal



<b>IDE</b>	<b>Integrated Development Environment</b>
<b>IEEE</b>	<b>International Electrical and Electronics Engineers</b>
<b>IP</b>	<b>Internet Address</b>
<b>IR</b>	<b>Infrared</b>
<b>IrDA</b>	<b>Infrared Data Association</b>
<b>ISM</b>	<b>Industrial Scientific and Medical</b>
<b>ISO</b>	<b>International Standard Organization</b>
<b>IT</b>	<b>Information Technology</b>
<b>J2ME</b>	<b>Java 2 Micro Edition</b>
<b>J2SE</b>	<b>Java 2 Standard Edition</b>
<b>JAWBT</b>	<b>Java APIs for Bluetooth Wireless Technology</b>
<b>JRE</b>	<b>Java Runtime Environment</b>
<b>JSR 82</b>	<b>Java APIs for Bluetooth Wireless Technology</b>
<b>JTWI</b>	<b>Java Technology for the Wireless Industry</b>
<b>KEA</b>	<b>Key Exchange Algorithm</b>
<b>L2CAP</b>	<b>Logical Link Control and Adaptation Protocol</b>
<b>LAN</b>	<b>Local Area Network</b>
<b>LC</b>	<b>Link Controller</b>
<b>LCD</b>	<b>Light Cathode Display</b>
<b>LM</b>	<b>Link Manager</b>
<b>LMP</b>	<b>Link Manager Protocol</b>
<b>MIDlet</b>	<b>MIDP Application</b>



<b>MIDP</b>	<b>Mobile Information Device Profile</b>
<b>MTU</b>	<b>Maximum Transmission Unit</b>
<b>OBEX</b>	<b>Object Exchange</b>
<b>OS</b>	<b>Operating System</b>
<b>OSI</b>	<b>Open System Interconnection</b>
<b>PAN</b>	<b>Personal Area Network</b>
<b>PC</b>	<b>Personal Computer</b>
<b>PDA</b>	<b>Personal Data Assistant</b>
<b>PDU</b>	<b>Protocol Data Unit</b>
<b>Piconet</b>	<b>Bluetooth network</b>
<b>PIN</b>	<b>Personal Identification Number</b>
<b>PKI</b>	<b>Public Key Infrastructure</b>
<b>PPM</b>	<b>Pulse Position Modulation</b>
<b>PPP</b>	<b>Point-to-Point Protocol</b>
<b>RF</b>	<b>Radio Frequency</b>
<b>RFCOMM</b>	<b>Radio Frequency Communication Protocol</b>
<b>RSA</b>	<b>Rivest Shamir Adleman</b> <b>(Public key cryptography algorithm named for its inventors)</b>
<b>SCO</b>	<b>Synchronous Connection Oriented</b>
<b>SDK</b>	<b>Software Development Kit</b>
<b>SDP</b>	<b>Service Discovery Protocol</b>
<b>SIG</b>	<b>Special Interest Group</b>



<b>SPINS</b>	<b>Session Personal Identification Numbers</b>
<b>TCP</b>	<b>Transport Control Protocol</b>
<b>UA</b>	<b>User Asynchronous channel</b>
<b>UDP</b>	<b>User Datagram Protocol</b>
<b>UI</b>	<b>User Isochronous channel</b>
<b>URI</b>	<b>Uniform Resource Identifier</b>
<b>URL</b>	<b>Uniform Resource Locator</b>
<b>US</b>	<b>User Synchronous channel</b>
<b>UWB</b>	<b>Ultra Wideband</b>
<b>WLPAN</b>	<b>Wireless Personal Area Network</b>
<b>ZIA</b>	<b>Zero Interaction Authentication</b>





# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Most olden computers have physical key to lock the system, it had no, or at best, very little data security. This continued for a number of years until the importance of data was truly realized. Until then, computer data was considered useful, but not something to be protected. When computer applications were developed to handle financial and personal data, the real need for security was felt like never before. People realized that data on computers is an extremely important aspect of modern life. Modern computers assume that they are personal to the user and the operating system starts to provide adequate security and authentication. Therefore, various areas in security began to gain prominence. Two typical examples of such security mechanisms were as follows:

- User authentication
- Encoding of stored information

This research is focus in the part of user authentication in the context of mobile computers.

#### 1.1.1 Security Model

There are several approaches to implement a security model: