

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xii
	LIST OF FIGURES	xiii
	LIST OF ABBREVIATIONS	xvi
	LIST OF APPENDICES	xviii
1	INTRODUCTION	1
	1.1 Background of the Problem	1
	1.2 Statement of the Problem	4
	1.3 Project Aim	6
	1.4 Objectives of the Study	6
	1.5 Scope of the Study	7
	1.6 Significance of the Study	8
2	LITERATURE REVIEW	10
	2.1 Introduction	10
	2.2 Pervasive Computing	11
	2.2.1 Pervasive Computing Features	13
	2.2.2 Pervasive Computing Challenges	15

2.3	Service Discovery	16
2.3.1	Definition of Service and Service Discovery	16
2.3.2	Differences between Service and Web Service	17
2.3.3	Service Discovery Framework	17
2.4	Security	19
2.4.1	CIA Triad	20
2.4.2	Access Control Overview	22
2.4.3	The Process of Accountability	24
2.4.4	Identification and Authentication Techniques	25
2.5	Service Discovery in Pervasive Computing Environments	27
2.5.1	Differences between Enterprise and Pervasive Computing	28
2.5.2	Challenges in Service Discovery in Pervasive Computing	28
2.5.3	Service Discovery Design	30
2.6	Authentication in Pervasive Computing Environments	36
2.7	Classification of Service Discovery Models	39
2.7.1	Infrastructure-based Security	39
2.7.2	Infrastructure Less security	40
2.7.3	Smart Space Dependent Security	41
2.7.4	Hardware Supported Security	41
2.8	Related Works	42
2.8.1	Description of Service Discovery Protocols	43
2.8.2	Bluetooth SDP Security	48
2.8.3	UPnP Security	48

2.8.4	Jini Security	49
2.8.5	SSDS Security	49
2.8.6	Splendor Security	49
2.9	Comparative Evaluation of State-of-the-Art Protocols	50
2.10	Summary	54
3	RESEARCH METHODOLOGY	55
3.1	Introduction	55
3.2	Research Methodology	56
3.2.1	Observation, Reasoning and Problem Formulation	59
3.2.2	Literature Review	59
3.2.3	Requirement Specification	60
3.2.4	Development	61
3.2.5	Verification	62
3.2.6	Report Writing	62
3.3	Operational Framework	64
3.4	Instrumentation	65
3.5	Research Planning and Schedule	67
4	FRAMEWORK DESIGN	68
4.1	Definition of the Proposed Framework	69
4.2	Architectural Design	70
4.2.1	Service Discovery Issues	72
4.2.2	Security Issues	73
4.3	Components of Proposed Framework	75

4.3.1	Client	75
4.3.2	Directory	75
4.3.3	Service Proxy	76
4.3.4	Third-party Server	79
4.3.5	PKASSO System	79
4.3.6	PMI System	81
4.4	Execution Process	81
4.4.1	Initial Phase	82
4.4.2	Mutual Authentication	85
4.4.3	Main Phase	89
4.5	Summary	92
5	PROTOTYPE IMPLEMENTATION AND VALIDATION	93
5.1	Introduction	93
5.2	Instrumentation	94
5.3	Installation and Configuration	95
5.4	Case Study Definition	97
5.5	Server Side Prototype Implementation	98
5.5.1	Creating Web Service	98
5.5.2	Publishing Web Service	102
5.5.3	Testing Web Service in Application Server	106
5.5.4	Adding Security Libraries	107
5.6	Client Side Prototype Implementation	111
5.6.1	Consuming Web service	111
5.6.2	Creating Graphical User Interface (GUI)	115

5.7	Testing	116
5.7.1	Server Side Application Testing	117
5.7.2	Client Side Application Testing	121
5.8	Summary	123
6	CONCLUSION AND FUTURE WORK	124
6.1	Summary of the Research	124
6.2	Contribution of the Research	126
6.3	Future Work	126
	REFERENCES	129
	Appendices A-B	136-143

LIST OF TABLES

TABLE NO.	TITLE	PAGE
2.1	Service Discovery Protocols and Characteristics (Part1)	43
2.2	Service Discovery Protocols and Characteristics (Part2)	44
2.3	Service Discovery Protocols and Characteristics (Part3)	45
2.4	Service Discovery Protocols and Characteristics (Part4)	46
2.5	Service Discovery Protocols and Characteristics (Part5)	47
2.6	Evaluative of Current Protocols for Service Discovery	53
3.1	Operational Framework	64
3.2	Research Planning and Schedule	67
4.1	Comparison between PKI Technologies	80

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
2.1	A Wireless Telemedicine System	12
2.2	A Visual Representation of the Framework	18
2.3	A Sample Complete Security Program	20
2.4	CIA Triad	21
2.5	Classification of Components of Service Discovery Protocols	30
3.1	Research Procedure	57
3.2	Research Procedure Description	58
3.3	Research Flow Chart	63
4.1	Proposed Conceptual Framework	69
4.2	Architecture of Proposed Framework	71
4.3	Service Proxy Internal Structure	76
4.4	Service Proxy Process	78
4.5	Initial Phase Sequence Diagram	84
4.6	Mutual Authentication Sequence Diagram	87
4.7	Mutual Authentication Class Diagram	88
4.8	Main Phase Sequence Diagram	90
4.9	Main authentication Class Diagram	91
5.1	Main Page of NetBeans	96
5.2	Available Servers on IDE	97
5.3	Creating Web Application (Part 1)	99

5.4	Creating Web Application (Part 2)	99
5.5	Adding Web Service to Web Application (Part 1)	100
5.6	Adding Web Service to Web Application (Part 2)	101
5.7	Added Web service to Web Application	101
5.8	Using Sample Web Service Class	102
5.9	Web Service Publishing (Part 1)	103
5.10	Successful Built Application	104
5.11	Web Service Publishing (Part 2)	104
5.12	Deploying Application on the Server	105
5.13	Web Service Publishing (Part 3)	105
5.14	Specifying URL to Test Web Service	106
5.15	The Displayed Web page to Test Web Service	107
5.16	Reused Classes to Support Authentication	108
5.17	SSORole and SSOUser Classes	109
5.18	SSOSessionManger and SSOSessionMangerService	110
5.19	Creating Client Application (Part 1)	111
5.20	Creating Client Application (Part 2)	112
5.21	Adding Web Service Reference to Client Application (Part1)	113
5.22	Adding Web Service Reference to Client Application (Part2)	114
5.23	Added Web Service to Application	114
5.24	WSDL File of Added Web Service	115
5.25	Created GUI in Client Application	116
5.26	Web Service Execution in Server Side	117
5.27	Result of Web Service Invocation	118

5.28	WSDL File of Invoked Web Service	119
5.29	SOAP Request and Response	120
5.30	Provided GUI for Client Application	121
5.31	Displayed Message Box to Incorrect Answer	122
5.32	Presented Message Box to Correct Answer	122

LIST OF ABBREVIATIONS

ACL	-	Access Control List
AVCM	-	Attribute Vector Calculus Model
CA	-	Certificate Authority
CA-RBAC	-	Context Aware Role Based Access Control
CIA	-	Confidentiality Integrity Availability
CSAS	-	Context Sensitive Authorization Scheme
CSRA	-	Context-based Secure Resource Access
DNS	-	Domain Name System
GUI	-	Graphical User Interface
IDE	-	Integrated Development Environment
IE	-	Intelligent Environments
INS	-	Intentional Naming System
IrDA	-	Infrared Data Association
JDK	-	Java Development Kit
J2EE	-	Java Enterprise Edition
JOSSO	-	Java Open Single Sign-On
JAX-WS	-	Java API for XML Web Services
LAN	-	Local Area Network
MAC	-	Message Authentication Code
MANET	-	Mobile Ad hoc Network
MEGA	-	Mathematic Equation Generator A edition
PC	-	Personal Computer

PDA	-	Personal Digital Assistant
PIN	-	Personal Identification Number
PKI	-	Public Key Infrastructure
PMI	-	Privilege Management Infrastructure
PTM	-	Pervasive Trust Management
RFID	-	Radio Frequency Identification
SDP	-	Service Discovery Protocol
SJSAS	-	Sun Java System Application Server
SLP	-	Service Location Protocol
SME	-	Service-based Mobile Environment
SOAP	-	Simple Object Access protocol
SSDS	-	Secure Service discovery Service
SSO	-	Single Sign-On
TRAC	-	Trust-based Architecture
UPnP	-	Universal Plug and Play
URL	-	Uniform Resource Locator
WSDL	-	Web Service Description Language
WSN	-	Wireless Sensor Network
XML	-	Extensible Markup Language

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Installation and Configuration	135
B	Step-by-Step Instruction for Adding Library	142