ACCEPTABILITY FACTORS OF IRIS-BASED AUTHENTICATION APPROACH AMONG NIGERIAN USERS OF AUTOMATED TELLER MACHINE

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By
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ABSTRAK

ABSTRACT

The present socio-economic problem in Nigeria has increased the crime rate tremendously to the extent that the ubiquitous advantage of Information Technology (IT)-oriented services has been deprived due to the vulnerability; a good example is the alarming automated-teller machine (ATM) fraud in the country. A preliminary study is conducted among 104 Nigerian ATM users purposely to find out their perception on the current Personal Identification Number (PIN) authentication. The findings of the study showed that users are not fully secured using the authentication approach and they prefer biometric technology for the future authentication method. With respect to this, iris-based authentication is proven to be the best biometric authentication due to its best acceptance and rejection criteria. Although, there is a need to migrate to iris-based biometric authentication, there has not been any detailed study to determine its acceptability among users of public zone terminals such as the ATM. Therefore, this study aims at determining the factors that verify users' acceptance of iris-based authentication approach in Nigerian public domains, specifically the ATM, for allowing its successful implementation in the future. In achieving the research aim, quantitative approach was mainly applied to survey the ATM users; while qualitative approach was used to conduct content analysis and categorize respondents' opinions. A total of 351 respondents were involved. A survey instrument is developed based on the underpinning theory Unified Theory of Acceptance and Use of Technology (UTAUT) and also from six dimensions of Behavioural Intention (BI) model. This study contributes to both theory and practice; for the underpinning theory, UTAUT, the hypothesized relationships between four factors of UTAUT (i.e. Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Condition) are all supported which further validates the authenticity of the dimensions in technology acceptance and diffusion research for public domain. This study is among the initiators to investigate the acceptance factors of iris-based authentication and it also opens ways for future researches using the UTAUT model. The impact of the extension performed to the original UTAUT by including Attitude and Anxiety presents a better measure of behavioural intention to use the technology in question by explaining more variance that what is explained without the extension; which is in contrary to the opinions of previous researchers. Furthermore, the moderating effect of gender and age is examined where none of the constructs is influenced by gender and only Effort Expectancy and Anxiety are influenced by age of the respondents in contrary to the original UTAUT model. This led to the final proposed model of acceptance of iris-based authentication method for Nigerian public domains which is expected to assist iris authentication technology companies to come out with a usable iris-based authentication technology having considered all the factors identified in this study.
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TABLE OF CONTENTS

PERMISSION TO USE .............................................................................. i
ABSTRAK .................................................................................................. ii
ABSTRACT ............................................................................................... iii
ACKNOWLEDGEMENT ........................................................................... iv
TABLE OF CONTENTS ............................................................................. v
LIST OF TABLES .................................................................................... x
LIST OF FIGURES ................................................................................... xiii
ABBREVIATIONS .................................................................................... xiv

CHAPTER 1 .............................................................................................. 1
BACKGROUND OF THE STUDY ............................................................. 1
1.1 Introduction ...................................................................................... 1
1.2 Motivation ......................................................................................... 2
1.3 Background To Problem Statement ............................................... 8
  1.3.1 Basis Of The Preliminary Study ................................................. 8
  1.3.2 Questions Of The Preliminary Study ......................................... 8
  1.3.3 Survey Study ............................................................................ 9
  1.3.4 Method Used ........................................................................... 10
  1.3.5 Results And Discussion ........................................................... 10
  1.3.6 Conclusion ............................................................................. 14
1.4 Problem Statement ........................................................................... 15
1.5 Research Objectives ........................................................................ 20
1.6 Research Question .......................................................................... 22
1.7 Research Methodological Framework ............................................ 23
  1.7.1 Choosing Topic ......................................................................... 26
  1.7.2 Theory ....................................................................................... 26
  1.7.3 Formulating Research Questions And Objectives .................. 26
  1.7.4 Study Design ........................................................................... 27
  1.7.5 Data Collection ....................................................................... 27
  1.7.6 Data Analysis .......................................................................... 28
  1.7.7 Data Interpretation ................................................................. 28
1.7.8 Reporting ........................................................................................................... 28
1.8 Theoretical Framework ....................................................................................... 28
1.9 Scope Of The Research ....................................................................................... 31
1.10 Contributions Of Research ............................................................................... 32
1.11 Structure Of The Thesis ..................................................................................... 36
1.12 Definition Of Terms ......................................................................................... 37
1.13 Summary ............................................................................................................ 39

CHAPTER 2 .................................................................................................................. 40
REVIEWs ON AUTHENTICATION-RELATED FRAUDs IN NIGERIA
AND BIOMETRICS AUTHENTICATION ................................................................. 40
2.0 Introduction ........................................................................................................... 40
2.1 Level of IT Awareness in Nigeria ....................................................................... 41
2.2 ATM Authentication: Nigerian Experience ...................................................... 42
2.3 Identification /Authentication And Access Control ......................................... 47
2.4 Authentication With Public Terminals .............................................................. 50
2.5 Biometric Identifier: An Alternative To Present Approach .......................... 52
2.6 Issues In Implementing Biometric Authentication .......................................... 57
2.7 Overview Of Biometric System ......................................................................... 60
2.8 Review Of Biometric Identifiers ....................................................................... 64
  2.8.1 The Physiological Biometric Identifiers ...................................................... 64
    2.8.1.1 The Face ................................................................................................. 64
    2.8.1.2 The Fingerprint ..................................................................................... 65
    2.8.1.3 The Hand .............................................................................................. 67
    2.8.1.4 The Human Iris .................................................................................... 68
    2.8.1.5 The DNA ............................................................................................... 70
  2.8.2 The Behavioural Biometric Identifiers ......................................................... 71
    2.8.2.1 The Key Stroke ..................................................................................... 71
    2.8.2.2 The Signature ...................................................................................... 72
    2.8.2.3 The Voice .............................................................................................. 73
  2.8.3 Implication Of Types Of Biometric Identifiers On The Study ................. 74
  2.8.4 Justification For Iris Identification ............................................................... 75
2.8.5 Iris Authentication implementation in India ................................................. 79
2.9 Biometric Authentication Process ................................................................. 80
2.9.1 Implication Of Biometric Authentication Process On The Study ..................... 81
2.10 Review Of Related Works ............................................................................. 82
2.10.1 Implication Of Related Works On The Study ................................................. 89
2.11 Summary ........................................................................................................ 91

CHAPTER 3 ........................................................................................................ 92
CONCEPTUALIZED MODEL AND HYPOTHESES DEVELOPMENT ......................... 92
3.1 Introduction ...................................................................................................... 92
3.2 Eight Preceding Models Tested Against UTAUT .............................................. 93
3.2.1 Theory Of Reasoned Action (TRA) .............................................................. 93
3.2.2 Technology Acceptance Model (TAM) ......................................................... 94
3.2.3 Motivation Model (MM) .............................................................................. 97
3.2.4 Theory Of Planned Behaviour (TPB) ........................................................... 98
3.2.5 Combined TAM And TPB (C-TTAM-TPM) ................................................. 99
3.2.6 Model Of PC Utilization (MPCU) .............................................................. 99
3.2.7 Innovation Diffusion Theory (IDT) ............................................................ 100
3.2.8 Social Cognitive Theory (SCT) ................................................................. 101
3.3 Unified Theory Of Acceptance And Use Of Technology (UTAUT) ................... 103
3.3.1 Applications Of UTAUT On Technology Acceptance ................................. 104
3.4 Modifications To Original UTAUT ................................................................. 105
3.5 Research Constructs And Hypotheses Formulation .......................................... 110
3.5.1 Performance Expectancy (PE) ................................................................. 110
3.5.2 Effort Expectancy (EE) .............................................................................. 111
3.5.3 Social Influence (SI) ............................................................................... 113
3.5.4 Facilitating Conditions (FC) ................................................................... 114
3.5.5 Attitude (ATT) ....................................................................................... 114
3.5.6 Inclusion Of Self-Efficacy And Anxiety .................................................... 116
3.5.6.1 Anxiety (ANX) .................................................................................. 116
3.5.6.2 Self-Efficacy (SEF) ............................................................................. 117
3.5.7 Behavioural Intention (BI) .................................................. 118
3.5.8 Hypotheses For Moderating Variables ........................... 118
3.6 Research Variables ............................................................ 121
3.7 Summary ........................................................................ 123

CHAPTER 4 ........................................................................... 124
RESEARCH METHODOLOGY .................................................. 124
4.1 Introduction ................................................................ 124
4.2 Research Paradigm ....................................................... 124
4.3 Research Design ............................................................. 125
4.4 Research Approach ......................................................... 128
4.5 Data Collection .............................................................. 132
  4.5.1 Instrument Design ....................................................... 133
  4.5.2 Sampling ................................................................ 142
  4.5.3 Reliability And Validity Of Measurement Items .......... 144
  4.5.4 Pilotng The Questionnaire .......................................... 145
    4.5.4.1 Pilot Result ......................................................... 146
  4.5.5 Final Instrument ........................................................ 151
  4.5.6 Survey Administration ................................................ 152
4.6 Measurement Of Variables .............................................. 153
4.7 Unit Of Analysis .............................................................. 157
4.8 Summary ....................................................................... 157

CHAPTER 5 ........................................................................... 158
FINDINGS ........................................................................... 158
5.1 Introduction ................................................................ 158
5.2 Profile Of Respondents ................................................ 161
5.3 Reliability And Validity Of The Measurements .............. 161
  5.3.1 Normality Of The Data ............................................... 161
  5.3.2 Exploratory Factor Analysis ...................................... 165
5.4 Testing Of The Research Hypotheses ............................. 169
5.5 Answering The Research Questions ............................... 187
5.6 Model Evaluation .......................................................... 193
5.7 Analysis And Interpretation Of Qualitative Responses .......... 194
5.8 Summary ....................................................................... 196

CHAPTER 6 ........................................................................ 197

CONCLUSION ...................................................................... 197
6.1 Introduction ................................................................. 197
6.2 Discussion ..................................................................... 197
6.2.1 Outcome of Hypotheses testing .................................. 200
6.2.2 Research Questions .................................................. 201
6.2.3 Research Objectives .................................................. 208
6.3 Limitations Of The Study ............................................... 209
6.4 Future Research Opportunities ....................................... 211
6.5 Summary ....................................................................... 212
6.6 Practical Implication of the study .................................... 215
6.7 Theoretical Implication of the study ................................. 215

REFERENCES ..................................................................... 217

Research Publication ......................................................... 235
Appendix A: Preliminary Study Questionnaire ......................... 236
Appendix B: Main Study Questionnaire .................................. 239
Appendix C: Sources of Instrument ........................................ 246
Appendix D: Basis For the Item's Inclusion .............................. 247
Appendix E: Statistical Analysis ........................................... 249
Appendix F: Profile of Experts for Content Validity ................. 273
LIST OF TABLES

Table 1.1: Cronbach's α for the 3 constructs ................................................. 12
Table 1.2: Descriptive Statistics for Biometric (BB) ........................................ 12
Table 2.1: Application areas of biometric system .......................................... 62
Table 2.2: The architecture of a typical biometric system ............................. 63
Table 2.3: Comparing biometric identifiers .................................................... 78
Table 3.0: Applications of UTAUT .................................................................. 105
Table 3.1: Justification for UTAUT modification (Addition) ....................... 106
Table 3.2: Justification for UTAUT modification (Deletion) ....................... 108
Table 3.3: Summary of Research Hypothesis ............................................... 120
Table 3.4: Research variables ........................................................................ 122
Table 4.1: Characteristics of quantitative and qualitative approach ............ 130
Table 4.2: Performance Expectancy Coding ............................................... 136
Table 4.3: Effort Expectancy Coding .............................................................. 137
Table 4.4: Social Influence Coding ............................................................... 138
Table 4.5: Facilitating Condition Coding ...................................................... 139
Table 4.6: Attitude Coding ............................................................................ 140
Table 4.7: Anxiety Coding ............................................................................ 140
Table 4.8: Self-Efficacy Coding ................................................................. 141
Table 4.9: Behavioural Intention Coding ...................................................... 142
Table 4.10 (a): Average Reliability of the Construct (Pilot) ..................... 147
Table 4.10 (b): Average Reliability of the Construct (Main Study) ............ 148
Table 4.11: Item-Total Statistics of Performance Expectancy .................... 148
Table 4.12: Item-Total Statistics of Effort Expectancy ............................... 149
Table 4.13: Item-Total Statistics of Self-Efficacy ....................................... 149
Table 4.14: Item-Total Statistics of Attitude .............................................. 150
Table 4.15: Item-Total Statistics of Social Influence .................................. 150
Table 4.16: Item-Total Statistics of Facilitating Condition ....................... 150
Table 4.17: Item-Total Statistics of Anxiety ............................................... 151
Table 4.18: Item-Total Statistics of Behavioural Intention ....................... 151
Table 4.19: Interpretation of Factor Analysis ...................................................... 155
Table 4.20: Categories of correlation ................................................................. 155
Table 5.1: Distribution by Gender ................................................................. 160
Table 5.2: Distribution by Age ................................................................. 160
Table 5.3: Normality Test over distribution by gender .......................... 162
Table 5.4: Normality Test over distribution by age ................................................. 163
Table 5.5: Tests of Normality .................................................................. 164
Table 5.6: Cases of outliers ................................................................... 165
Table 5.7: KMO and Bartlett's Test .............................................................. 166
Table 5.8: Dropped Items after factor analysis ...................................................... 167
Table 5.9: Exploratory Factor Loadings .............................................................. 168
Table 5.10: Hypothesis (H1) Correlations ....................................................... 170
Table 5.11: Hypothesis (H2) Correlations ........................................................... 171
Table 5.12: Hypothesis (H3) Correlations ........................................................... 171
Table 5.13: Hypothesis (H4) Correlations ........................................................... 172
Table 5.14: Hypothesis (H5) Correlations ........................................................... 173
Table 5.15: Hypothesis (H6) Correlations ........................................................... 174
Table 5.16: Hypothesis (H7) Correlations ........................................................... 174
Table 5.17: Independent Samples Test (PE) ....................................................... 176
Table 5.18: Independent Samples Test (EE) ....................................................... 177
Table 5.19: Independent Samples Test (SI) ....................................................... 178
Table 5.20: Independent Samples Test (ATT) .................................................... 179
Table 5.21: Test of Homogeneity of Variances (PE) ......................................... 181
Table 5.22: ANOVA (PE) ........................................................................ 181
Table 5.23: Test of Homogeneity of Variances (EE) ......................................... 182
Table 5.24: ANOVA (EE) ........................................................................ 182
Table 5.25: Test of Homogeneity of Variances (SI) ......................................... 183
Table 5.26: ANOVA (SI) ........................................................................ 183
Table 5.27: Test of Homogeneity of Variances (FC) ......................................... 184
Table 5.28: ANOVA (FC) ........................................................................ 184
Table 5.29: Test of Homogeneity of Variances (ATT) ....................................... 185
Table 5.30: ANOVA (ATT) ........................................................................ 185
Table 5.31: Test of Homogeneity of Variances (ANX) ......................................................... 186
Table 5.32: ANOVA (ANX) ................................................................................................. 186
Table 5.33: Correlations Matrix between Behavioural dimensions ......................... 190
Table 5.34: Overall Model Summary .................................................................................. 191
Table 5.35: Stepwise Regression Analysis result .............................................................. 192
Table 5.3(a): Model Summary without ATT and ANX .................................................. 193
Table 5.36(b): Model Summary without ANX ................................................................. 193
Table 6.1: Order of importance of the predictor .............................................................. 207
LIST OF FIGURES

Figure 1.1: Users readiness to change to Biometric ............................................. 13
Figure 1.2: Research Methodological Framework .................................................. 25
Figure 1.3: Relationships between the theories and Research Variables ................. 30
Figure 1.4: Research Contributions ........................................................................ 36
Figure 2.1: Access control in an automated system ............................................. 49
Figure 2.2 Shoulder Surfing Scenario ....................................................................... 52
Figure 2.3: The iris authentication process ............................................................ 69
Figure 2.4: Public Authentication Using iris .......................................................... 70
Figure 2.5: The human iris ..................................................................................... 77
Figure 2.6: General Biometric Authentication Process ......................................... 81
Figure 3.1: Theory of Reasoned Action .................................................................. 94
Figure 3.2: Technology Acceptance Model ............................................................ 97
Figure 3.3: Original UTAUT .................................................................................. 109
Figure 3.4: Proposed Research Mode ..................................................................... 110
Figure 3.5: Hypothesized Research Model ............................................................ 121
Figure 4.1: Research Methodology ......................................................................... 131
Figure 5.1: Final Correlated Research Model ...................................................... 187
ABBREVIATIONS

A: Attitudes towards use
ANOVA: Analysis of Variance
ANX: Anxiety
ATM: Automated Teller Machine
ATT: Attitude
BI: Behavioural Intention
CBN: Central Bank of Nigeria
C-TAM-TPB: Combined TAM and TPB
DNA: Deoxyribonucleic acid
DTPB: Decomposed TBP
EE: Effort Expectancy
EFCC: Economic and Financial Crime Commission
EV: External Variable
FAR: False Acceptance Rate
FC: Facilitating Condition
FRR: False Rejection Rate
IBIA: International Biometric Industry Association
ID: Identity
IDT: Innovation Diffusion Theory
IT: Information Technology
KMO: Kaiser-Meyer-Olkin
MM: Motivational Model
MOGA: Multi-Objectives Genetic Algorithm
MPCU: Model of PC Utilization
PE: Performance Expectancy
PEOU: Perceived Ease Of Use
PIN: Personal Identification Number
PU: Perceived Usefulness
SCT: Social Cognitive Theory
SEF: Self-Efficacy
SI: Social Influence
SPSS: Statistical Package for Social Science
TAM: Technology Acceptance Model
TAM2: Technology Acceptance Model 2
TPB: Theory of Planned Behaviour
TRA: Theory of Reasoned Action
UB: Use Behaviour
UTAUT: Unified Theory of Acceptance and Use of Technology
CHAPTER 1

BACKGROUND OF THE STUDY

1.1 Introduction

The world has turned to a global village via Information Technology (IT). This dynamic growing digital world has called for fast responding and reliable security devices. The singular fact is that almost all business data are now being converted into an electronic form which requires us to protect such information from some unethical persons who are always exploring possibilities of gaining illegal access to the information. It has become practically impossible for any organization to succeed without IT (Iloanusi & Osuagwu, 2006). This has brought the need, to migrate from the traditional ways of doing things to an information technology compliant way so as to improve efficiency. The need for IT in almost all organizations cannot be over emphasized. Some estimates indicate that since 1980s, about 50 percent of all new capital investment in organization has been in IT (Suryadi, 2007). Therefore, this chapter discusses research motivation,
The contents of the thesis is for internal user only
REFERENCES


Benamati, J., & Rajkumar, T. M. (2002). A design of an empirical study of the applicability of the technology acceptance model to outsourcing decisions. SIGCPR'02, 52-57.


230


232


Research Publications

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