Internet of Things for Healthcare Purposes: Extending the Technology Acceptance Model for Saudi Arabia Patients

Meshari Alanazi and Ben Soh

College of Science, Health and Engineering, La Trobe University, Australia

Summary
The Internet of Things (IoT) refers to billions of physical devices that are connected to the internet, collecting and sharing data. Nowadays, IoT technology impacts our daily lives and perspectives from telecoms and healthcare to education and transportation. Many countries have paid attention to this technology, the Kingdom of Saudi Arabia for example puts a major emphasis on IoT as a driver of innovation and modernization in line with Vision 2030. However, concerns exist over the using of such technology. One can consider the acceptance of IoT technology by its intended users as a lack of user acceptance has been identified as an obstacle to the success of new technologies. Thus, the objective of this research is to develop an extended theoretical model and test it empirically to determine the acceptance of IoT services for healthcare sector in the Kingdom of Saudi Arabia using the Technology Acceptance Model (TAM). Accordingly, a Cross-Sectional survey is specifically designed to collect the data from the sample that will be selected using the Random Sampling technique. To validate the model, the data will be analyzed using the Structural Equation Model, based on the Partial Least Square approach. Such research is important to assist the top management to aware about the acceptance of IoT technology and to ensure that new designs of IoT services are implemented.

Key words:
Internet of Things, Healthcare, Technology Acceptance Model, Structural Equation Model.

1. Introduction

With recent advances in internet technologies, users move to use more general and remotely digital tools that support communication, healthcare, education, and other aspects in every part of their lives [1]. Many industries advance this experience. The Internet of Things (IoT) is considered as a good example in this regard, which connects various items to a wireless network by embedding them with electronic, software, or sensor technology. This network of devices allows to move to the next level of wireless world and offers significant improvements across critical domains such as connectivity, speed, and accessibility [2].
In fact, the IoT is expected to bridge diverse technologies to enable new applications in different domains such as healthcare, transportation, manufacturing, and alike [3]. Surveys of technologies and applications of IoT were presented in [4-6].

Fundamentally, a typical IoT system consists of four different elements: devices, gateways, cloud and apps [6]. These architectural elements can be pictured as four stages in a process that are integrated to improve the business efficiency, accuracy, and maximize economic benefits [7]. Stage 1 consists of devices, typically physical hardware wireless sensors, to be sensed remotely across existing network. Stage 2 includes Gateways that collect, preprocess and transfer the sensed data from devices to the cloud. In Stage 3, the analyzing and managing processes of the sensed data are performed before the data moves on to the cloud. Several jobs are carried out via cloud in Stage 4, this includes device management, data acquisition, data storage and access, real-time and/or offline data analytics, and device actuation.
In this context, IoT has many advantages to offer [8]. Today, Healthcare services are costlier than ever, global population is aging, the number of chronic diseases is on a rise and medical diagnostic consumes a large part of hospital bills. As a result, the healthcare would become out of reach to most people. IoT technology can move the routines of medical checks from a hospital (hospital-centric) to the patient’s home (home-centric). Although IoT delivers an impressive set of benefits, concerns exist over the extent to which such expenditures have produced the intended benefits. One can consider the acceptance of IoT technology by its intended users as lack of user acceptance has been identified as an obstacle to the success of new technologies.
In this paper, we concentrate on the factors affecting the acceptance of IoT technology for healthcare from a conceptual viewpoint. To do this, an extended technology acceptance model will be developed and used to examine what variables affect the adaption of IoT technology for healthcare purpose in Saudi Arabia. Besides the original factors of TAM (Perceived Usefulness, Perceived Ease of Use, Attitude, and Behavioral Intention to Use), four factors are added (Connectedness, Convenience, Privacy, and Cost that subsequently influence usage intention). To collect the required information, a survey instrument will be developed to measure the perception. The survey will be then distributed over 385 patients to collect data to test the research model. Finally, the collected data will be

Manuscript received February 5, 2019
Manuscript revised February 20, 2019

analyzed using the Structural Equation Model, based on the Partial Least Square approach.

This paper is organized as follows. A background material needed to accomplish our research objectives is provided in Section 2. The literature review is offered in Section 3, while the theoretical framework is outlined in Section 4. The final conclusion and future work are we offered in Section 5.

2. Preliminary Material

Before presenting our work, we first introduce some background material that is needed to understand our approach.

2.1 Internet of Things (IoT)

Internet of Things (IoT) allows billions of smart devices to be connected to the Internet. According to a study conducted by Cisco, the number of connected devices overtook the human population in 2010 and is estimated to be 50 billion by 2020 [9]. IoT enables the integration of computers, sensors and networking to develop new capabilities and services [10]. These services aim to improve the system performance as well as the quality of life such as healthcare, transportation, manufacturing, and so on. In fact, IoT has received enormous attention after many years of development and pilot programs. Many technologies and applications were developed. Detailed information can be found in [11-12].

2.2 IoT Applications

In fact, there are an extensive number of IoT applications to be considered. Next, we briefly described the most common ones.

Smart home: IoT allows homeowners to control smart devices, often by a smart home app, in order to provide security, comfort, and convenience. This includes lighting, heating and air conditioning, and media [13]. Over the last few years, multiple providers have released platforms and accessing these platforms has become more accessible such as: Stringify, OpenHAB, OpenHAB, and Home Assistant [14].

Healthcare: In today settings, patients can get their healthcare outside hospitals and clinics. This is motivated by the spread of smart devices where the patients' vital signs can be shared with the caregivers [15]. Many developers have developed clinical information systems. One can consider for example the IBM and ActiveHealth Management (American provider of healthcare services), which provide easy access to health care services for information from different sources such as laboratory data and electronic medical record (EMR) [16].

Transportation: Application of the IoT extends to all aspects of transportation systems (the vehicle, the infrastructure, and the driver or user) [17]. In this regard, many IoT applications have been developed to incorporate in maintaining vehicle health, curbing traffic, and improving fleet logistics. Experts forecast the transportation industry will spend $40 Bn. annually on IoT by 2020 [18].

Manufacturing: IoT is a core component of the industrial transformation efforts, including Industry with its fourth revolution. Nowadays, the term industrial Internet of things (IIoT) is often encountered in the manufacturing industries, referring to the industrial subset of the IoT. It is estimated that the potential of growth by implementing IIoT will generate $12 trillion of global GDP by 2030 [19].

2.3 Technology Acceptance Model (TAM)

The technology acceptance model (TAM) is an information systems theory proposed by Davis et al. in 1989 to estimate and illustrate the user's adoption behaviors toward modern technologies [20]. The model is illustrated in Figure 4 and consists of four factors influence users' decisions about how and when they will use the technology:

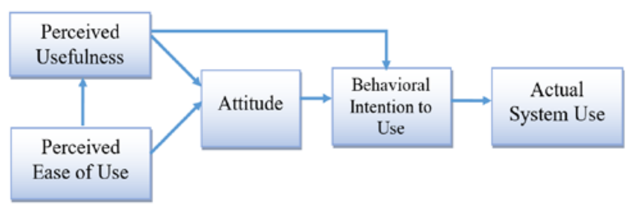

Fig. 1 The Original TAM Model [51].

- *Perceived usefulness (PU),* which reflects the degree of a person's belief that using a particular system would enhance his or her job performance.
- *Perceived ease-of-use (PEOU),* which reflects the degree to which a person believes that using a particular system would be free from effort. These two factors are particular beliefs that act as determinants of computer acceptance behaviors. Further, PU is influenced by PEOU, and both determine people *Attitude (AT)* toward using the system. On the other hand, AT and PU determine the *Behavioral intention to use (BI).*
- *Behavioral intention to use (BI),* which in turn determines the actual system use [20]. In particular, according to TAM, the outcome component that indicates acceptance is *Behavioral Intention (BI),* which signifies individual's intention to use the technology before exhibiting actual using behavior [21]. Simply put, if individual's BI is higher, the tendency to use the technology is also higher.

3. Related Work

The former studies inspected the level of user's belief to justify the people's acceptance or rejection of a proposed information technology. While the later, focuses on the variables upon which they based on to justify their decisions to use or not a proposed information technology. Regarding the using of TAM, many studies have considered TAM model to inspect the users' acceptance of many technologies in Saudi Arabia [22-30]. For example, [22] considered the acceptance and use of IT in general in Saudi Arabia. These studies examined individual, technological, and organizational factors affecting computer acceptance based on a data that was collected from computer users in private and public organizations. They contend that social and cultural influences could bridge the gap towards a better understanding of IT acceptance if certain factors are taken into account.

On the other hand, more specific studies have been proposed to consider the Academic and higher education in Saudi Arabia such as [23]. Here, the TAM core factors (perceived ease of use, perceived usefulness, and attitude toward usage) are used to build a theoretical framework in additional to new external variables (the lack of learning management systems (LMS) availability, prior experience, and job relevance. The overall research model suggests that all mentioned variables either directly or indirectly affect the overall behavioral intention to use an LMS.

The e-learning and e-government are also studied in [24] and [25]. The work related to e-learning were seeking a causative explanation of the decision behavior of individuals toward the acceptance and assimilation of e-learning in academic settings. Surveys were distributed on students and the collected data were analyzed using structural equation modeling in order to determine the factors that influence the learners' intention to use e-learning. However, the researchers of [25] investigated the influence of technology, government agencies, risk, citizens' characteristic. The Structure Equation Modelling was utilized to analyze the collected data. The findings of the study reveal the positive and significant impacts of both technical factors and citizens' characteristic while factors related to government agencies and risk provide negative impacts in trust in e-government.

Moreover, the acceptance of e-banking is also considered in [26], where customers perceive and adopt internet banking (IB) in Saudi Arabia was examined. Besides the TAM factors, the construct of Web Security was added to determine the level of adoption to use IB.

Ultimately, E-health is extensively studied in many directions. Examples include: (1) using of cloud computing in Healthcare [27], (2) using of monitoring system for elderly Saudi Arabians [28], and (3) trusting of stored medical data as Electronic health record EHR [29], which extends the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model to expect the behavior of using EHR by medical staff. To achieve that, a set of factors are examined to determine whether trust in stored data significantly affect behavioral intention (BI) of medical staff. Recently, authors of [30] examined the factors influencing nurse's acceptance of electronic medical record in a Saudi Arabia hospital.

These studies confirm the strength of the TAM in determining the level of acceptance to use different IT services in a developing economy. To the best of our knowledge, no one has considered the using of TAM model to determine the acceptance of using IoT in the healthcare sector in Saudi Arabia.

4. The Extended Technology Acceptance Model Proposal

The advent of IoT has led to the emergence of several concerns. Literature review shows that there are many challenges still facing the application of Internet of things including, data security & privacy of the collected data, the services quality/efficiency, the computer anxiety, and the cost of services. For example, in the last two years, the health information of nearly 18 million has been breached electronically [31]. This results in loss of trust by users, who expect their health information privacy to remain secured and protected.

Thus, concerns have existed for using of IoT technology in the healthcare sector. To that end, we propose a new model extending the Technology Acceptance Model (TAM) to determine the acceptance of healthcare IoT services in the Kingdom of Saudi Arabia. Without taking into account this concern, such technology may face resistance or rejection by users, or it may result in great loss in the technology implementation and might paralyze it.

4.1 Research Methodology

To achieve the aim of this work, we begin by developing an extended TAM model particularly by studying the previous studies on technology acceptance model. Based on the literature review, the users' acceptance factors are identified. Then the research model is designed, which includes defining the research's factors, measurements, and hypothesis as discuss in the next sections. Finally, the designed model will be evaluated experimentally using the quantitative approach. To this end, a questionnaire will be designed specifically for this study to collect data from the participants. The data will then be analyzed statistically to conduct the users' intention to accept and use IoT technology.

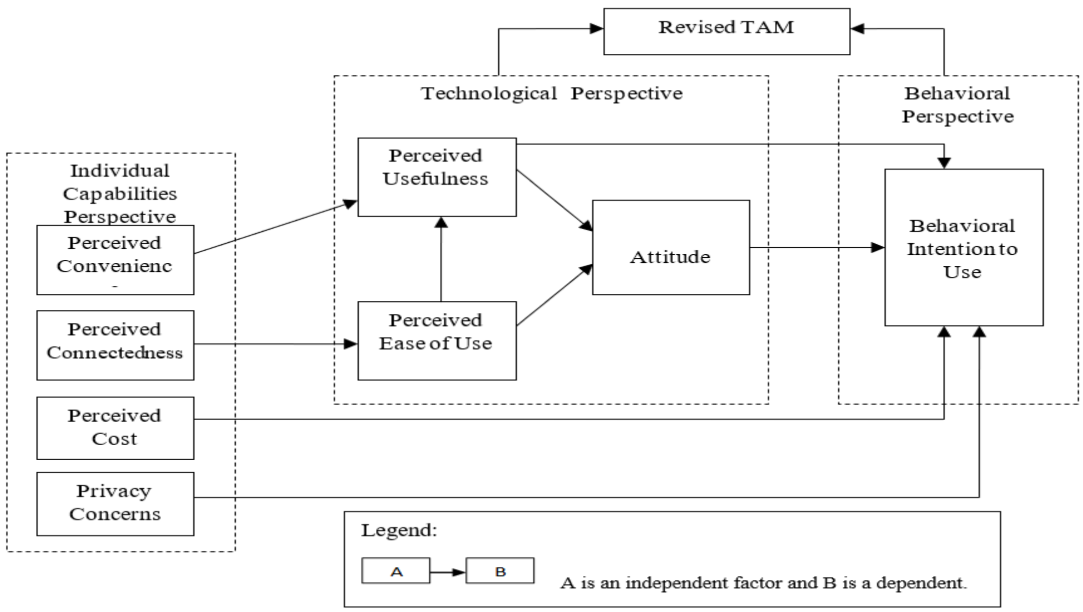

Fig. 2 Proposed Research Model.

4.2 Research Model

Various empirical studies are developed to investigate the adoption of a new technology, where the Technology Acceptance Model (TAM) is utilized and the quantitative approach is employed. Therefore, this study employs the same approach and utilizes theories testing, which shows the idea of relationships. So, one can gauge the qualities of connections among factors. Figure 2 illustrates the proposed model, which aims to assess the influence of the four external variables (Connectedness, Convenience, Privacy, and Cost) upon the intention of use of IoT services by specifying the relationships among them and also among the four belief constructs (viz. the factors: Perceived Usefulness, Perceived Ease of Use, Attitude, and Behavioral Intention to Use) that subsequently influence the usage intention.

In other words, we want to find the associated underlying hypotheses to determine if there is a correlation between these factors and the external variables; this is important because without acceptance, discretionary users will seek alternatives, while even dedicated users will likely manifest dissatisfaction and perform in an inefficient manner, negating many, if not all, the presumed benefits of a new technology. Moreover, by specifying the factors or variables influencing the adoption of technologies and considering them in the process of system's design and implementation, the risk of resistance or rejection by users will be minimized.

In particular, the four factors of TAM are adopted from [21]. While Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) are used to measure the technological perspective, Attitude (AT) and Behavioral Intention Use (BI) are used to measure the behavioral perspective. In particular, the PU factor consists of 6 measurement items, which are: (1) Accomplish tasks more quickly, (2) Improve my job performance, (3) Increase productivity, (4) Enhance effectiveness on the job, (5) Make job easier, and (6) Useful in job. On the other hand, the PEOU factor consists of 6 measurement items, which are: (1) Easy to learn, (2) Easy to control, (3) Clear and understandable, (4) Flexible to interact with, (5) Easy to become skillful, and (6) Easy to use. Moreover, the BI factor consists of 3 measurement items, which are: (1) Intend to use, (2) Predict to use, and (3) Plan to use IoT services. However, the AT factor consists of only 3 measurement items, which are: (1) System is a good idea, (2) Have positive feelings toward IoT, and (3) Wise idea to use IoT.

In our proposed model, we extend the TAM factors to include the perspective of four Individual Capabilities as shown in Figure 3: (1) Perceived Connectedness (PCD) [32]; (2) Perceived Cost (PC) [33]; (3) Perceived Convenience (PCV) [34]; and (4) Privacy Concerns (.PCO) [35]. In our investigation, the focus for each of the Individual Capabilities is as follows.

The PCD factor focuses on three themes: (1) IoT: (2) use any service of IoT; and (3) interact with the services from anywhere. For the PC factor, three measurement items are focused on: (1) Cost the IoT technology; (2) Easily afforded IoT services; (3) Burden to use IoT services. On the other hand, the PCV factor focuses on the three measurement items: (1) IoT used conveniently at any time; (2) IoT used conveniently at anywhere; (3) IoT is not complicated. Finally, the PCO factor focuses on these measurement items: (1) Others can use my personal information; (2) Others can steal my personal information; (3) Concerns about standards used for protecting data privacy and security.

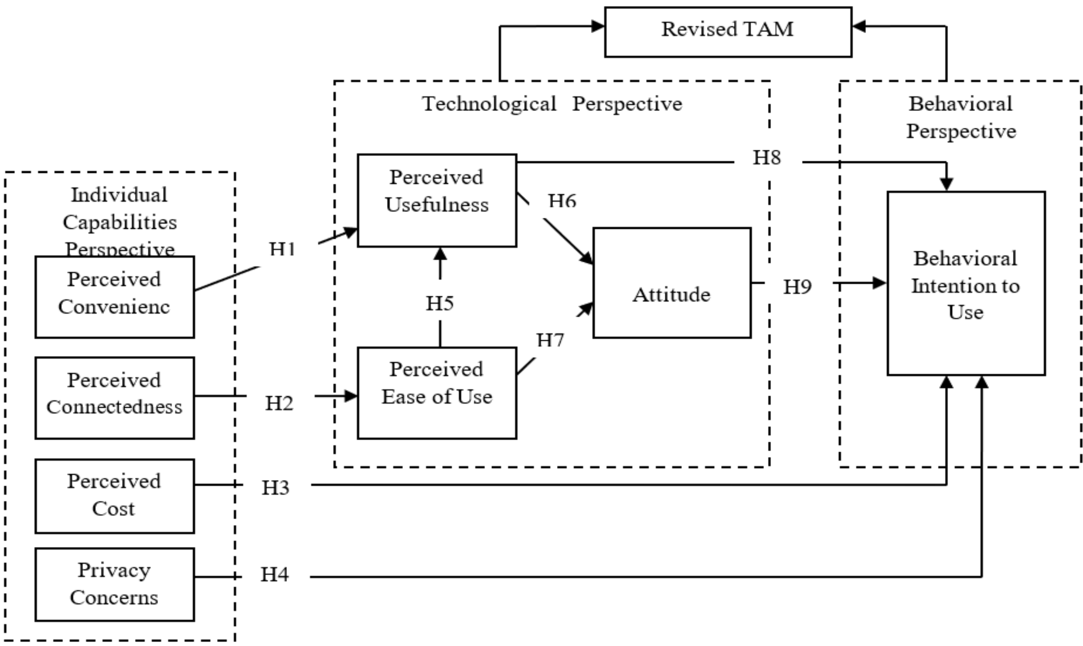

Fig. 3 Proposed Research Model Incorporating Hypotheses

4.3 Research Hypothesis

Having defined the required factors in Section 3.2, it is important for us to investigate how these factors relate to our proposed research model shown in Figure 3. To this end, we employ hypothesis testing methodology to clarify the relationships among the factors. With respect to that, we design the hypotheses in a directional organization. In this configuration, the connection between two factors is illustrated with terms such as (positive, negative). Furthermore, this study utilizes a reasoning procedure for hypotheses development and evaluation. It consists of four stages: building up the model, detailing testable hypotheses, gathering data, and lastly testing the hypotheses. Table 1 summarizes the hypotheses we used in our study. Moreover, the hypotheses are mapped with the model in Figure 3. After constructing the research model and formulating the hypotheses, we have determined the research context. The next section discusses the data collection.

5. Data Collection and Analysis

Our work uses a self-administered questioner as the instrument for gathering data, which reduces cost and time and increases the reliability of the responders in comparison with the other techniques [37].

Table 1: Research Hypotheses

Hypotheses	
H1	PCV has a direct effect on PU.
H2	PCD has a direct effect on PEOU.
H3	PC has a direct effect on BI.
H4	PCO has a direct effect on BI.
H5	PEU has a direct effect on PU.
H6	PU has a direct effect on AT.
H7	PEOU has a direct effect on AT.
H8	PU has a direct effect on BI.
H9	AT has a direct effect on BI.

5.1 Questionnaire Design

The questionnaire has been designed based on the factors and measurement items listed in Section 3.2. It utilizes a five-point Likert scale with anchors ranging from “strongly disagree” to “strongly agree”. The interval scale is used

because it allows for specific mathematical operations on the data collected from respondents.
The questionnaire consists of two parts. Part 1 contains sociodemographic questions (respondent age, gender, and income) and a basic question on IoT awareness that has been used as a screening question. The screening question used was “Do you know what IoT technologies are?” All respondents then moved on to Part 2 that contains open-ended questions, which measure the intention of the respondents to use IoT for healthcare.

5.2 Sampling

The sample size calculation is based on the Cochran’s Sample Size Formula [36] as it is considered especially appropriate in situations with large populations. In our study, we target the patients above the working age because the study aims to determine the acceptance of IoT services, which are used by adult users. According to the General Authority for Statistics in the Kingdom of Saudi Arabia 2016, the proportion of the total population of Saudi Arabia above the working age is 75.2%, which is equal to 23870215 persons, which is large. Based on the Cochran’s Sample Size Formula:

$$no = \frac{z^2\ (p * q)}{e^2} \qquad (1)$$

Where:
- *e* is the desired level of precision (i.e. the margin of error).
- *p* is the (estimated) proportion of the population which has the attribute in question, q is 1–p.
- *z*-value is found in Z table.

In this study, we want 95% confidence, p = 0.5 and at least 5 percent—plus or minus—precision. A 95 % confidence level gives us Z values of 1.96, per the normal tables, so the sample size =

$$\frac{(1.96)^2 * (0.5) * (0.5)}{(0.05)^2} = 385$$

Hence the survey is distributed to over 385 patients from Saudi Arabia hospitals to collect data to test our research model. This sample will form the key informants for our study. As this study looks for the acceptance of IoT services by working people, this portion forms the target age of our study. Out of the portion, 80% live in five administrative districts in the KSA. Makkah region is ranked first among all districts with 27%, followed by Riyadh with 25%, Eastern Region with 15%, Aseer with 7%, and Al-Madinah with 6%. Accordingly, the sample will be selected from these regions according to their percentages of the total population in the KSA.

5.3 Data Analysis

Collected data on this work will be statistically analyzed using Structural Equation Model (SEM), based on the Partial Least Square (PLS) approach. This approach should be able to determine and examine the overall model as one unit. It could additionally examine models with multiple independent factors, even if there are correlations between different unbiased factors or extraordinary dependent factors. Furthermore, the goodness of the path coefficients to be examined, and the hypotheses’ testing to be executed by using a suitable approach based on the shape of the collected data.

6. Conclusion and Future Work

To study the acceptance of using IoT in the healthcare sector in Saudi Arabia, we propose in this paper a new model (shown in figure 3) that extends the TAM to include another four factors (see Section 3.2): PCD, PC, PCV, and PCO. A hypothesis testing was utilized to test the relationship among the factors in the proposed model.
As future work, we will continue the data analysis phase for our approach. Furthermore, we will turn our focus to assess the readiness and awareness of the IoT technology in the Kingdom of Saudi Arabia with respect to the infrastructure, laws, and procedures as the lack of awareness will result in great loss in the technology implementation and might paralyze it.

References

[1] Al-Fuqaha, Ala and Guizani, Mohsen and Mohammadi, Mehdi and Aledhari, Mohammed and Ayyash, Moussa. “Internet of things: A survey on enabling technologies, protocols, and applications,” IEEE Communications Surveys & Tutorials, vol. 17, no. 4, pp. 2347-2376, 2015.
[2] D. Uckelmann, M. Harrison, and F. Michahelles, “An architectural approach towards the future internet of things,” in Architecting the internet of things. Springer, pp. 1–24, 2011.
[3] J. Gubbi, R. Buyya, S. Marusic, and M. Palaniswami, “Internet of things (IoT): A vision, architectural elements, and future directions,” Future Generation Computer Systems, vol. 29, no. 7, pp. 1645–1660, 2013.
[4] A. Al-Fuqaha, M. Guizani, M. Mohammadi, M. Aledhari, and M. Ayyash, “Internet of things: A survey on enabling technologies, protocols, and applications,” IEEE Communications Surveys & Tutorials, vol. 17, no. 4, pp. 2347–2376, 2015.
[5] B. Kantarci and H. T. Mouftah, “Sensing services in cloud-centric internet of things: A survey, taxonomy and

challenges," in IEEE International Conference on Communication Workshop (ICCW), pp. 1865–1870, 2015.
[6] Taivalsaari, Antero and Mikkonen, Tommi. "On the development of IoT systems," 2018 Third International Conference on Fog and Mobile Edge Computing (FMEC), 2018.
[7] Santucci, Gérald. "The Internet of Things: Between the Revolution of the Internet and the Metamorphosis of Objects," European Commission Community Research and Development Information Service, 2016.
[8] Al-Ali, AR and Zualkernan, Imran A and Rashid, Mohammed and Gupta, Ragini and Alikarar, Mazin. "A smart home energy management system using IOT and big data analytics approach," IEEE Transactions on Consumer Electronics, vol. 63, no. 4, pp. 426--434, 2017.
[9] Dave Evans, "The Internet of Things, How the Next Evolution of the Internet Is Changing Everything", white paper by Cisco, 2011.
[10] B. Roberto Minerva and D. Rotondi, "Towards a definition of the internet of things (IoT)," Tech. Rep., 2015.
[11] B. N. Silva, M. Khan, and K. Han, "Internet of Things: A Comprehensive Review of Enabling Technologies, Architecture, and Challenges," IETE Technical Review, pp. 1-16, 2017.
[12] M. Mukherjee, I. Adhikary, S. Mondal, A. K. Mondal, M. Pundir, and V. Chowdary, "A Vision of IoT: Applications, Challenges, and Opportunities with Dehradun Perspective," International Conference on Intelligent Communication, Control and Devices, 2017.
[13] Chen, Min and Yang, Jun and Zhu, Xuan and Wang, Xiaofei and Liu, Mengchen and Song, Jeungeun, "Smart home 2.0: Innovative smart home system powered by botanical IoT and emotion detection," Mobile Networks and Applications, Vol. 22, No. 6, pp. 1159-1169, 2017.
[14] Stojkoska, Biljana L Risteska and Trivodaliev, Kire V, "A review of Internet of Things for smart home: Challenges and solutions," Journal of Cleaner Production, Vol. 140, pp. 1454-1464, 2017.
[15] Darwish, Ashraf and Hassanien, Aboul Ella and Elhoseny, Mohamed and Sangaiah, Arun Kumar and Muhammad, Khan, "The impact of the hybrid platform of internet of things and cloud computing on healthcare systems: Opportunities, challenges, and open problems," Journal of Ambient Intelligence and Humanized Computing, pp. 1-16, 2017.
[16] Sultan N, "Making use of cloud computing for healthcare provision: opportunities and challenges," International Journal of Information Management, Vol: 34, pp. 177–184, 2014.
[17] Mahmud, Khizir and Town, Graham E and Morsalin, Sayidul and Hossain, MJ, "Integration of electric vehicles and management in the internet of energy," Renewable and Sustainable Energy Reviews, 2017.
[18] Guerrero-Ibanez, Juan Antonio and Zeadally, Sherali and Contreras-Castillo, Juan, "Integration challenges of intelligent transportation systems with connected vehicle, cloud computing, and internet of things technologies," IEEE Wireless Communications, Vol. 22, No. 6, pp. 122-128, 2015.
[19] Daugherty, Paul and Banerjee, Prith and Negm, Walid and Alter, Allan E, "Driving unconventional growth through the industrial internet of things," Journal of Accenture Technology, 2015.
[20] F. D. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," MIS Q., vol. 13, no. 3, p. 319, 1989.
[21] E. Basak, et al., "Examining the Factors Affecting PDA Acceptance among Physicians: An Extended Technology Acceptance Model," Journal of Healthcare Engineering, vol/issue: 6(3), pp. 399-418, 2015.
[22] Hu, Han-fen and Hu, Paul Jen-Hwa and Al-Gahtani, Said S, "User Acceptance of Computer Technology at Work in Arabian Culture: A Model Comparison Approach," Technology Adoption and Social Issues: Concepts, Methodologies, Tools, and Applications, pp. 1521-1544, 2018.
[23] Binyamin, Sami and Rutter, Malcolm and Smith, Sally, "The Students' Acceptance of Learning Management Systems in Saudi Arabia: A Case Study of King Abdulaziz University," International Academy of Technology, Education and Development (IATED), 2017.
[24] Binyamin, Sami and Rutter, Malcolm and Smith, Sally, "Factors Influencing the Students' Use of Learning Management Systems: A Case Study of King Abdulaziz University", International Conference on e-Learning, pp. 289-297, 2017.
[25] Alzahrani, Latifa and Al-Karaghouli, W and Weerakkody, V, "Developing citizens' trust towards successful adoption of e-government: An empirical study from Saudi Arabia," Academy of Contemporary Research Journal, Vol. 5, No. 2, pp. 9-15, 2016.
[26] Sharma, Sujeet Kumar and Govindaluri, Srikrishna Madhumohan and Al-Muharrami, Saeed and Tarhini, Ali, "A multi-analytical model for mobile banking adoption: A developing country perspective," Review of International Business and Strategy, Vol. 27, No. 1, pp. 133-148, 2017.
[27] Alharbi, Fawaz and Atkins, Anthony and Stanier, Clare, "Cloud Computing Adoption in Healthcare Organisations: A Qualitative Study in Saudi Arabia," Transactions on Large-Scale Data-and Knowledge-Centered Systems, pp. 96-131, 2017.
[28] Alsulami, Majid H and Atkins, Anthony S and Campion, Russell J and Alaboudi, Abdulellah A, "An enhanced conceptual model for using ambient assisted living to provide a home proactive monitoring system for elderly Saudi Arabians," 2017 IEEE/ACS 14th International Conference on Computer Systems and Applications (AICCSA), pp. 1443-1449, 20017.
[29] Malik Alazzam et al, "Trust in stored data in EHRs acceptance of medical staff: using UTAUT2," International Journal of Applied Engineering Research, Vol. 11, No. 4, pp. 2737-2748, 2016.
[30] Aldosari, Bakheet and Al-Mansour, Sheema and Aldosari, Hanan and Alanazi, Abdullah, "Assessment of factors influencing nurse's acceptance of electronic medical record in a Saudi Arabia hospital, Informatics in Medicine Unlocked, Vol. 10, pp. 82-88, 2018.
[31] The Financial Impact of Breached Protected Health Information: A Business Case for Enhanced PHI Security, a

seminal report by the American National Standards Institute, https://datavantage.com/images/resources/The_Financial_Impact_of_Breached_PHI-1.pdf
[32] E. Park and K. J. Kim, "An Integrated Adoption Model of Mobile Cloud Services: Exploration of Key Determinants and Extension of Technology Acceptance Model," Telemat. Informatics, vol. 31, no. 3, pp. 376–385, 2014
[33] G. C. Moore and I. Benbasat, "Development of an instrument to measure the perceptions of adopting an information technology innovation," Inf. Syst. Res., vol. 2, no. 3, pp. 192–222, 1991.
[34] C. Yoon and S. Kim, "Convenience and TAM in a ubiquitous computing environment: The case of wireless LAN," Electron. Commer. Res. Appl., vol. 6, no. 1, pp. 102–112, 2007.
[35] M. S. Featherman and P. A. Pavlou, "Predicting e-services adoption: A perceived risk facets perspective," Int. J. Hum. Comput. Stud., vol. 59, no. 4, pp. 451–474, 2003.
[36] Charan J, Biswas T. "How to calculate sample size for different study designs in medical research?." *Indian J Psychol Med*.35(2), pp. 121-6, 2013.
[37] Bourque, Linda and Fielder, Eve P. "How to conduct self-administered and mail surveys." Vol. 3, 2003.

Meshari Alanazi received the B.S. degree in Computer Science from Northern Border University and M.S. degree in Computer Science from Western Illinois University in USA 2016, respectively. During 2016-2018, he was Lecturer in Norther Border University and from 2018 he started his PhD in La Trobe University.

Ben Soh obtained his PhD in Computer Science & Engineering from La Trobe in 1995. Since then, he has successfully supervised to completion nine PhD students and published more than 160 peer-reviewed research papers. He has made significant contributions in the following research areas: Fault-Tolerant and Secure Computing, Cloud Computing, Information Systems Research, Pervasive Wireless Network Communications, and Business Process Management.