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A Novel Conceptual Model of e-Participation using Biometrics Technologies

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Abstract. Participation from all relevant stakeholders is important to achieve the goal of every activity successfully. Nowadays, Information and Computer Technologies, for example, Biometrics, Internet of Things (IoT) and Big Data are used to support participation from the relevant stakeholders. Electronic Participation (e-Participation) already utilized broadly to empower people participation in politics, business, government, cultural activities. Moreover, Biometrics has been used broadly for an identification system. Biometrics system identifies physiological instead of behavioral attributes, such as palm veins, iris recognition, face recognition, fingerprint, DNA, palm print, hand geometry, retina, and odor/scent. Therefore, this research would like to collaborate e-Participation and Biometrics fields from the multidisciplinary perspective. Furthermore, the literature reviews show that research collaboration between e-Participation and Biometrics Technologies are still limited. Hence, the objective of this research was to develop a novel conceptual model of e-Participation using Biometrics technologies. This paper contributes by developing a novel conceptual model of biometrics technologies for e-Participation implementation. This research has some implications. For theory development, this research contributes to the novel conceptual model in e-Participation, E-Government, Information Systems, Informatics, Computer Science, Image Processing, and Biometrics fields. For Practice, the novel model could be utilized for practitioners, policy-makers, and other relevant stakeholders for e-Participation implementation using Biometrics Technologies.

1. Introduction

Participation from all relevant stakeholders is important to achieve the goal of every activity successfully. Nowadays, Information and Computer Technologies (ICT), for instance, Big Data, Internet of Things (IoT) and Biometrics are used to support participation from the relevant stakeholders. Electronic Participation (e-Participation) already used widely for encouraging participation in politics, business, government, cultural agenda. Moreover, Biometrics already utilized broadly as system identification. Biometrics system identifies physiological instead of behavioral attributes, such as DNA, palm print, hand geometry, fingerprint, face recognition, palm veins, retina, iris recognition, and odor/scent. Therefore, the research would like to collaborate e-Participation and Biometrics fields from the multidisciplinary perspective.



Furthermore, one of the literature reviews shows that research collaboration between e-Participation and Biometrics Technologies are still limited. The aim of this research was to propose a novel conceptual model of e-Participation using Biometrics technologies. This paper is continuing our research about e-Participation, and particularly it's model, framework and theory development. This research contributes by developing a novel conceptual model of biometrics technologies for e-Participation implementation.

The brief structures of this paper are Introduction consist of a background, gaps in the existing research, aim of the research, contributions, and implications. Furthermore, the second section is research methods which describe step by step research. Moreover, the third section is analysis and discussion, which present a novel conceptual model of e-Participation using biometrics technologies and the analysis as well as the advantages and limitations of the model. The fourth section will explain the research summary, conclusions, contributions, and further research opportunities.

2. LITERATURE REVIEWS

2.1. e-Participation

There are various definitions of e-Participation as follows: [1] point out e-Participation is an application of ICT, particularly internet, to encourage citizen engagement in public decision-making activities. Furthermore, [2] also explained e-Participation is *“the various dynamic activities of interaction, communication, participation and management through several electronic technologies, implemented by numerous stakeholders, such as internal, external, dominant and less dominant stakeholders, which are supported by support systems, influencing and influenced by many complex factors, changes, laws and policies as well as financial capital”*.

Moreover, e-Participation frameworks have been developed by other researchers as follows: [3] proposed three stages of participation for promoting e-democracy actions and policy making over agenda setting, analysis, policy formulation, and implementation; [4] established a framework for evaluating e-Participation activities and appliances; [5] developed a framework consists of several layers as follows: the democratic activities, participation fields, participatory approach, classification of apparatus and related ICT technologies; [1] established a model contains components of e-Participation actors, activities, effects, assesment, contextual aspects and the research methods; [6] also developed a domain model of e-Participation contains the stakeholder, participation activities and ICT apparatus; [7] proposed a framework of ICT technologies usage for e-Participation implementation; [8]proposed a framework contains 7 phases as follows: policy and capacity development, planning and goal processes, programs and contents establishment, activities and devices, promotion, participation, post-application study; [9] developed six-stages repeated guidance to facilitate improvement and application of e-Participation programs; [10] developed an assesment framework for e-Participation in parliaments; [9] developed a framework for e-Participation activities that covers the comprehensive engineering methods and facilitates communications between program practitioners with various technical and political backgrounds from multi viewpoints; [11] applied ANT to proposed e-Participation Framework in Malaysia case study; [12] proposed a framework for assesing the effect of e-Participation activities; [13] established a metamodel for the e-Participation model; [14] also developed a model of e-Participation for school case study; [2] also proposed a generic model of e-Participation based on Indonesia and the UK case studies; [15] established a model combines of Internet of Things (IoT) and e-Participation.

According to [16] that Biometrics is a system to assess unique physical or behavioral attributes for individual identification and authentication. Biometrics for physical identification includes fingerprints, retina, iris, hand or palm geometry, or facial attributes. Moreover, Biometrics for behavioral authentication are keystroke pattern, gait, voice, and signature are various research about Biometric Technologies, such as [17] explored Biometrics as a future identification; [18] explained Biometrics system for secure individual authentication; [16] described Biometric security system, such as fingerprints, hand geometry, iris-based, face recognition, retina-based, signature verification and voice

authentication; [19] also examined Biometrics for authentication for e-world; [20] explained about 3D Face Cam which is a fast and accurate 3D Imaging Device; [21] captured Biometric Authentication Systems; [22] examined various biometrics methods including strengths and weaknesses, challenges and techniques to spoof biometrics systems as well as how to prevent them; [23] examined a framework of Biometrics and Watermarking for Fingerprint identification, Copyright security, Ownership authentication, and Security technologies; [24] examined Multimodal Biometrics as a future systems; [25] examined theory, methods, and applications of Heart Biometrics; [26] captured Biometrics in the Cloud; [27] captured principles and applications of Electrocardiographic (ECG) Biometrics; [28] explored Biometrics Applications in e-Health Security.

3. RESEARCH METHODS

This research was conducted based on desk research approach. These research stages start from developing a research design, then we set the aim of the research, after that, we conducted literature reviews about e-Participation especially existing models and frameworks of e-Participation as well as Biometrics concept and its application in various fields. Furthermore, we collected and evaluated existing models and frameworks of e-Participation and biometrics then developed a novel conceptual model by combining the relevant parts of e-Participation and Biometrics models. The next step is the description and analysis of the new model about its advantages and limitations as well as identified the novelties and contributions of the novel model.

Table 1. Step by step of actual research

Step	Activity	Output
1	Set Up Aim of the research	Research Aim
2	Review the existing models and frameworks of e-Participation and Biometric Technologies	A literature review about e-Participation and Biometrics
3	Develop a novel conceptual model of e-Participation using Biometrics technologies	A novel conceptual model of e-Participation using Biometrics technologies
4	Analysis of the advantages and limitations of the novel conceptual model	Advantages and limitations of the novel model
5	Emphasize the conclusion, contribution and further research opportunities regarding e-Participation and Biometrics	Pros and Cons of the novel model

4. ANALYSIS AND DISCUSSION

Based on the literature reviews above, then we added additional media of biometrics technologies, as shown in figure 1 below. This model is an extension of the previous model developed by [15]. This research would like to add several biometrics technologies which could support the e-Participation process. As a result, the main parts of this model consist of stakeholder (s), media, object/planning actions, and support systems. The stakeholders could be wider stakeholders, citizen, NGO, government, politicians, researchers, and others [15]. The media include existing electronic technologies such as website, mobile, social media, radio, TV and others. Furthermore, Biometrics technologies consist of 3D Face Cam, Joint Biometrics, and Watermarking, Fingerprint, Iris-based, retina-based, hand

geometry, face recognition, signature verification, voice authentication, kin spectrum, ear pattern, gait-based person identification, voice, video camera, scanner, smart card technologies, electrocardiographic (ECD) signals, cloud-based and multimodal based. Moreover, Internet of Things (IoT) contains perception, network, and service (application) layers.

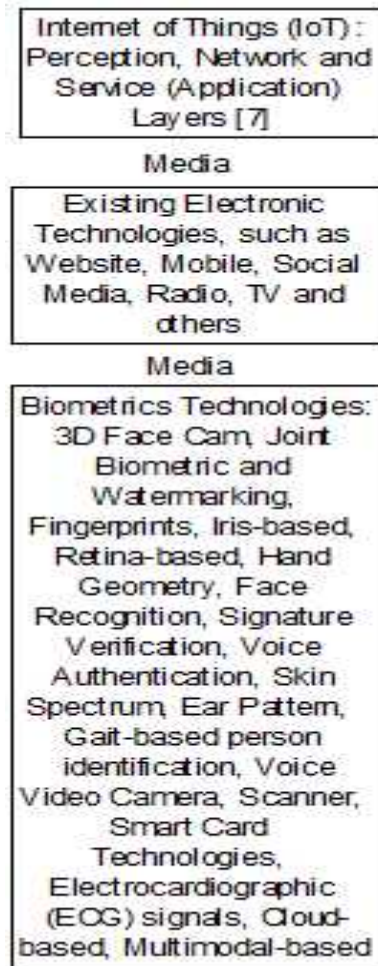


Figure 1. An additional component of Biometrics technologies

The newness thing in this model is the biometrics technologies. These technologies could be used for supporting citizen participation, for example, fingerprints, iris, and retina based signature verification, face recognition, voice authentication, cloud-based biometric technologies could be used for the citizen that involve in a public meeting for making the city decision making.

The novel model above has some advantages, such as combining various technologies, including IoT and Biometrics. It was also using the interdisciplinary approach from computing, finance, public administration, politics, culture, biometrics, web science, and IoT fields. However, this model also has a limitation, such as it has not been applied in the real case study[15].

5. CONCLUSIONS

This research aims to develop a new conceptual model of e-Participation using biometrics technologies. The most obvious finding to emerge from this study is that biometrics technologies could be used to encourage citizen participation. The study contributes to a novel conceptual model of e-Participation using biometrics technologies. These findings have significant implications for the understanding of

biometrics technologies to support citizen participation. This research has some implications as follows: for theory, this research contributes to the novel conceptual model in e-Participation, E-Government, Information Systems, Informatics, Computer Science, Image Processing, and Biometrics fields. For Practice, the novel model is beneficial for practitioners, policy-makers, and other relevant stakeholders to utilize Biometrics Technologies for e-Participation implementation. This research has thrown up many questions in need of further investigation and experiment, such as how electrocardiographic (ECG) signals and gait-based person identification could be used for supporting citizen participation in the policy-making process.

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