

## Design of a TAM Framework with Emotional Variables in the Acceptance of Health-based IoT in Indonesia



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### Abstract

*Utilizing IoT based on health services cannot be avoided, especially during a pandemic requiring a screening process for a person's condition. It serves as an important tool for conducting initial health assessments, which are critical in determining subsequent healthcare interventions. Healthcare-oriented IoT solutions offer a cost-effective approach to remote health evaluation, expanding their reach to remote and underserved areas. The implementation of Safe Entry Stations (SES) further enhances this process by capturing fundamental health metrics such as blood pressure, heart rate, and respiratory rate. This article delves into the exploration of the determinants that influence individuals' intentions to adopt health-focused IoT devices. This introduces a new Technology Acceptance Model (TAM) framework by including additional variables. These findings, as revealed through SmartPLS analysis, confirm the significant impact on the acceptance and integration of health-oriented IoT devices. This research underscores the important role of IoT technology in the healthcare sector and contributes relevant insights for its widespread adoption and implementation.*

**Keywords:** Healthcare-based IoT, Safe Entry Station (SES), Health Screening, IoT Devices Acceptance, SmartPLS Analysis



## 1. Introduction

Technology Acceptance Model, serves as an essential term in comprehending the framework employed in this research. TAM is a model utilized to gauge the acceptance of technology by individuals in various facets of social life[1]. It encompasses specific variables that identify the factors influencing technology acceptance by users[2].

The background of this research delves into the technological landscape in the context of IoT-based health services, with a particular focus on the pandemic situation[3]. Currently, technology is increasingly permeating various aspects of human life, including the business world, industry, manufacturing, and healthcare services[4]. However, in the healthcare sector, there are distinct characteristics that set it apart from other sectors[5]. It is crucial to understand that in the context of healthcare services, emotional and physiological factors can play a significant role in technology acceptance, unlike in the realms of business, industry, and manufacturing[6]. This research centers on technology acceptance in healthcare services, with an IoT-based health device, such as the Secure Entry Station (SES), as the focal point.

The SES employs video analysis technology capable of measuring an individual's heart rate, blood pressure, respiratory rate, and fatigue level[7]. The results from the SES device serve as the foundation for subsequent steps in healthcare services, operating automatically without the need for intervention from healthcare professionals.

However, what makes this research intriguing is the introduction of additional variables related to physiological and emotional factors, especially within the patient-healthcare worker relationship[8]. As demonstrated in this study, there seems to be a need to consider variables such as empathy, sympathy, and social interaction within the context of technology acceptance in the healthcare sector[9], [10]. Furthermore, this research employs data collection through questionnaires based on Google Forms, involving 100 respondents representing diverse genders and age ranges, from 17 to over 50 years. The data from these questionnaires are then analyzed using the Smart PLS application to identify the positive and negative influences of physiological and emotional variables on technology acceptance in the healthcare sector.

Thus, this research attempts to introduce a more holistic perspective in understanding technology acceptance in the context of IoT-based healthcare services, acknowledging the vital role of emotional and physiological factors in the interaction between technology and individuals, especially in sensitive situations like a pandemic.

## 2. Research Method

### 2.1. Data Collection

Data for this research was obtained through the administration of questionnaires using Google Forms. The decision to employ questionnaires was driven by their efficiency in gathering structured data and ensuring response consistency[11]. The questionnaire was meticulously designed to elicit responses from a representative sample population, with the objective of evaluating their acceptance of IoT-based health technology, specifically the Secure Entry Station (SES)[12], [13]. The survey was structured to explore the impact of physiological and emotional variables on technology acceptance within the healthcare sector[14]. The data collection process encompassed several key steps. The questionnaire was thoughtfully crafted, comprising items that probed technology acceptance, physiological factors, emotional factors, and demographic information[15], [16]. Careful attention was given to ensure clarity and ease of response. A total of 100 respondents were chosen to participate in the survey, with a deliberate effort to achieve diversity in terms of gender and age groups. Respondents were categorized into three age segments: 17-35 years, 36-50 years, and above 50 years. This diverse participant group was selected to offer a comprehensive perspective on technology acceptance within the healthcare sector.

To facilitate data collection, the questionnaire was electronically distributed through Google Forms. Participants were provided with a hyperlink to access and complete the survey. This approach allowed for remote data collection, minimizing potential biases often associated

with face-to-face interviews. Prior to commencing the survey, participants were presented with a clear and comprehensive explanation of the research objectives and their rights as respondents. Informed consent was diligently obtained from each participant, ensuring their understanding and voluntary participation in the study.

## 2.2. TAM (Technology Acceptance Model)

It is a widely used theoretical framework that explains how users adopt and use technology. TAM argues that perceived usefulness and perceived ease of use are key determinants of users' intention to use technology[17], [18]. According to the model, users are more likely to adopt and use technology if they find it useful and easy to use[19]. TAM has been widely applied in various fields, including health, education and business[20]. It has been used to predict and explain user behavior in relation to various technologies, such as electronic health records, mobile health applications, and social media platforms[21], [22]. The model has been revised and expanded over the years, with newer versions incorporating additional factors that influence technology adoption and use.

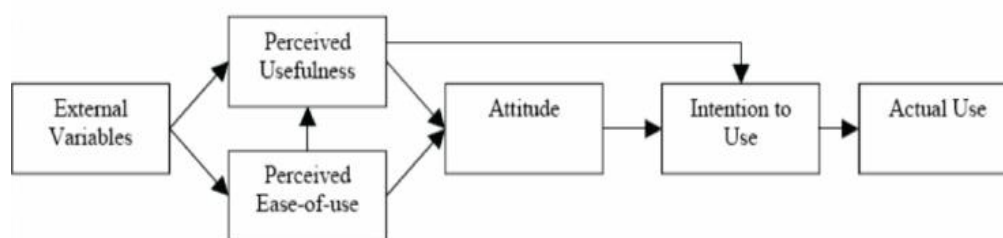


Figure 1. Technology Acceptance Model

## 2.3. Implementation of TAM in Health Services

The Technology Acceptance Model (TAM) has been widely used in healthcare, including in the context of IoT[23]. TAM has been used to study the acceptance and use of various IoT devices and applications by patients and Healthcare providers[24], such as wearable devices, remote monitoring systems, and telemedicine platforms. By assessing the perceived usefulness and ease of use of these technologies, TAM can help healthcare organizations and technology developers understand and predict user behavior[25]. In healthcare IoT, TAM has been applied to evaluate the application and use of IoT technology for disease management, patient monitoring, and other healthcare-related tasks[4]. TAM has also been used to identify factors that may influence the adoption and use of IoT technology, such as privacy concerns and technological barriers.

## 2.4. Safe Entry Station

HIS [26] is an IoT-based Health Device that includes a multispectral camera and an AI-based program. This device is designed to identify, measure, assess, monitor and report a subject's well-being[27], [28]. Figure 2 below shows the actual SES Device. This SES collects data on age, blood pressure, heart rate and respiratory rate.



Figure 2. Safe Entry Station Devices

The work process of SES is supported by artificial intelligence (AI) using multispectral cameras and voice recognition to analyze facial physiological data patterns and predict various health conditions including symptoms of infectious diseases, disorders due to drugs or alcohol, or fatigue[29], [30]. SES uses facial filtering and analysis and voice to identify various conditions by leveraging multiple data models created using machine learning (“ML”) algorithms[31]. SES captures various parameters as well as vital signs of the scanned individual[32]. SES does not require bodily fluids or human intervention, helping to eliminate human error and the potential for discrimination and prejudice. In particular, SES detects symptoms related to workplace health and safety such as Fatigue Detection, Distraction, Infectious Disease symptoms within seconds[33]. Indicators signal whether individuals passed or not, giving organizations the ability to implement secondary safety protocols before allowing flagged individuals to enter the facility. The Solutions feature from SES supports the following parameters:

- a. Face Detection & Real Face
- b. Violation of Standard Operating Procedures (SOP) (closed eyes, side face, mask, glasses, head covering, etc.)
- c. Body temperature from Eye Inner Canthus
- d. Detect eye redness
- e. Heartbeat Detection
- f. Respiratory Rate Detection

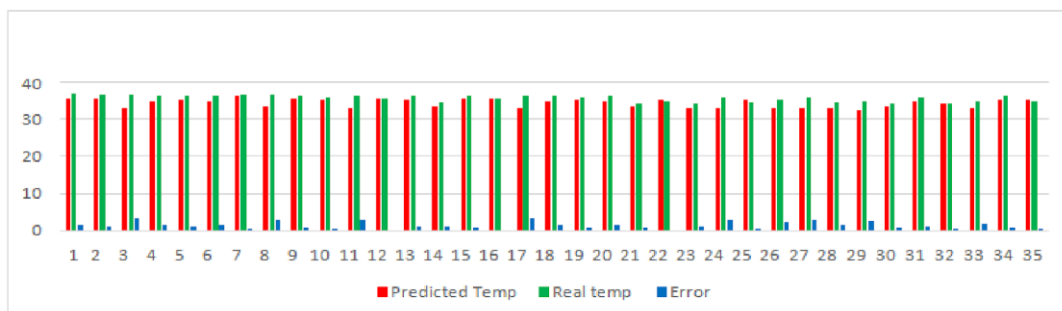


Figure 3. Analysis of SES

### 3. Findings

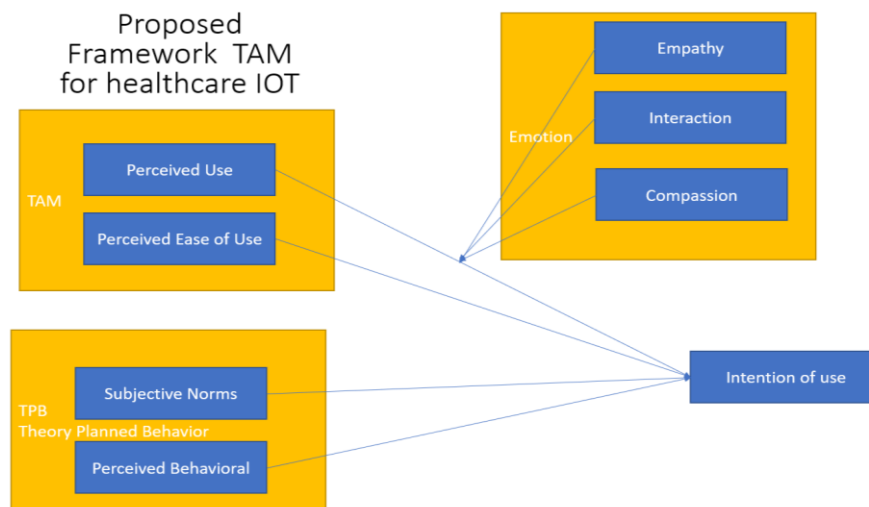


Figure 4. TAM Framework with Additional Variables

In conducting testing with TAM Mode, quantitative research was conducted for this study, which was used to explore users' desires in using IoT-based Health Devices. Respondents were taken from university students, the general public and professional circles. Each user of this healthcare-based IoT device was given a questionnaire regarding their experience in using a healthcare-based IoT device. In conducting testing with TAM Mode, quantitative research was conducted for this study, which was used to explore the desires of users in using IoT-based Healthcare Devices. Respondents were taken from university students, the general public and professional circles. Each user of this healthcare-based IoT device is given a questionnaire regarding their experience in using a healthcare-based IoT device[34]. The TAM model is then analyzed using SMART PLS. The use of SMART PLS can be useful for carrying out analyzes that are very dependent on the responses and subjective viewpoints of respondents, so SMART PLS is used to accommodate this need.

#### Hypothesis

- H1: Empathy has a negative influence on perceived ease of use
- H2: Interaction has a negative influence on perceived ease of use
- H3: compassion has a negative influence on perceived ease of use
- H4: Subjective Norms have a positive influence perceived ease of use
- H5: Perceived behavior has a positive influence on perceived ease of use

The questionnaire was given via Google form to respondents, with a variety of ages, as far as possible fulfilling all variants of *generation theory*.

#### 3.1 VARIABLE QUESTION 1 (Perceived of Use)

1. Using SES will help me feel safer and protected from COVID-19.
2. I believe that using SES will be an effective way to prevent the spread of disease.
3. SES will make it easier for me to comply with health and safety guidelines.
4. Using SES will help me feel more confident about my own health and safety.
5. I believe that using SES will be an important step in returning to normal activities.
6. SES will make it easier for me to participate in events or activities that require a higher level of health and safety precautions.
7. I hope that using SES will help me and the people around me to stay healthy and

- avoid disease.
8. Using SES will increase my confidence in the organization or place that implements it.
  9. I believe that using SES would be the responsible thing to do for me and others.
  10. SES will be an effective tool to reduce the spread of disease and keep communities safe.

### 3.2 VARIABLE QUESTION 2 (Perceived Ease of Use)

1. SES is easy to use.
2. In my opinion, the process of using SES is very easy.
3. I feel confident in my ability to use SES.
4. SES is designed in such a way that it is easy to understand and use.
5. Using SES wouldn't be too difficult for me.
6. I don't expect to encounter any major difficulties using SES.
7. I believe that using SES will be a simple process.
8. SES is user friendly and easy to navigate.
9. I don't anticipate any problems using SES.
10. I would be comfortable using SES without help.

### 3.3 VARIABLE QUESTION 3 (Perceived Behavioral)

1. My friends and family would approve of me using the Secure Entry Station.
2. If my supervisor suggested that I use a Secure Entry Station, I would be inclined to do so.
3. I'm sure my colleagues will support my decision to use Secure Entry Station.
4. Health experts recommend using SES, and this will influence my decision to use it.
5. I trust government guidance on using Secure Entry Stations, and this will influence my decision to use them.
6. Knowing that others in my community use Secure Entry Station will encourage me to do the same.
7. I would feel pressure from my coworkers to use Secure Entry Station if they all used it.
8. If my family members use SES, chances are I will too.
9. Seeing people around me using the Secure Entry Station would make me feel like it was the right thing to do.
10. Knowing that the majority of people in my community use Secure Entry Station will influence my decision to use it.

### 3.2 VARIABLE QUESTION 4 (Subjective Norms)

1. I have access to the necessary hardware and software to use the Secure Entry Station.
2. My workplace provides the necessary support for me to use Secure Entry Station.
3. I have the necessary technical skills to use Secure Entry Station.
4. Secure Entry Station is available in multiple languages, making it easy for me to use.
5. Secure Entry Station is compatible with my mobile devices, making it easy to access.
6. The organization that provides the Secure Entry Station offered training and support to help me use it effectively.
7. Instructions for using the Safe Entry Station are clear and easy to follow.
8. The Safe Entry Station is located and accessible to me.
9. I have the information necessary to understand why using a Safe Entry Station is important.
10. Safe Entry Stations are regularly maintained and updated, ensuring that they are

reliable and effective.

### 3.2 VARIABLE QUESTION 5 (Empathy)

1. How happy are you using Safe Entry Station?
2. Using the Safe Entry Station was a pleasant experience for me.
3. How much fun did you have using the Safe Entry Station?
4. I feel satisfaction when using the Safe Entry Station.
5. How interesting do you think the Secure Entry Station is to use?
6. Using the Safe Entry Station is a source of entertainment for me.
7. I enjoyed exploring the features and functions of the Secure Entry Station.
8. How much does the Safe Entry Station give you a good feeling?
9. I found using the Safe Entry Station to be a satisfying experience.

The results of the survey encompassing various variables indicate that the general public has a positive intention to use Secure Entry Stations (SES) as part of their efforts to ensure safety and health during the pandemic. They view the use of SES as an effective means to prevent disease transmission, which, in turn, makes them feel safer and more confident in adhering to health guidelines. Furthermore, the adoption of SES is influenced by support from friends, family, colleagues, healthcare professionals, and government recommendations. The ease of using SES is also a key factor in the acceptance of this device, with users feeling comfortable and confident in its usage. Emotionally, the use of SES provides a positive experience with a high level of satisfaction and happiness.

Additionally, the integration of IoT-based health services is essential, especially during a pandemic, where the screening of an individual's health condition is crucial. It serves as a vital tool for conducting initial health assessments, which play a critical role in determining subsequent healthcare interventions. IoT solutions focused on healthcare provide a cost-effective approach to remote health evaluation, expanding their reach to remote and underserved areas. The implementation of Safe Entry Stations (SES) further enhances this process by capturing essential health metrics like blood pressure, heart rate, and respiratory rate.

This article delves into an exploration of the determinants that influence individuals' intentions to adopt health-focused IoT devices. It introduces a novel framework to the Technology Acceptance Model (TAM) by incorporating additional variables. The findings, as revealed through SmartPLS analysis, confirm the significant impact on the acceptance and integration of health-oriented IoT devices. This research underscores the critical role of IoT technology in the healthcare sector and contributes relevant insights for its widespread adoption and implementation. In summary, SES holds significant potential in helping the public adhere to health guidelines and maintain safety during the ongoing pandemic, in conjunction with the broader utilization of healthcare-oriented IoT solutions.

### 4. Conclusion

The utilization of Internet of Things (IoT) in the healthcare sector has become increasingly inevitable, particularly in the current pandemic scenario where the initial screening of an individual's health condition holds paramount importance. This preliminary condition assessment serves as a determinant for the subsequent course of action based on these findings. Healthcare-based IoT facilitates a more straightforward process for healthcare professionals to conduct initial assessments, even in remote areas, and at a relatively low cost. The deployment of a Safe Entry Station (SES) proves instrumental in gauging an individual's health level, as it measures fundamental parameters such as blood pressure, heart rate, respiratory rate, among others. This article delves into the various factors that influence an individual's intention to embrace healthcare-based IoT devices and

introduces a novel framework to the Technology Acceptance Model (TAM) by incorporating new variables. The outcomes of the study, as determined through SmartPLS analysis, reveal significant impacts on the acceptance of healthcare-based IoT device usage. This article underscores the critical role of IoT utilization in the healthcare domain and contributes substantially to our understanding of the factors affecting the adoption of IoT-based healthcare technology.

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