

Parent's acceptance on wearable technology for children's safety

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ABSTRACT

This paper presents a study on parent's acceptance on wearable technology for children's safety. Recently, there are many applications of wearable technology used in ensuring children's safety, such as GPS tracking devices that are seen to be related to the safety of the children. However, the Malaysian parents have not been using these technologies to protect their children due to lack of knowledge on the wearable technology, non-familiarity with the devices, privacy and also security concern of data in wearable technology. Thus, the objective of the present research is to identify the significant factors that influence parents' acceptance on wearable technology for their children's safety and to identify the greatest influence factors for the acceptance of these wearable technologies for children's safety. These factors are expected to bring about usefulness, ease of use, trust, privacy risk, financial risk and intention to use these technologies. As such, quantitative survey method was employed in the present study to obtain the result for the factors acceptance. The analysis and findings were done using IBM SPSS Version 25 tools via Pearson Correlation Analysis and Multiple Linear Regressions to get the result for the acceptance and to achieve the research objectives. Based on the result, it is discovered that the factors significant to intention to use of the wearable technology are perceived usefulness, perceived ease of use and trust while privacy and financial risk are factors seen to be non-significant to intention to use the wearable technology. Lastly, trust is discovered to be the greatest factor influencing parents to accept wearable technology and intention to use the technology. However, it is recommended for further study to employ experimental method in carrying out the research in order to get the real trust feeling of intention to use the wearable technology.

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1. INTRODUCTION

This paper presents a study on parent's acceptance on wearable technology for children's safety. Driven by the rise of wearable technology, the market for wearable devices is growing exponentially worldwide. Currently, the overall market for wearable technology is 111 million units as of 2016, with more than 80% per cent of them being wrist-worn devices, such as smart watch or wristband respectively [1]. As such, the wearable market is growing faster because as of 2014, the global wearable technology market accomplished \$5.26 billion sales [2]. There are many applications of wearable technologies that can be used in ensuring children's safety, such as smart watches, GPS tracking devices, Bluetooth child safety devices and many more. The functions of these devices are to monitor children and alert their parents in time of

emergencies. Wearable technology is grouped into five primary characteristics; consumable, unrestrictive, perceptible, controllable, and mindful [3, 4].

According to a report retrieved from The Star on 29th September 2017, it was stated that in between January to June of the same year, the Royal Malaysian Police (RMP) received reports of 723 missing children's cases. Furthermore, it was also revealed that averagely four children disappear each year in Malaysia. As such, the use of child wearable tracking device has been identified as a method to help reduce this child abduction issues going on in Malaysia, hence the need for Malaysian parents to consider wearable technology in protecting their children.

More so, wearable technology allows parents to track their children's whereabouts via the use of GPS functions. Some wearable tracking systems have additional safety features, which allow the children to send distress signal to their parents instantly in the case of emergencies. Design of use is one of the main criteria that concern the parents when buying any wearable tracking devices for their children, including GPS smart watch or Bluetooth tracker, thus, the wearable technology design has been growing steadily in the current market. The design is engineered to be suitable with children's lifestyle for it to become lot more practical [5]. Another technology that can be employed in helping parents monitor their children for safety reasons is by using the CCTV recorder, but there are limitations attached to this medium as it can only be used to monitor the child via indoor camera. Also, the parents can no longer monitor their children when the children are out of the CCTV's view. Therefore, there is a need for the children to wear safety devices when doing outdoor activities, such as going to school and playground, as it is definitely heart-wrenching, painstaking and horrendous experience for the parents if they lost their children.

This is the more reason why parents should keep a closer watch on their children, where some go the extra mile in ensuring their children's safety by investing in wearable tracking devices. This is because wearable technology offers new chance to record human activity. The advancement in technology now develops the miniature wearable device with sensor embedded in the system. It enhances proficiency, efficiency, administration, and commitment crosswise over ventures [6]. Nowadays, many challenges are identified through the usage and design of wearable technology for children's safety. Among these challenges is power consumption as the wearable technologies and devices consume high power to operate [7]. Others research of wearable technology are related to health and robot such as in [8-11].

1.1. Problem Statement

Wearable technology is one of the most recent innovations in the electronic gadget field. It comes in a wide range of structures that can be worn on human body, for example GPS tracker and different forms. According to personal interview carried out with Keisuke Ando [12], who is one of the security experts in Security Company of SECOM Sdn. Bhd., he mentioned that most of the parents in Malaysia do not use wearable technology to track their children compared to Japan. Although, the parents believe and trust that wearable technology can save the children. but they are more concern on some factors, such as security and data privacy [12]. Meanwhile, from the result of preliminary study conducted with ten parents from SECOM Sdn. Bhd., it was discovered that, three of them mentioned about their lack of knowledge while another three of the selected respondents said that they do not have any experience using the devices. Another two parents are more concerned about the price of the wearable technology devices and do not trust the wearable technology. These are among the reasons why they are not using some of this technology.

On the other hand, another two parents are familiar with the wearable technology and have used the technology. However, they are still concerned with the privacy and security of data in wearable technology. Other constraints faced with using wearable technologies are power consumption, communication, capacity, design constraints and privacy as well as security issues [3]. Based on this, in order to ensure the safety of the children in the future, it is imperative to understand parents' perspective towards acceptance of the devices into perceived usefulness, perceived ease of use, financial risk, privacy risk as well as trust on the wearable technology for children. It is believed that the present research can help consumer to identify acceptance factors on wearable technology for parents concerning their children's safety and also provide good guideline for the market by referring to parents' perspectives.

The present research objectives are to identify the significant factors for parents' acceptance on wearable technology for their children's safety and identify the greatest influence factors for parents' acceptance on wearable technology for children safety. Conversely, the research scope focuses on Malaysian parents towards their perspective of acceptance factors in using wearable technology for their children's safety. Lastly, the present study is conducted only to parents with children below 18 years old, while in terms of the parents, there is no limit to any age range.

2. CONCEPTUAL MODEL

The following research model is adapted from previous researchers that have determined the relationship acceptance between independent and dependent variables respectively, including perceived usefulness, perceived ease of use, trust, privacy risk as well as financial risk. All the independent variables have relationship with intention to use of the dependent variable. More so, previous study has adapted TAM model [13], where perceived usefulness and perceived ease of use have impact on intention to use was proposed. The proposed model by Phillip was adapted from TAM [13]. PU and PEOU are originally derived from Davis [13], while PYR and FR are adapted from Yang [14], while the independent variable of trust is referred from the model adapted from [13].

2.1. Perceived Usefulness (PU)

Perceived usefulness (PU) is ‘the degree to which a person believes that using a particular system would enhance his or her job performance’. This effect is on the individual’s attitude towards using the technology [13]. According to Davis [13], customer adaptation behavior is determined by the intention to use a particular system, which in turn is determined by perceived usefulness as well as ease of use of the technologies and systems. Yu-Hui and Stuart [15] found that perceived ease to use and perceived usefulness affect the behavioral of intentions.

However, the present research focuses on perceived usefulness of wearable technologies on children as the survey participants cannot physically test the technologies devices for perceived ease to use but can make an assumption about their usefulness on the basic of the description given to them. Perceived usefulness is measured based on [13] the scales distributed questionnaire with explanatory diagram of about the device in order to understand the ability of the generic product features that is accessed. It was also measured to determine the detailed information that potential users’ behavior have been measured on.

2.2. Perceived Ease of Use (PEOU)

Perceived ease of use (PEOU) is referred to ‘the degree to which a person believes that using a particular system would be free of effort’ [13]. In general, the perceived ease of use model affects the perceived usefulness and has a direct influence on attitude. The theory of acceptance model 2 which is adapted from Venkatesh and Davis added five factors to original models [16]. The factors are; subjective norm, image, job relevance, output quality and result demonstrability.

2.3. Financial Risk

Financial risk is defined as the probability of considering the purchase or maintenance of a wearable technology or devices acceptance. IT security concern are considered as a major reason for resisting wearable technology since the technologies are capable of tracking as well as storing highly sensitive personal data. According to [17], financial risk is defined as the net financial loss to the consumer, including the possibility that the product may be repaired, replaced or the purchase price be refunded. This is because it is believed that consumer concern over the financial loss in buying wearable technology could negatively affect their purchase intentions [14, 18].

2.4. Privacy Risk

Perceived risk in general can exert influence on people’s behavior [19]. Many studies have confirmed the existence of a negative influence of different facets of perceived risk on the usage of technologies [20]. However, the present research will explore about how perceived privacy risk has a direct negative influence on the behavioral intention to use wearable technology for children and negative influence on the behavioral intention to use through perceived usefulness and perceived enjoyment [13, 21]. According to Zhang *et al.* [22], the concept of perceived risk was originally developed by Bauer in 1960, which stated that the consumers purchase behavior would likely lead to hard predict. As such, the consumers purchase decision becomes the uncertainty of the outcome of the initial concept of perceived risk or privacy risk [22].

More so, available literatures show that perceived risk or privacy risk is one of the very few research areas in consumer behavior which can properly be said to have a research tradition. Although, perceived privacy risk is not the sole explanatory factor in buyer’s behavior, as it has been established as an integral part of the purchase decision [14]. Perceived privacy risk is the amount of risk that the consumer perceives in the buying decision and or the potential consequences of a poor decision [22]. Also, the perceived risk is a construct that measures beliefs of the uncertainty regarding possible negative consequences (dangers).

2.5. Intention to Use (IU)

The intention to use (IU) is defined based on the explanation of behavioral intention as a measure of strength concerning intention to carry out a certain behavior. According to [23], perceived usefulness (PU)

and also perceived ease of use (PEOU) are dominants and first factor that influence intention to use the wearable technology. Intention to use (IU) is used as a dependent variable for this research and all the independent variables will be tested if they have significant relationship or not with IU.

2.6. Trust

In many model of the technology acceptance, trust is included as a direct antecedent of behavioral intention to use technology [24]. Studies from the TRA [25] mentioned that users’ beliefs affect their intentions, thus belief in trust will affect their behavioral intentions. Generally, trust has been defined heavily in the literature as the relationship between trust and information privacy concerns [26]. Some of the available literatures define it as an important factor that influences behavioral intention to use technology and has a strong effect when compared to information privacy concerns. Furthermore, [27] defined it as the intention to accept vulnerability to a trustee based on positive expectations of his or her actions shown to be a crucial determination in technology acceptance. On the other hand, functionality refers to whether one expects a technology to have the capacity or capability to complete a required task. As such, security, privacy and reliability of the data and information should be essential for customers, as they are concerned with the privacy and security of the personal information handled by wearable, as well as with the usefulness of the information provided [28].

3. RESEARCH METHOD

The research method for this study involves five phases. The first phase is literature review and also preliminary investigation to find out the problem and gap in this area. The second phase is a more detail literature review to find the suitable model or framework related to the acceptance of wearable technology. The next phase, third phase is related to preparation of quantitative survey method. The fourth phase is the analysis and finding phase which analysis is conducted using IBM SPSS Version 25 and analysis is using Pearson correlation and Multiple Linear Regression to achieve the specified objectives. The last phase is the fifth phase, the discussion of the findings of the research follow by the conclusion of this research.

4. RESULTS AND ANALYSIS

4.1. Sampling Result

Table 1 depicted the sampling result details. The total number of collected and answered questionnaires are from 304 respondents based on purposive sampling. However, only 301 questionnaires are accepted for analysis after data cleaning process.

Table 1. Sampling Result Details

Sampling Method	Number of Questionnaire Distributed	Questionnaire Collected.	Rejected	Overall total respondents
Online Distribution (WhatsApp, Email, Social Media)	300	246	3	243
Manual Distribution	100	58	-	58
Total		304		301

4.2. Reliability Test

In the present study, reliability test was completed after the pilot test. This is to guarantee the dependability of the factors in the wake of gathering information, ranging from 301 respondents after being separated from 304 respondents. The outcomes demonstrate that Cronbach's alpha which is gained from the second tests is higher than the principal unwavering quality test, hence the result from the second investigation is utilized.

4.3. Normality Test

The present study employs normality test to determine whether the data is all around the demonstrated test through a typical dissemination [29]. Normal distribution can be checked through the bell curve or bell-shaped. Reference [30] expressed that a normality test is completed to ensure that every information data are dispersed ordinarily, in order to produce measurable outcomes for the examination. Additionally, the present research uses normality Skewness and Kurtosis to identify normality of data. More so, the value total mean of each construct is also employed to ensure the result to be normally distributed.

As such, if the value is in the range of -2 to +2, the data is considered as normally distributed. According to [30], the qualities for Skewness and Kurtosis between - 2 and +2 are viewed as appropriate so

as to demonstrate ordinariness dispersed. Conversely, previous research by [31] also mentioned that the use of the indices is for the acceptable limits of -2 to +2. From the Table 2, it can be seen that the data is normal distributed because the range of the value of Skewness and Kurtosis is within -2 to +2.

Table 2. Result Normality Skewness and Kurtosis

	PU	PEOU	TST	IU	PYR	FR
Skewness	-0.865	-0.839	-0.842	-0.728	-0.655	-0.707
Std Error for Skewness	0.140	0.140	0.140	0.140	0.140	0.140
Kurtosis	0.913	0.512	0.579	0.259	-0.353	-0.321
Std Error for Kurtosis	0.280	0.280	0.280	0.280	0.280	0.280

Conversely, all the variable items for the present research were measured using five point Likert-scale. The descriptive analysis table is not shown in this paper as limited space is available in this paper. Based on the descriptive analysis of mean value, the highest score mean is PU1 (Perceived Usefulness 1) at '4.23'. It means the assumption that potential parents would like to use the wearable technology is highest for the future. Secondly, the lowest mean variable is PYR2 (Privacy Risk), and the value is '3.50' which demonstrates the difference that can be seen between perceived usefulness and privacy risk. Most of parents agree with the questions, as all are concerned about the data privacy for wearable technology, as the parents are worried that if the children are observed by someone else.

4.4. Pearson Coefficient Analysis

Generally, the Pearson's Correlation is used for the correlation analysis to learn relationship between the independent and dependent variable. The Pearson's correlation is a coefficient (r) of range from -1 to +1 and indicates either the correlation is positive or negative. According to [32], Pearson Correlation row (r) is the r value, which can be from -1 to +1 to represent a small size of effect ± 0.3 for a medium. Section 4.8 discusses further on the explanation of the result.

4.5. Multiple Regression Model

In order to identify the variables that are related, a prediction model was developed using Multiple Regression analysis. Although, the researcher can use simple linear regression, if the number of independent variables in the study is only one but in the case of more than one as the present research, the multiple regression models (Lind *et al.*, 2008) was employed. This is because, it is believed that the regression model will help the researcher to predict the extent of Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Trust (TST), Perceived Privacy (PYR), Financial Risk (FR), Intention to Use (IU) for parents' acceptance on wearable technology for their children's safety.

If R-Square value is $0.5 < r < 0.7$, the value is generally considered a moderate effect size [33]. Also, if R-Square value is < 0.3 , the value is generally generated as none or very weak effect size. More so, if R-Squared value is $0.3 < r < 0.5$, the value is generally considered as weak or low effect size. Lastly, if R-Squared is $r > 0.7$, the value is generally considered strong. As indicated by [34] who prescribed that R Square estimation of 0.75, 0.50, or 0.25 for endogenous idle factors can be considered as harsh standard guideline be individually depicted as generous, moderate or weak.

Based on this, R Squared is 0.515 or 51%. That means the value is considered as moderate effect size. This also means the combination of the perceived usefulness, perceived ease of use, privacy risk, trust, financial risk and intention to use is 51% (Adjusted R square = 0.507) and is the predictive potential for acceptance to use wearable technology by parents. The interpretation on this situation is that 51% of the variance in acceptance of wearable technology for children's safety actually attributed to perceived ease of use, perceived usefulness, trust, financial risk and privacy risk.

The significant value is 0.000 and less than 0.005. As such, the $p < 0.005$ indicates that the overall regression model is statistically predicting, and the significance outcome of the variable means either it is a good fit for the data. On the other hand, the multiple correlations for independent variable, consisting of perceived usefulness (PU), perceived ease of use (PEOU), trust (TST), privacy risk (PYR) as well as financial risk (FR), as well as the dependent variable, which is intention to use (IU). It can also be seen that the R-Value is 0.718, representing the correlation between the predictors which has a good and strong correlation.

According to [24], the correlation coefficient is the connection between two autonomous factors (in bivariate relationship), r extended among +1 and -1 for totally positive and negative connection individually, while $r=0$ implies that no connection between factors (correlation coefficient without units), thus it is possible to ascertain connection between paired data. Therefore, if there should be an occurrence of

Pearson connection, then the information should ordinarily convey and scale the type of factors. However, in the event that a couple of factors are ordinal, or if there should increase an occurrence of non-ordinary dispersion, then spearman relationship is reasonable for this information. Regression is the connection between free factor (x) and subordinate variable (y), Beta zero alludes to an estimation of Y when X=0, while Beta one alludes to the adjustment in factor Y when the variable X changes one unit. Hence, the regression model is described as significant (sig. <0.000) and fit for the present study.

Furthermore, the result of the variables, such as perceived usefulness (PU) is (Beta=0.239, t=4.370, p=0.000), perceived ease of use (PEOU) is (Beta=0.149, t=2.469, p=0.014), trust (TST) is (Beta=0.417, t=6.617, p=0.000), privacy risk (PYR) is (Beta=0.036, b=0.605, p=0.546) and financial risk (FR) is (Beta=-0.047, t=-0.783, p=0.434). Lastly, the perceived usefulness (PU) and trust (TST) are the statistically significant predictors of acceptance for wearable technology.

The trust is a statistically significance in acceptance of wearable technology with value Beta of 0.417 larger than perceived usefulness (PU). It means that the highest larger effect population influencing the acceptance of wearable technology is a variable trust (TST). While the value of significance of variable perceived ease of use (PEOU), privacy risk (PYR) and financial risk (FR) are not significant predictors of acceptance of wearable technology. More so, the parents in Malaysia still have trust and believe that wearable technology still can save as well as protect their children's safety.

4.6. Significant Perceived Usefulness (PU) and Intention to Use (IU)

H₀, There is no significant relationship between perceived usefulness and intention to use (IU) wearable technology. H₁, There is a significant relationship between perceived usefulness (PU) and intention to use (IU) wearable technology. According to the result in the P-value perceived usefulness (PU) is 0.000. This means that H₁: P<0.005: correlation is significant, which brings moderate effect size population. Conversely, perceived usefulness (PU) of 0.594 coefficient correlation was indicating that it is a positive and a moderate correlation. Finally, H₀ is rejected as the P-value is less than 0.005. Hence, it proves that there is a significant relationship between perceived usefulness and intention to use wearable technology.

4.7. Significant Perceived Ease of Use (PEOU) and Intention to Use (IU)

In terms of H₁: P<0.005: correlation is significant, meaning that it has moderate effect size population. The perceived ease of use with value correlation is 0.593, indicating a positive and a moderate correlation for H₀: there is no significant relationship between perceived ease of use (PEOU) and intention to use (IU) wearable technology. Also, in terms of H₁: there is a significant relationship between perceived ease of use (PEOU) and intention to use (IU) wearable technology. Finally, H₀ is rejected as the P-value is less than 0.005. Hence, it is proven that there is a significant relationship between perceived ease of use and intention to use wearable technology.

4.8. Significant Trust (TST) and Intention to Use (IU)

In terms of H₁: P<0.005: correlation is significant, indicating a strong effect size population or strong correlation. The trust (TST) value correlation is 0.677, indicating a positive and strong correlation. While for H₀: there is no significant relationship between trust (TST) and intention to use (IU) wearable technology. Similarly, for H₁: there is a significant relationship between trust (TST) and intention to use (IU) wearable technology. It is found that H₀ is rejected as the P-value is less than 0.005. It proves that there is a significant relationship between trust (TST) and intention to use (IU) wearable technology.

4.9. Significant Privacy Risk (PYR) and Intention to use (IU)

The privacy risk (PYR) and financial risk (FR) are negatively correlated value. For H₁: P>0.005. Correlation is no significant and a very weak effect size population or can be called as a very weak correlation. The value is -0.117 which is indicated as negative.

In terms of H₀: there is no significant relationship between privacy risk (PYR) and intention to use (IU) wearable technology. For H₁: there is a significant relationship between privacy risk (PYR) and intention to use (IU) wearable technology. Lastly, H₀ is accepted as the P-value is greater than 0.005. Therefore, it is proven that there is no significant relationship between privacy risk (PYR) and intention to use (IU) wearable technology.

4.10. Significant Financial Risk (FR) and Intention to Use (IU)

The financial risk is a negative correlated value, H₁: P>0.005. Correlation is not significant and has very weak effect size population or can be called as a very weak correlation. The value is -0.146 which is indicated as negative for H₀: there is no significant relationship between financial risk (FR) and intention to use (IU) wearable technology. Conversely, for H₁: there is a significant relationship between financial risk

(FR) and intention to use (IU) wearable technology. Lastly, H_0 is accepted as the P-value is greater than 0.005. Therefore, it is proven that there is no significant relationship between financial risk (FR) and intention to use (IU) wearable technology.

5. CONCLUSION

This final section explains the findings of the present study, consisting of parents' acceptance on wearable technology for children's safety. The main finding from this quantitative survey achieved the present research two main objectives (RO) and research questions (RQ), as it is identified that there is significant factors for parents' acceptance on wearable technology for children's safety. Secondly, the greatest influence factor for parents' acceptance on wearable technology for children's safety has also been identified. Based on the result, it is discovered that the factors significant to intention to use of the wearable technology are perceived usefulness, perceived ease of use and trust while privacy and financial risk are factors seen to be non-significant to intention to use the wearable technology. Lastly, trust is discovered to be the greatest factor influencing parents to accept wearable technology and intention to use the technology. However, it is recommended for further study to employ experimental method in carrying out the research in order to get the real trust feeling of intention to use the wearable technology.

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