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Unveiling insights into stress and anxiety management through the adoption of wearable technologies by Indian youth

Kanchan Pranay Patil *
S. Vijayakumar Bharathi †
Dhanya Pramod §
Adrit Saksena ‡
Akshita Jain @
Ankit Mahajan #
Symbiosis Centre for Information Technology
Symbiosis International (Deemed University)
Pune 411057
Maharashtra
India

Abstract

Purpose: This study, based on UTAUT2 theory, investigated the adoption and usage of wearable technology for anxiety and stress management among Indian youth. Wearable technology can be effectively used for biometric monitoring, activity tracking, relaxation exercise, facilitating lifestyle adjustments and gamification.

Methodology: Data collected from young Indian consumers of wearable technology (N=288) were analyzed through variance-based partial least square structural equation modelling (SEM) to assess the conceptual model.

Findings: Research findings indicate that Performance expectancy, social influence, and perceived privacy significantly influence behavioural intentions towards wearable technology. However, effort expectancy as well as Facilitating conditions did not significantly impact the behavioural intentions of wearable technology users. The moderation effect of anxiousness with performance expectancy, facilitating conditions, social influence, and perceived privacy on behavioural intentions was significant. The moderation effect of anxiousness with effort expectancy was insignificant on behavioural intentions. The impact of behavioural intentions on the usage of wearable technologies was significant.

* *E-mail:* **kanchan@scit.edu (Corresponding Author)**
† *E-mail:* **svkbharathi@scit.edu**
§ *E-mail:* **dhanya@scit.edu**
‡ *E-mail:* **adrit.saksena@associates.scit.edu**
@ *E-mail:* **akshita.jain@associates.scit.edu**
E-mail: **ankit.mahajan@associates.scit.edu**

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Implications: The study offered implications for the wearable technology industry and health and wellbeing industry, contemplating the adoption and usage of wearable technologies for consumer wellbeing. At the same time, practical implications help professionals in creating and promoting these technologies, highlighting the importance of balancing innovation with ethical apprehensions like privacy for effective adoption into mainstream healthcare procedures.

Subject Classification: *68-11.*

Keywords: *Wearable technologies, Anxiety, Stress management, UTAUT2, Anxiousness.*

Introduction

In an era of unprecedented technological advancements, the well-being of individuals has become an area of concern, particularly among the youth population [1][2]. Due to the increased urbanization of societies, individuals face challenges arising from stress and anxiety, which harms their mental wellbeing. In this direction, the current research investigates stress and anxiety measurement through wearable technologies among the Indian youth. It is a crucial contribution to the existing body of information science knowledge to study the relationship between digital technologies and mental health [3]. The research motivation originates from the fact that stress and anxiety have become integral to youngsters' daily lives, accentuated by their personal and professional fast-paced lifestyles [4][5]. It is worthwhile to explore the role of intelligent wearable technologies in enabling the youth to manage their stress and anxieties effectively. Investigating the possibility of integrating digital technology into wearables for mental health monitoring can spawn innovative applications for the vibrant youth population in the country. Smart wearable technology adoption is a popular domain for academic research interests. Yet, there is a noticeable research gap exists in studying its efficacy for stress and anxiety measurement and foster better mental health management among the youth populace [6][7]. There is immense opportunity to research the impact of smart wearables technology adoption on the outcomes of mental health management, to which the current study contributes.

The study contributes to a better understanding of the current status of adoption and trigger interventions for future research possibilities. Hence, the research objectives defined are:

- *To examine the adoption and use of Wearable Technologies for Stress and Anxiety Measurement*

This objective will investigate the extent to which wearable technologies are utilized by the Indian youth for stress and anxiety measurement. By understanding the current landscape of technology adoption, we can discern the potential impact on stress and anxiety management.

- *To Evaluate the Acceptance of Wearable Technologies for Mental Health Monitoring*

Building upon the exploration of usage, the second objective will assess the factors influencing the acceptance of wearable technologies for mental health monitoring among the youth in India. We examine variables such as performance, effort, privacy, facilitating and social factors impacting behavioural intentions towards wearable technologies and their actual use.

The research outcome contributes towards understanding the dynamics between wearable technologies, stress, and anxiety among the youth in India. The contribution can give foundation for a comprehensive exploration that can potentially apprise policies, interventions, and technological advancements geared towards improving the well-being of the Indian youth.

Literature Review

The following paragraphs synthesize current findings, emphasizing the direction for further research to understand the impact, efficacy, and ethical implications of going ahead with wearable technologies for mental health monitoring among youth.

Wearable Technologies for Stress and Anxiety Measurement

Managing stress and anxiety by leveraging the functions of wearable technologies has been a growing interest, since the recent past. Inclusion of digital wearables into daily life has not only facilitated real-time monitoring, but also enhanced the quality of insights into mental health decision making [8]. In the past, researchers studied the potential of wearable devices in monitoring the physical and psychological touch points relating to stress and anxiety; also examined the devices' technological prowess from a feasibility and desirability standpoints [9] [10]. Realtime data gathering is enabled through a variety of bio-sensors including accelerometers, electrodermal sensors and cardiac monitors [11] [12]. These research works confirm the possibilities of wearable devices to

enable environmentally valid mechanisms for managing stress and anxiety in varied situations, ranging from occupational to domestic lives. Notwithstanding its potentials, there are challenges relating to the security and privacy of personal data, accuracy and reliability of outputs stand still under-addressed [8]. There are important device-specific considerations such as diversified stress responses, reliable measurement indicators and user-centric interfaces, which contribute to the development and adoption of these technologies. Over-dependence of technology can spinoff privacy and security concerns among youth, which needs a careful consideration. In addition, ethical issues about user consent, data anonymity calls for greater attention towards building end-users' trust and motivate widespread adoption [13]. Therefore, the effective adoption depends how youth perceive wearables as an integral part of their psycho-physical health management, as interventions on mental wellbeing continue to evolve [14].

Acceptance of Wearable Technologies for Mental Health Monitoring

Wearable devices contributed to a sharp increase in mental health monitoring practices, spreading its prominence with its digital features and functionalities among the youth populace [15][16]. The gamified features of these devices are engaging, enjoyable and personalized making it a welcoming adoption among youth [17]. Young users, expect empowerment, autonomy and control over their psycho-physical health management. The feature-richness of digital wearables to visualize

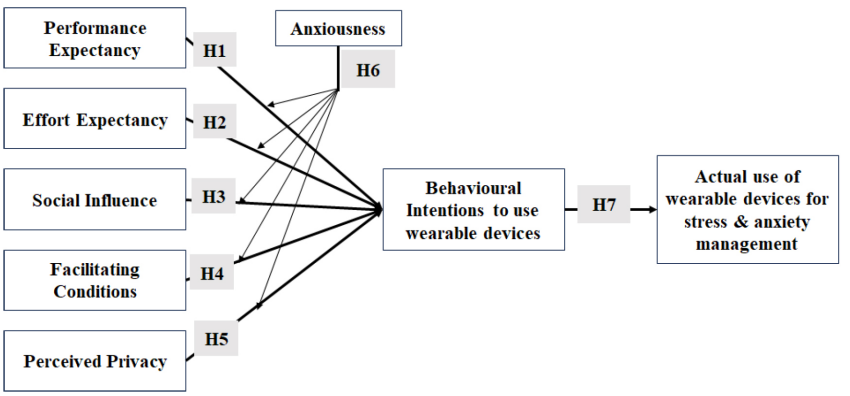


Figure 1

Conceptual Framework

metrics, can fulfill the expectations making the populace increasingly open to its adoption [15].

Underpinning Theory

We referred to the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) as the conceptual framework for the research. Being a popular and well-proven model, UTAUT2 combined important antecedents of technology acceptance such as expectations about performance and effort, influences of social groups and conditions that facilitates adoption [18][19]. The theory will bring out intricate interactions of these variables in holistically investigating the acceptances and use of digital wearable devices by youth for monitoring their psycho-physical well-being. The model enables a robust underpinning to the behavioural aspects of technology acceptance and offers critical insights to develop plausible interventions to the domain of mental health among young people. Figure 1 illustrates the theoretical model confined to the current study. The subsequent paragraphs explain the hypotheses.

Definition of Hypotheses

As an integral component of the theory, *performance expectancy (PE)* attempts to relate the young users' expectations about the wearable devices' capabilities with their behavioural intentions to adopt it [20]. This causal relationship is important to further examine their likelihood of adopting wearables for stress and anxiety monitoring. So, we propose the hypothesis as

H1: PE will affect the behavioural intentions of youngsters to use digital wearables for managing their anxiety and stress levels.

Effort expectancy (EE) is the next construct native to the underpinning theory. In a contextual sense, it echoes the youths' perception about the effort needed to understand and apply digital wearables for mental health monitoring [21]. The construct has a significant bearing on the users' behavioural intents to support its usage, which draws us to the hypothesis which reads as

H2: EE will positively impact the youth's behavioral intentions to practice digital wearable for managing the dynamics of anxiety and stress.

The third construct in the model is *social influence (SOIN).* Given the context of intelligence wearables adoption by youth, this construct is

important to understand the interrelationship between digital technologies and social forces at work. [22]. Therefore, the hypothesis is given as

H3: SOIN will significantly initiate youth's behavioural intentions to adopt digital wearable devices for anxiety and stress management.

Facilitating conditions (FC) represents the fourth construct in the theoretical model. It is important to establish a relationship between the circumstances that facilitate the positive intentions toward technology acceptance and usage [23]. In this research context, it largely contributes towards determining the youngsters' behavioural intents towards considering wearable devices, due to which we state the hypothesis as

H4: FC will favourably impact the youth's behavioural intentions to consider wearable devices for supervising their varying levels of anxiety and stress.

Perceived privacy (PP), is the fifth construct in the model. It is worthwhile to consider perceived privacy because it examines an individual's belief about the ability of digital technologies to protect personal data [24]. The belief tacitly impacts behavioural intentions about technology acceptance. Therefore, the hypothesis stated is

H5: PP will favourably influence the youth's behavioural intentions to approve wearable devices for anxiety and stress management.

Anxiousness (AX), is a contextually relevant construct in our study, which controls the end-user's sensitivity of uneasiness while considering the acceptance of digital disruptions [25]. It will be worthy to study the regulating effect of anxiousness on PE, EE, SI, FC, and PP. We argue that it significantly regulates the impact of UTAUT2 antecedents on the behavioural intentions of Indian youth to use wearable devices for stress and anxiety management. The complex interaction between anxiousness and these determinants outlines the adoption of such gadgets [26][27]. So, we propose the hypothesis as

H6: Anxiousness about technology adoption moderates the impact of UTAUT2 antecedents on the youth's behavioural intentions to use wearable gadgets to manage their stress and anxiety.

Finally, youth's behavioural intentions (BI) to use intelligent wearables for anxiety and stress management greatly affect their actual adoption of these devices. Positive intentions lead to willingness to incorporate technology into daily life, bridging the gap between intention and tangible use in dealing mental health concerns [28]. Therefore, we hypothesize as

H7: BI will have a significant bearing on the youth's adoption of wearables for anxiety and stress management.

Research methodology

The study aims to determine whether wearable technologies adoption can facilitate anxiety and stress management among the Indian youth. Primary data was considered for this study. To collect the responses, we used purposive sampling and selected young participants who had experience of using wearable technologies. Google Form was used to disseminate the questionnaire.

Measures

Important factors from previous scales reported in the literature were taken into consideration when designing the questionnaire. The primary constructs of UTAUT2, namely Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, perceived privacy, and Behavioural Intentions to use wearable technologies, were measured using the same items that [18] and [29] used to validate their UTAUT2 model. Six items from were used to gauge the young respondents' anxiety related to technology [25]. Respondents' answers to UTAUT2 items were measured in this study using a seven-point Likert scale with anchors ranging from strongly agree to strongly disagree.

Data Collection

Purposive sampling was used by researchers according to two standards: 1. Participants should be between the ages of 18 and 30. 2. Have experience with wearable technology, such as Fitbit and smartwatches. Out of the 400 questionnaires we sent, 288 were finished and submitted for additional data analysis, yielding a response percentage of 72%. The PLS-SEM tool was used to analyze the data. Demographics of respondents are presented in Table 1.

Data analysis

Using a structural equation modeling analysis with SmartPLS 4.0, the measurement (outer) and structural (inner) models were tested [30].

Measurement Model evaluation

Composite reliability (rho_c) and Cronbach Alpha values above 0.7 were used to evaluate the key reliability constructs, and factor loadings

Table 1
Respondent profile

Characteristics	Category	Frequency	%
Gender	Male	147	51.04
	Female	141	48.96
Age	18-25	156	54.17
	26-30	132	45.83
Marital Status	Married	120	41.67
	Single	168	58.33
Education	Undergraduate	154	53.47
	Post graduate	70	24.31
	Professional	64	22.22
Occupation	Student	168	58.33
	Service	86	29.86
	housemaker	34	11.81

>=0.7 and AVE >=0.5 were used to evaluate convergent validity [25]. The criteria established by Fornell and Larker [31] were applied to assess the discriminant validity. The results shown in Table 2 verified that the construct validity and scale reliability requirements were satisfied.

Structural Model

R^2 estimates, the significant level (t statistic), and standardized path coefficients (beta values) were used to assess the structural model. According to Table 3, the suggested model has a respectable ability to forecast how people would use wearable technology. The suggested model's predictive power is deemed acceptable, with R^2 values of 0.572 for wearable technology use and 0.638 for behaviour intentions. All of the proposed associations are assessed, as indicated in Table 4.

The results show that PE, SOIN, PP has a positive significant influence (H1: β= 0.252; p<=0.001; H3: β= 0.360; p<=0.001; H5: β= 0.303; p<=0.001) on behavioural intentions towards wearable technologies. However, EE and FC were insignificant towards behavioural intentions (H2: β= 0.025; p >=0.05; H4: β= 0.154; p >=0.05). Further behavioural intentions had significant positive effect on wearable technologies usage for anxiety and stress management (H7: β= 0.427; p <= 0.01) (see Table 3).

Table 2

Measurement Model

Construct	ANX	EE	FC	INT	PE	PP	SOIN	USE	Alpha	rho_c	AVE
ANX	0.891								0.832	0.907	0.794
EE	0.444	**0.854**							0.806	0.917	0.729
FC	0.340	0.230	**0.884**						0.737	0.894	0.782
INT	0.255	0.263	0.251	**0.885**					0.767	0.911	0.783
PE	0.315	0.615	0.603	0.191	**0.892**				0.719	0.978	0.795
PP	0.439	0.340	0.328	0.419	0.407	**0.855**			0.797	0.919	0.731
SOIN	0.420	0.390	0.378	0.339	0.327	0.315	**0.873**		0.765	0.917	0.763
USE	0.277	0.567	0.555	0.500	0.488	0.476	0.464	**0.787**	0.725	0.901	0.619

Table 3
Values of R^2

	R-square	R-square adjusted
INT	0.635	0.627
USE	0.554	0.553

Table 4
Hypotheses Relationship

Hypothesis	Constructs	Beta(β)	t statistics	p values	Decisions
H1	PE -> INT	0.252	4.725	0.000	Supported
H2	EE -> INT	0.025	0.557	0.573	Not Supported
H3	SOIN -> INT	0.36	5.587	0.000	Supported
H4	FC -> INT	0.154	1.45	0.078	Not Supported
H5	PP -> INT	0.303	3.072	0.002	Supported
Moderation Analysis					
H6a	ANX* PE-> INT	0.178	4.704	0.01	Supported
H6b	ANX* EE-> INT	0.065	0.387	0.496	Not Supported
H6c	ANX* SOIN-> INT	0.654	7.024	0.000	Supported
H6d	ANX* FC-> INT	0.173	2.551	0.021	Supported
H6e	ANX* PP-> INT	0.331	5.662	0.000	Supported
H7	INT-> USE	0.427	6.876	0.000	Supported

The moderating influences of PE, SOIN, FC, PP (H6a: β= 0.178; p<=0.05; H6c: β= 0.654; p<=0.001; H6d: β= 0.173; p<=0.05; H6e: β= 0.331; p<=0.001) and anxiousness on the behavioural intentions towards wearable technologies were significant. However, moderating influences of EE and anxiousness on the behavioural intentions towards wearable technologies was not significant (H6b: β= 0.065; p> 0.05).

Discussion

This study examined the factors predicting wearables' intention and use for measuring stress and anxiety using a modified-extended UTAUT2 model. Investigating the behavioral intention to utilize wearables for managing stress and anxiety is essential to building user-centered, efficient

solutions that can improve both the general public's health and individual well-being. The acceptance and adoption of wearable technology designed to measure stress and anxiety are influenced by several key factors. These factors encompass consumers' opinions about the gadget's efficacy, its ease of use, the impact of social influence, the availability of necessary resources and support, and data privacy considerations. The study also reiterated the need for prioritizing data protection and privacy functionalities to developers of digital wearables. The results empirically validate the components of the underpinning theory such as performance expectancy, social influence, and perceived privacy. These components, according to our study significantly impact the possibility of youngsters adopting digital wearable devices for monitoring and measuring their stress and anxiety levels. Our findings are in line with earlier works from multi-contexts, which accentuates the relevance of UTAUT2 constructs as dependable predictors of technology acceptance [20][22].

However, the study found that effort expectancy and facilitating conditions do not get validated, corroborating with select earlier studies [32][33]. The variation in the technological understanding and an individual's ability can lead to the perceived convenience of using wearables. We understand that youth are adequately equipped to initiate and use digital wearables, resulting in the rejection of H2. These devices are used with bare minimum infrastructure, such as a smart phone with an appropriate app, downloaded mostly free of cost from an android or mac store. Therefore, facilitating conditions as a driver for behavioural intention was insignificant (H4).

Contribution to theory

There are some important implications to theory emerging out of this research. First, the results backup the ongoing understanding about the applications of digital wearables to newer or under-explored domains, one of which is management of stress and anxiety. Second, we extend the realms of UTAUT2 theory to examine the youngsters' motives to adopt smart wearables, such performance, effort, social stimuli and privacy concerns. The findings augment the ongoing research efforts by confirming certain critical aspects that impact the acceptances of wearable devices for stress and anxiety monitoring [23]. Third, the study substantiates the theoretical landscape of UTAUT2 by including new constructs such as anxiety and privacy, which are pertinent to the context of youth. Through the theoretical lens, the study recognized the role of emotional aspects

and confidentiality concerns while understanding youngsters' intentions about digital technologies for monitoring their mental wellbeing [34]. Fourth, the role of anxiousness as a moderator significantly enhances the contemporariness to the technology acceptance literature in healthcare. It extends the applicability of the theory by explaining how anxiousness of the youth segment can control their willingness to use digital smart wearables in their professional and personal routine to manage stress and anxiety [33].

Implications to Practice

The study's findings provide practical insights that significantly support experts and enterprises in the wearable technology sector, particularly in assessing stress and anxiety. First, it is essential to prioritize endorsing transparent data management. It realizes communication transparency in collecting, storing and consuming data. It is important to build features that can empower users over data control and privacy. Second, by leveraging the efficacy of social influence in promotion campaigns, marketers have a greater opportunity to boost adoption rates of smart wearables for mental well-being management [32]. Third, creating a feeling of amity among peer-users, can contribute their enhanced awareness and product appeal. Fourth, companies need to plan holistic user guides, online support systems to facilitate youngsters take informed buying decisions. Fifth, technology start-ups and marketers need to focus on the ethical considerations of digital wearables to justify product innovation.

Sustained success in this domain depends on ongoing innovation, collaboration with mental health experts, and strategies for developing long-term user engagement, such as gamification and feedback mechanisms. Implementing these practical implications allows companies to effectively promote and integrate wearable devices for stress and anxiety measurement while dealing with user concerns and cultivating trust within the market [28].

Limitations

While this study has provided valuable insights, there are numerous restrictions that need to be considered. Relying solely on a quantitative survey approach may not adequately capture the nuanced qualitative aspects of the phenomenon under investigation. It is crucial to emphasize

that this study is cross-sectional in nature, and as such, it cannot establish generalizability. Also, other factors such as cost, affordability, which are not part of the current study can also impact behavioural intentions.

Conclusion

The study offered important insights about the adoption of smart wearable devices by the youth population for monitoring and measure stress and anxiety levels. Critical components of the UTAUT2 theory validated in the study can be referred by researchers to contribute to the ongoing deliberation around digital gadgets for mental health advancement. The study findings can be used to develop strategies for health and wellness product promotion. From a managerial standpoint, we recommend that healthcare providers and product manufacturers can work together in developing smart wearables which are user-centric across all dimensions such as innovation, ethics, responsibleness. In addition, as the adoption of smart wearable technology is of growing interest to academia and the industry, this study made an attempt to contribute to researchers and practitioners. Future works can adopt mixed research methods by integrating qualitative and quantitative aspects of data to enhance the validity of the research contribution. Longitudinal studies can effectively measure the attitudinal and behavioural changes with passage of time. In addition, future research should focus on examining the ethical consequences related to the data lifecycle throughout the useful life of the smart wearable devices.

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