



Survey-Based Descriptive Study on University Students' Adoption and Behavioral Patterns of IoT-Based Payment Systems in Malaysia

Sun Tong¹, Zhang JiaYi², Duan XinYi³, Liu Cheng Ming⁴, Xia Xuanze⁵, Gutianyu⁶, Aliana Shazma Amir⁷, & Evawaynie Valquis Md. Isa⁸

¹⁻⁸ Faculty of Business and Communication, Universiti Malaysia Perlis (UniMAP), Malaysia

Abstract

This study investigates university students' adoption, usage patterns, and behavioral perceptions of IoT-based payment systems in Malaysia. Using a survey approach, ten students were examined to explore the frequency of usage, perceived financial control, impulsivity, trust, and influence on financial decision-making. Findings reveal high adoption and habitual usage, with students exhibiting moderate trust in system security and varied perceptions of financial control. While access to digital transaction data enhances awareness, it does not necessarily translate into disciplined financial behavior, indicating a gap between insight and action. Concerns such as security, micro-spending, and app limitations were identified. The study highlights the interplay between trust, habitual use, and digital financial literacy, suggesting the need for apps to evolve from passive trackers to behavioral nudges supporting budgeting, savings, and financial decision-making. The results provide insights for developers, educators, and policymakers aiming to optimize digital financial tools for young adults.

Keywords: IoT payments, digital financial literacy, university students, behavioral patterns, financial control

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*E-mail: Sun.Tong@gmail.com

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INTRODUCTION

The emergence of Internet of Things (IoT)-based payment systems has transformed financial transactions globally. IoT payment methods, including QR codes, contactless cards, and mobile wallets, enable seamless, frictionless payments, reducing reliance on cash and traditional banking infrastructures (Lee & Shin, 2020). In Malaysia, the growing youth adoption of e-wallets such as Touch 'n Go, Boost, and GrabPay reflects a rapid digital transition in financial behavior.

IoT payment systems not only facilitate convenience but also provide data-driven insights for users. Transaction histories, real-time notifications, and visual dashboards enhance awareness and offer opportunities for improved financial management (Nguyen et al., 2021). These tools are particularly relevant for university students transitioning to independent financial decision-making.

While digital payments simplify transactions, they may influence spending behaviors, including impulsivity and overspending. Behavioral finance literature suggests frictionless payments can reduce the "pain of paying," potentially encouraging unplanned purchases (Prelec & Loewenstein, 1998). Understanding these effects among students is crucial for promoting responsible digital financial habits.

Trust in IoT platforms is essential for adoption and sustained use. Security features, platform reputation, and brand reliability contribute to user confidence (Lu et al., 2011). However, risks such as phishing, phone theft, and fake QR codes remain potential concerns affecting user behavior and perception.

Despite high adoption rates, limited research exists on Malaysian university students' perceptions of financial control, spending behavior, and decision-making influenced by IoT payments. A descriptive, survey-based approach provides insight into real-world usage patterns, challenges, and opportunities for app improvement and financial literacy interventions.

This study aims to (i) examine the frequency and patterns of IoT payment adoption among university students, (ii) evaluate perceived financial control, impulsivity, and trust, and (iii) identify behavioral and technological challenges associated with IoT payments. Findings are expected to inform educators, policymakers, and developers in enhancing digital financial tools and promoting responsible financial behavior.

Literature Review

The adoption of Internet of Things (IoT)-based payment systems has been strongly associated with convenience, speed, and intuitive user interfaces, which collectively enhance the overall user experience (Dahlberg, Guo, & Ondrus, 2015; Milian, Spinola, & de Carvalho, 2019). University students, in particular, demonstrate higher receptivity due to their technological fluency, habitual use of mobile applications, and integration of digital tools into daily life (Nguyen, Pham, & Tran, 2020; Lim, Tan, & Rahman, 2021). Adoption decisions are further influenced by factors such as perceived usefulness, perceived ease of use, social influence, and behavioral intention, consistent with the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) frameworks (Davis, 1989; Venkatesh, Thong, & Xu, 2012; Kurniasari et al., 2022).

Digital financial tools offer enhanced visibility of personal finances, enabling real-time monitoring and tracking of expenditures. Theoretically, such visibility supports better financial control, self-regulation, and disciplined budgeting (Venkatesh et al., 2012; Lu, Yang, Chau, & Cao, 2011). However, awareness of spending does not automatically translate to behavioral modification, revealing a persistent gap in financial literacy and the capacity for self-regulation among young adults (Lusardi, Mitchell, & Curto, 2010; Amir, Md Isa, Johari, & Islam, 2025). This distinction underscores the need to evaluate not just access to transaction data but the behavioral outcomes of digital payment adoption.

IoT-based payment systems may also reduce the psychological "pain of paying," a phenomenon identified by Soman (2003), whereby frictionless transactions diminish consumers' conscious awareness of spending. Such mechanisms can lead to micro-spending and impulsive financial behavior, even among otherwise disciplined users. Empirical evidence suggests that while some students exercise self-control, subtle overspending can occur unnoticed over time, particularly through repeated small-value transactions (Prelec & Loewenstein, 1998; Roh, Yang, Xiao, & Park, 2024).

Trust remains a central determinant of sustained IoT payment adoption. Users' confidence in the technical security features of platforms such as biometric authentication, encryption, and transaction monitoring—combined with brand credibility, plays a critical role in mitigating perceived risk (Gefen, Karahanna, & Straub, 2003; McKnight, Carter, Thatcher, & Clay, 2011). Nevertheless, human-centered vulnerabilities, including device theft, phishing, and social engineering, continue to influence user perception and highlight residual risk even in technologically secure systems (Rahman & Ismail, 2022; Amir, Quayyum, & Isa, 2025).

Beyond transactional functionality, IoT payment systems can act as behavioral nudges, subtly shaping financial decisions. Features such as spending dashboards, personalized alerts, gamified budgeting, and reward mechanisms encourage reflective consumption and proactive financial management (Thaler & Sunstein, 2008; Lim et al., 2021). This aligns with insights from behavioral finance, emphasizing that thoughtfully designed interfaces can promote conscious spending habits and enhance digital financial literacy (Amir, Isa, Johari, & Islam, 2025).

Understanding patterns of usage, trust, and behavioral outcomes among university students is critical for designing interventions that integrate financial literacy into digital platforms. Students transitioning to independent financial management are particularly susceptible to both the benefits and pitfalls of IoT payments, making them an ideal demographic for studying the intersection of technology, behavior, and financial decision-making (Chuah, Cao, Guo, & Lian, 2019; Nguyen, Nguyen, & Tran, 2021; Amir, Quayyum, & Isa, 2025). Insights from this population can guide developers, educators, and policymakers in optimizing digital financial tools for both transactional efficiency and behavioral support.

METHODOLOGY

This study employed a descriptive survey design, integrating both quantitative and qualitative approaches to comprehensively examine university students' adoption and behavioral patterns related to IoT-based payment systems. The mixed-methods approach allowed for the collection of numerical data to identify trends and patterns, while qualitative insights provided a deeper understanding of students' experiences, perceptions, and challenges when using these digital financial tools.

A total of ten university students from UniMAP Campus Cyberjaya, Malaysia participated in this study. The sample was balanced in terms of gender, with six female and four male students, and primarily comprised individuals aged 20–22 years, reflecting the typical transitional stage from dependent to semi-independent financial management. This demographic was considered ideal for exploring early-stage digital financial behavior and the role of IoT-based payments in daily monetary decisions.

Data were collected using a structured survey instrument that included Likert-scale questions covering five key dimensions: (i) frequency of IoT payment usage, (ii) perceived financial control, (iii) impulsivity in spending, (iv) trust and perceived security, and (v) influence on financial decision-making. Additionally, an open-ended question was included to capture participants' personal experiences, challenges, and concerns that might not be fully reflected through closed-ended questions.

Surveys were administered either online or face-to-face, depending on participants' availability and preference. Prior to participation, students were informed of the study's purpose and voluntarily provided consent, ensuring ethical compliance and participants' autonomy in sharing information.

Quantitative responses were analyzed using descriptive statistics, including mean, median, and frequency distributions, to summarize the level of adoption, trust, and behavioral tendencies among respondents. Qualitative responses from the open-ended question were thematically coded to identify recurring patterns, concerns, and insights regarding the use of IoT payment systems. Finally, a cross-analysis was conducted to explore potential correlations between usage frequency, trust levels, and financial behavior, providing a holistic understanding of how these variables interact within the student population.

FINDINGS AND ANALYSIS

Summary of Respondent Demographics, IoT Payment Usage, and Financial Behavior

Section / Variable	Key Findings	Interpretation / Insights
Respondent Demographics	10 students; majority aged 20–22; 6 female, 4 male	Suitable sample for examining digital financial behavior.
IoT Payment Usage Frequency (Q1)	Mean: 4.8 Median: 5	High adoption; habitual use integrated into daily financial activities.
Perceived Financial Control (Q2)	Mean: 3.4 Median: 4	Awareness of transactions exists, but behavior change is limited.
Impulsivity in Spending (Q3)	Mean: 2.8 Median: 3	Neutral to low impulsivity; micro-spending possible.
Trust and Security (Q4)	Mean: 3.8 Median: 4	Trust is moderately high; app security and brand reputation are key.
Influence on Financial Decision-Making (Q5)	Mean: 3.6 Median: 4	Supports short-term budgeting and spending awareness; limited long-term planning.
Open-Ended Feedback (Q6)	Security concerns, micro-spending, app limitations, no issues for some	Highlights behavioral and infrastructural challenges.
Emerging Patterns	High usage reinforces trust; data access ≠ behavior change	Need for apps to evolve from trackers to behavioral nudges.

The study involved ten university students, with a majority aged 20–22 years and a gender distribution of six females and four males. This demographic is appropriate for exploring early-stage digital financial behavior, as students in this age group are transitioning from dependent to semi-independent financial management (Lusardi et al., 2010). Gender may subtly influence financial behavior; prior research suggests that female users often exhibit greater caution in spending and higher sensitivity to security risks in digital financial environments (Zhou et al., 2021). By including both genders and focusing on this transitional age group, the study captures a relevant spectrum of young adults' interaction with IoT-based payment systems.

Participants reported a high frequency of IoT payment usage (mean = 4.8, median = 5), indicating that these technologies are deeply integrated into their daily routines. This aligns with the Technology Acceptance Model (TAM), which posits that perceived ease of use and perceived usefulness drive technology adoption (Davis, 1989). The habitual usage observed suggests that IoT payment systems have become part of routine financial behavior, reinforcing trust in the system and facilitating automatic, frictionless transactions. Prior studies confirm that university students, due to their technological literacy, are early adopters of digital payment platforms and incorporate them into routine financial decisions (Dahlberg et al., 2015; Lee & Shin, 2020).

The mean score for perceived financial control was 3.4, with a median of 4, indicating that while students recognize the benefits of tracking and managing transactions, behavior change is not guaranteed. This can be explained through Behavioral Finance Theory, which distinguishes between awareness and action (Thaler & Sunstein, 2008). Students may see the data presented in apps such as transaction summaries and dashboards, but without external prompts or intrinsic motivation, awareness does not necessarily lead to improved budgeting or savings behavior. Studies by Nguyen et al. (2021) highlight similar findings, where digital payment tools increase transparency but do not automatically enhance self-regulated financial management.

Responses on impulsivity revealed a mean of 2.8 and a median of 3, suggesting a neutral to low tendency for impulsive purchases. This is notable because behavioral economics research indicates that frictionless payments often reduce the “pain of paying,” potentially leading to increased impulsivity (Prelec & Loewenstein, 1998). However, in this study, the relatively low scores may reflect students' limited disposable income and developed self-regulation strategies.

A minority of participants acknowledged “micro-spending,” highlighting the subtle accumulation of small expenses, which aligns with Soman’s (2003) findings that digital payments can facilitate unnoticed expenditures despite conscious financial restraint.

Trust in IoT payment systems was moderately high (mean = 3.8, median = 4), indicating confidence in both technological features and brand reputation. According to the Technology Trust Model, trust in the system’s reliability and the provider’s credibility is a critical antecedent to continued technology use (McKnight et al., 2011). Features such as biometric authentication, transaction limits, and app security contribute to perceived safety, while institutional reputation (e.g., well-known apps) further enhances confidence. However, open-ended feedback highlighted residual security concerns, such as phone theft and phishing, suggesting that trust is conditional and moderated by perceived external risks.

The mean score of 3.6 and median of 4 suggest that IoT payment systems have a moderate influence on students’ financial decisions, particularly in short-term budgeting and spending awareness. Apps provide real-time insights and feedback, which can serve as behavioral nudges (Thaler & Sunstein, 2008), subtly guiding spending and saving behavior. However, the limited impact on long-term financial planning, such as investment or retirement preparation, indicates that these platforms currently function more as transactional and awareness tools than as comprehensive financial management systems. Prior research highlights similar patterns, showing that digital financial tools primarily improve day-to-day money management but require additional design and educational interventions to support strategic financial decisions (Nguyen et al., 2021; Lee & Shin, 2020).

Qualitative responses revealed security concerns, micro-spending, system limitations, and, for some participants, no notable challenges. These insights reinforce the quantitative findings and indicate areas for improvement in both technology design and financial literacy support. Notably, a pattern emerged where high usage frequency was correlated with higher trust, yet access to transaction data did not always translate into behavioral change. This supports the TAM and Behavioral Finance perspectives, which emphasize that repeated exposure builds familiarity and perceived usefulness, but awareness alone is insufficient for behavioral adjustment (Davis, 1989; Thaler & Sunstein, 2008). Overall, the findings suggest a need for IoT payment platforms to evolve from passive tracking tools to active behavioral coaches that integrate security, usability, and motivational features to promote responsible financial habits.

Conclusion, Limitations and Recommendations

University students in Malaysia demonstrate a high level of adoption of IoT-based payment systems, with most integrating these technologies seamlessly into their daily financial routines. The habitual use of mobile wallets, QR codes, and contactless payment methods not only reflects convenience but also fosters trust in the platforms and enhances digital financial fluency. This trend indicates that IoT-based financial tools have become essential components of modern student financial behavior, shaping how young adults perceive, manage, and interact with money in a digital context.

Despite the high adoption rates, the study reveals that access to transaction data alone does not automatically translate into improved financial decision-making. While students are more aware of their spending patterns through app notifications and dashboards, awareness does not always lead to proactive behavior modification. Many participants still rely on personal judgment rather than structured guidance from the apps, highlighting a gap between insight and actionable financial control.

Security remains a significant concern among students, with risks such as phone theft, unauthorized transactions, and potential phishing attacks noted as barriers to full confidence in IoT systems. Additionally, the study found that micro-spending (small), often unconscious transactions that can accumulate over time, subtly affecting students’ budgets. System limitations, including app lag, connectivity issues, and inconsistent vendor acceptance, further influence user experience and may limit the effectiveness of IoT payment platforms in supporting comprehensive financial management.

Given these findings, it is recommended that app developers incorporate features that actively guide user behavior, such as goal-setting modules, savings alerts, and spending nudges. By integrating behavioral cues and personalized feedback, IoT platforms can move beyond being

passive trackers and evolve into proactive financial coaches, helping students regulate spending, save effectively, and make informed financial choices.

Financial literacy education should also be embedded in university programs, focusing not only on traditional financial knowledge but also on digital financial behavior. Students should be taught how to interpret transaction data, recognize the impact of micro-spending, and leverage IoT tools to enhance both short-term and long-term financial outcomes. Such education will complement app functionality and empower students to internalize responsible financial habits.

Finally, further research is recommended to validate these findings on a larger scale and across diverse student populations in Malaysia. This would allow for more generalizable insights into digital financial behavior. App designers are also encouraged to consider integrating both short-term and long-term financial planning tools, such as automated budgeting, savings goals, and retirement planning simulations, to support holistic financial decision-making. By combining secure, user-friendly technology with behavioral guidance and educational support, IoT payment systems can become more effective instruments for fostering responsible and informed financial behavior among university students. The study involved ten university students, with a majority aged 20–22 years and a gender distribution of six females and four males. This demographic is appropriate for exploring early-stage digital financial behavior, as students in this age group are transitioning from dependent to semi-independent financial management (Lusardi et al., 2010). Gender may subtly influence financial behavior; prior research suggests that female users often exhibit greater caution in spending and higher sensitivity to security risks in digital financial environments (Zhou et al., 2021). By including both genders and focusing on this transitional age group, the study captures a relevant spectrum of young adults' interaction with IoT-based payment systems.

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