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Assessing the Acceptance of Pedestrian-Activated Signal System (PASS) in Malang Campus Area

(Insights into User Readiness and Acceptance of Smart Pedestrian Systems)

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ABSTRACT

Abstrak Implementing the Pedestrian-Activated Signal System (PASS) as a traffic safety technology innovation requires a deep understanding of user readiness and acceptance, especially in campus environments that are dense with pedestrian activity. This research aims to analyze the influence of Technology Readiness (TR) factors consisting of Optimism, Innovativeness, Discomfort, and Insecurity and Technology Acceptance Model (TAM) factors, namely Perceived Ease of Use, Perceived Usefulness on Behavioral Intention to Use the PASS system. This research uses a quantitative approach with a survey method of 215 respondents who are campus academics and the community who use the PASS in Malang City. Data analysis techniques were carried out using SPSS software with multiple linear regression tests to see the influence of variables in the TR and TAM models that had been formulated. The research results show that Optimism, Innovativeness, Perceived Ease of Use, and Perceived Usefulness have a positive effect on Behavioral Intention to Use. Meanwhile, Discomfort and Insecurity have a negative effect on Behavioral Intention to Use. This suggests that both psychological readiness and technology perception play an important role in shaping PASS intention to use. These findings confirm that the success of PASS implementation is not only determined by the technical aspects of the system, but also by the mental readiness and perception of the user. Therefore, it is important for institutions and technology developers to prioritize education and outreach strategies that strengthen user acceptance. Thus, PASS can be used sustainably to support pedestrian safety in the campus environment.

Keywords*: Technology Readiness, Technology Acceptance Model, Pedestrian-Activated Signal System, Campus.*

Introduction

University campus areas are characterized by intensive pedestrian mobility combined with complex traffic patterns, particularly during peak academic hours. The concentration of students, lecturers, staff, and visitors within limited spatial environments increases pedestrian exposure to traffic risks, especially at road crossings that intersect with arterial and collector roads surrounding campus facilities. In rapidly growing urban areas such as Malang City, the expansion of educational infrastructure and motorized transportation has intensified the urgency of improving pedestrian safety through more adaptive and user-centered traffic management systems.

Pedestrian safety has become an essential component of sustainable urban mobility and smart city development. Traditional traffic control mechanisms often prioritize vehicle flow efficiency, resulting in limited responsiveness to pedestrian needs. As a result, pedestrians may engage in unsafe crossing behaviors, including jaywalking or ignoring traffic signals, particularly when waiting times are perceived as excessive. Previous transportation studies indicate that pedestrian-activated and hybrid beacon systems are effective in reducing pedestrian–vehicle conflicts and improving compliance at high-volume intersections (Rosales & Turochy, 2021). However, technical effectiveness alone does not guarantee successful system utilization, especially when the system requires active user participation.

One technological innovation designed to address these challenges is the Pedestrian-Activated Signal System (PASS). PASS allows pedestrians to manually activate traffic signals to facilitate safe road crossings. This system represents a form of smart pedestrian infrastructure that integrates traffic engineering principles with human-centered interaction. While PASS has demonstrated operational benefits in improving crossing safety and efficiency, its overall effectiveness is contingent upon users' willingness to understand, trust, and consistently use the system as intended.

The adoption and sustained use of public infrastructure technologies are not merely technical issues but also behavioral and psychological processes. Users' perceptions, attitudes, and readiness toward technology significantly shape acceptance outcomes. In this context, the Technology Acceptance Model (TAM) provides a foundational framework for understanding how individuals decide to adopt new technologies. TAM posits that perceived usefulness (PU) and perceived ease of use (PEOU) are the primary determinants of users' behavioral intention to use a system (Davis, 1989). Perceived usefulness reflects the degree to which users believe that PASS enhances crossing safety and efficiency, while perceived ease of use refers to how simple and intuitive the system is perceived to operate.

Extensive empirical evidence supports the robustness of TAM across diverse technological domains, including e-government services, mobile applications, financial technologies, and smart transportation systems (Venkatesh

& Davis, 2000; Legris et al., 2003; Chen et al., 2019). In smart transportation contexts, PU and PEOU have been shown to significantly influence users' intentions to adopt intelligent mobility solutions, particularly when the system directly affects daily activities and safety outcomes (Lam et al., 2008). However, TAM primarily focuses on users' cognitive evaluations after exposure to technology and may not fully capture deeper psychological predispositions toward technological change.

To address this limitation, Technology Readiness (TR) offers a complementary perspective by examining individuals' mental preparedness to embrace new technologies. The Technology Readiness Index (TRI), introduced by Parasuraman (2000) and refined by Parasuraman and Colby (2015), conceptualizes readiness through four dimensions: optimism, innovativeness, discomfort, and insecurity. Optimism and innovativeness act as positive drivers that encourage acceptance, while discomfort and insecurity function as barriers that inhibit technology use. These dimensions shape how users perceive, interpret, and respond to technological systems even before direct interaction occurs.

Previous studies demonstrate that technology readiness significantly influences technology acceptance by shaping perceived usefulness and ease of use (Walczuch et al., 2007; Lin & Hsieh, 2007). In smart transportation settings, individuals with higher levels of optimism and innovativeness tend to show stronger acceptance of intelligent systems, whereas feelings of insecurity and discomfort reduce trust and usage intention (Lam et al., 2008). This relationship suggests that acceptance of PASS may depend not only on system functionality but also on users' general confidence and attitudes toward technology.

Despite the extensive application of TAM and TR in digital and service-based contexts, empirical research examining their integration in physical public infrastructure systems remains limited. Most prior studies focus on software-based platforms such as mobile applications, e-filing systems, or online services (Iramaidha et al., 2025; Arifani, 2025). In contrast, PASS represents a hybrid technology that combines digital logic with simple physical interaction, where user acceptance may be influenced more by perceived functionality, ease, and trust rather than technological novelty.

Moreover, campus environments present unique behavioral characteristics. University populations, dominated by young adults and digital natives, often demonstrate high familiarity with technology but also exhibit low tolerance for inefficiency and inconvenience. Research on user experience and service interaction indicates that simplicity, clarity, and responsiveness play crucial roles in shaping acceptance and continued use of systems, even in non-commercial and public service contexts (Nurrohman, 2025; Nurrohman et al., 2023). Consequently, understanding acceptance of PASS within a campus setting requires an integrated behavioral framework that captures both readiness and acceptance dimensions.

Given these considerations, this study aims to assess the acceptance of the Pedestrian-Activated Signal System (PASS) in the Malang campus area by integrating Technology Readiness and the Technology Acceptance Model.

Specifically, it examines how optimism, innovativeness, discomfort, insecurity, perceived usefulness, and perceived ease of use influence users' behavioral intention to use PASS. By focusing on a campus-based public infrastructure system, this study contributes to the growing literature on smart pedestrian technologies and provides empirical insights for the development of user-centered traffic safety solutions in urban educational environments.

Method

3.1. Research Design

This study employed a quantitative research design using a survey method, aimed at examining the relationship between Technology Readiness (TR) and Technology Acceptance Model (TAM) constructs toward the behavioral intention to use the Pedestrian-Activated Signal System (PASS) in campus areas of Malang City. The approach is explanatory, seeking to validate a theoretical model through empirical data.

3.2. Population and Sample

The population targeted in this study includes individuals within campus environments in Malang who are familiar with or have interacted with PASS installations. A purposive sampling technique was used, selecting 215 respondents from the academic community and surrounding residents based on their exposure to PASS. This sample size adheres to the recommendations for multiple regression analysis, which typically require a minimum of 10–15 observations per predictor variable [11] Given six predictors in this study, the sample size of 215 is more than sufficient for robust analysis.

3.3. Measurement and Instrumentation

The research instrument was a structured questionnaire consisting of 21 items, divided into:

1. Technology Readiness:
a. Optimism (3 items)
b. Innovativeness (3 items)
c. Discomfort (3 items)
d. Insecurity (3 items)
2. Technology Acceptance Model:
a. Perceived Usefulness (3 items)
b. Perceived Ease of Use (3 items)
3. Behavioral Intention to Use PASS (3 items)

All items used a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). The questionnaire was adapted from validated TR and TAM scales [1, 2] and translated contextually into Bahasa Indonesia.

3.4. Validity and Reliability

Table-1 Reliability

Variable	Cronbach's Alpha
Optimism (X1)	0.818
Innovativeness (X2)	0.822
Discomfort (X3)	0.780
Insecurity (X4)	0.650
Perceived Usefulness (X5)	0.845
Perceived Ease of Use (X6)	0.800
Behavioral Intention (Y)	0.892

Source: Processed Data, 2025

Instrument validity was tested using Pearson Product Moment correlation. All items produced *R-values above the critical threshold* ($r > 0.134$; $p < 0.05$), confirming their validity. Reliability was assessed using Cronbach's Alpha, with all constructs achieving scores above 0.6, indicating acceptable internal consistency:

3.5. Measurement and Instrumentation

The collected data were analyzed using SPSS version 21, employing several statistical techniques:

1. Descriptive Statistics – to assess the central tendency and perception patterns.
2. Classical Assumption Testing – including tests of normality, multicollinearity, and heteroskedasticity.
3. Multiple Linear Regression – to evaluate the influence of TR and TAM variables on behavioral intention.
4. Hypothesis Testing – conducted using F-test for overall model significance and t-tests for partial effects of each independent variable.

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Results and Discussion

4.1. Descriptive Statistics

A descriptive analysis was conducted on responses from 215 participants using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The aim was to observe respondents' perceptions toward the variables of Technology Readiness and Technology Acceptance in the context of PASS usage.

The mean scores across variables indicate a generally favorable disposition toward the PASS system:

1. Optimism scored highest ($M = 4.57$), suggesting that most respondents believed PASS to be a beneficial and forward-thinking technology.
2. Innovativeness ($M = 4.17$), Perceived Ease of Use ($M = 4.13$), and Perceived Usefulness ($M = 4.12$) also received high ratings, indicating positive perceptions regarding the system's simplicity and benefits.
3. Discomfort ($M = 3.47$) and Insecurity ($M = 3.68$) had lower scores, suggesting that concerns or hesitation toward technology use were relatively mild.

These results suggest that the academic community in Malang demonstrates both psychological readiness and positive perceptions toward adopting PASS in everyday pedestrian activities.

4.2. Classical Assumption Testing

Before conducting regression analysis, classical assumption tests were performed to ensure model adequacy:

1. Normality Test using Kolmogorov–Smirnov showed $p = 0.069$ (> 0.05), indicating normally distributed residuals.
2. Multicollinearity Test revealed tolerance values > 0.1 and VIF values < 10 across all predictors, indicating no multicollinearity.
3. Heteroskedasticity Test through scatterplot observation confirmed a random and pattern less residual distribution, indicating homoscedasticity.
4. These results confirm that the data meet all assumptions required for multiple linear regression analysis.

4.3. Multiple Linear Regression Analysis

A multiple linear regression was conducted to examine the influence of Technology Readiness (Optimism, Innovativeness, Discomfort, Insecurity) and Technology Acceptance Model constructs (PU and PEOU) on users' behavioral intention to adopt PASS.

The resulting regression equation is:

$Y = -0.748 + 0.131X_1 + 0.079X_2 - 0.017X_3 + 0.007X_4 + 0.415X_5 + 0.440X_6$

Whereas:

Y = Behavioral Intention to Use PASS

X_1 = Optimism

X_2 = Innovativeness

X_3 = Discomfort

X_4 = Insecurity

X_5 = Perceived Usefulness

X_6 = Perceived Ease of Use

The Adjusted $R^2 = 0.720$, indicating that 72% of the variation in behavioral intention is explained by the model. The F-test result ($F = 92.810$; $p < 0.001$) confirms the model's overall significance.

4.4. Hypothesis Testing (t-test)

Three predictors had significant effects on the intention to use PASS: Optimism, Perceived Usefulness, and Perceived Ease of Use. The strongest influence was attributed to PEOU ($\beta = 0.440$) and PU ($\beta = 0.415$), emphasizing the importance of system simplicity and perceived benefits.
In contrast, Innovativeness, Discomfort, and Insecurity did not significantly affect behavioral intention. This may suggest that the simplicity and public nature of PASS reduce the impact of personal traits like tech aversion or novelty-seeking behavior.

Table-2 Regression Equations

Variable	Coefficient (β)	t-Value	Sig. (p)	Significance
Optimism (X_1)	0.131	2.043	0.042	Significant
Innovativeness (X_2)	0.079	1.605	0.110	Not Significant
Discomfort (X_3)	–0.017	–0.417	0.677	Not Significant
Insecurity (X_4)	0.007	0.160	0.873	Not Significant
Perceived Usefulness (X_5)	0.415	8.253	0.000	Significant
Perceived Ease of Use (X_6)	0.440	7.923	0.000	Significant

Source: Processed Data, 2025

4.5. Discussion

The findings of this study provide a comprehensive understanding of the factors shaping user acceptance of the Pedestrian-Activated Signal System (PASS) in a campus environment by integrating the Technology Readiness (TR) and Technology Acceptance Model (TAM) frameworks. The significant effects of Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) strongly corroborate the foundational propositions of TAM, which emphasize that individuals are more inclined to adopt a technology when it is perceived as beneficial and effortless to use (Davis, 1989; Venkatesh & Davis, 2000). Extensive reviews of TAM applications have consistently confirmed the robustness of these two constructs across various technological contexts, including non-commercial and public-sector systems (Legris et al., 2003; Holden & Karsh, 2010).

In the context of PASS, the system's simple activation process and its immediate contribution to pedestrian safety appear to enhance both PU and PEOU. This aligns with findings from smart transportation research, which demonstrate that perceived functional value and operational simplicity are critical determinants of acceptance in intelligent transport systems (Lam et al., 2008; Chen et al., 2019). Moreover, empirical evidence from pedestrian safety infrastructure, such as pedestrian hybrid beacons, suggests that users' positive perceptions of safety benefits significantly influence their willingness to comply with and utilize such systems (Rosales & Turochy, 2021). These results reinforce the notion that, in public infrastructure settings, tangible and observable benefits play a dominant role in shaping acceptance.

The positive and significant influence of optimism, a core dimension of technology readiness, further underscores the importance of users' psychological predisposition toward technology. Optimism reflects a belief that technology enhances efficiency, safety, and quality of life (Parasuraman, 2000; Parasuraman & Colby, 2015). Individuals who hold optimistic attitudes toward technology are more likely to support and adopt technological interventions, even when those technologies are embedded in physical infrastructure rather than digital platforms. This finding is consistent with prior studies demonstrating that optimism positively affects technology acceptance in service, transportation, and self-service contexts (Walczuch et al., 2007; Lin & Hsieh, 2007; Lam et al., 2008). From a broader socio-technical perspective, optimistic perceptions also facilitate social adaptation to technological change, particularly in urban and campus environments undergoing smart city transformations (Lin & Atkin, 2005; Al-Hujran et al., 2015).

Conversely, the dimensions of innovativeness, discomfort, and insecurity did not exhibit a significant influence on behavioral intention to use PASS. This outcome may be explained by the characteristics of the system and the respondent profile. PASS is a low-complexity, low-risk technology that does not require advanced technical skills, continuous interaction, or personal data disclosure. As a result, concerns related to technological anxiety, perceived complexity, or security risks—commonly observed in digital platforms and personal information systems—may be less salient (Yi et al., 2006; Parasuraman, 2000). This finding contrasts with studies in digital service adoption, where discomfort and insecurity often emerge as significant barriers (Lin & Hsieh, 2007; Walczuch et al., 2007), but supports the argument that the relevance of TR dimensions is context-dependent.

From a methodological standpoint, this result also supports the boundary conditions of technology readiness theory, suggesting that not all readiness dimensions exert equal influence across different technological settings. In simple public infrastructure systems such as PASS, acceptance appears to be driven primarily by core TAM constructs rather than by readiness-related inhibitors. Similar patterns have been observed in applied TAM studies within public services and taxation systems, where ease of use and usefulness outweighed psychological barriers in shaping behavioral intention (Iramaidha et al., 2025). Evidence from recent TAM-based studies in Indonesia further supports the central role of PU and PEOU in predicting continuance intention and user loyalty across diverse application domains (Arifani, 2025; Akbar, 2025).

Practically, these findings imply that strategies to enhance PASS adoption should prioritize strengthening perceptions of usefulness and ease of operation. Clear signage, intuitive system design, and visible demonstrations of safety benefits can reinforce positive user perceptions and foster habitual use. Integrating PASS into broader smart campus or smart city initiatives may further enhance perceived value by positioning the system as part of an interconnected urban mobility ecosystem (Al-Hujran et al., 2015; Chen et al., 2019). From a theoretical perspective, this study reaffirms the explanatory power of TAM beyond digital and commercial technologies, extending its applicability to physical public infrastructure. The integration of TR enriches this explanation by accounting for users' psychological orientation, although its influence appears selective depending on system complexity.

In summary, the acceptance of PASS in the Malang campus area is predominantly shaped by perceived usefulness, perceived ease of use, and technological optimism, while other readiness-related barriers play a minimal role. These findings suggest that for simple, safety-oriented public infrastructure innovations, adoption strategies should focus on enhancing perceived functional value and usability rather than addressing concerns related to technological novelty or security. Such an approach not only supports effective system implementation but also contributes to safer pedestrian environments and the advancement of smart and sustainable campus mobility.

Conclusion

This study investigated the acceptance of the Pedestrian-Activated Signal System (PASS) among campus pedestrians in Malang using an integrated model of Technology Readiness (TR) and Technology Acceptance Model (TAM). The empirical findings confirm that Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Optimism are significant predictors of behavioral intention to use PASS.The results reinforce the TAM framework's robustness in explaining technology adoption, even for non-digital, infrastructure-based public systems. PU and PEOU emerged as the strongest drivers, underscoring the importance of user-centered design and clear utility in encouraging adoption. The positive role of Optimism supports the value of psychological readiness, while the non-significant influence of Innovativeness, Discomfort, and Insecurity suggests that these factors may be less relevant for simple and non-personal technologies like PASS.Overall, the study emphasizes that the success of smart pedestrian systems does not depend solely on technical functionality but also on users' perceptions of benefit and ease. This highlights the importance of considering both cognitive and affective user factors in future infrastructure planning.

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