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Designing and Evaluating Search and Rescue Management Applications using the Rapid Application Development Approach and the Technology Acceptance Model

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Abstract

This research evaluates the acceptance of a web-based application for search and rescue (SAR) activities among National Search and Rescue Agency (Basarnas Indonesia) volunteers, utilizing the Rapid Application Development method. The expanded Technology Acceptance Model (TAM) includes perceived usefulness, attitude towards using technology, perceived ease of use, and behavioral intention to use. With a quantitative approach involving one hundred respondents, Smart Partial Least Square (PLS) analysis indicates that perceived usefulness, attitude towards using technology, and behavioral intention to use significantly influence the actual technology use of the aplotSAR application. However, the Perceived Ease of Use variable does not have a significant impact. The proposed relationships align with research models, providing insights into user perceptions toward adopting the technology.

Keywords and phrases: Technology Acceptance Model, Search and Rescue Management, Web-based Application.
AMS (MOS) Subject Classifications: 68M15, 68M20, 62H15.
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1 Introduction

The role of Pentahelix in disaster response was first initiated by the Head of the National Disaster Management Agency (BNPB) in 2020 [**?**]. The disaster Pentahelix involves government, society, business, academics, and mass media collaborating in different phases of disaster management. The government, particularly the National Disaster Management Agency, regulates and coordinates disaster efforts. The National Search and Rescue Agency (BASARNAS Indonesia), a government entity, focuses on search and rescue tasks, aided by volunteer groups during disaster response. BASARNAS, the search and rescue coordinator, needs a web-based application to efficiently record volunteer activities, including check-in to check-out and activity logs. Currently, there is a lack of an administrative system to address this need, hindering effective coordination with potential SAR partners.

This study proposes a rapidly developed web-based application accessible via gadgets to record volunteer activity logs and Search and Rescue (SAR) potential for BASARNAS. Employing the Rapid Application Development (RAD) method, the application undergoes swift system development and functionality testing by disaster volunteers and stakeholders in SAR situations. The ultimate goal is to explore technology acceptance through the Technology Acceptance Model, as indicated in previous research [1][2]. According to the 2014 Regulation of the Head of the National SAR Agency, volunteers are essential human resources supporting SAR operations [3]. BASARNAS trains volunteers to be reliable, competent, and always ready for SAR missions.

Rapid Application Development (RAD) is a software development process classified as an incremental (multilevel) technique, emphasizing short and rapid linear sequential development cycles. RAD prioritizes speed in system development, including the use of prototypes, with a broad scope to meet user or system owner needs. [4]. The stages of application development using the RAD methodology are Requirements Planning, System Design, Development, and Feedback Collection [5].

TAM explains the behavior of technology users, including computers and applications. Previous researchers [6] used TAM to understand that users' reactions and perceptions of technology can influence their attitudes toward accepting technology. The TAM model measures user acceptance, evaluating external factors' impact on internal beliefs, attitudes, and intentions related to computer acceptance. It comprises two factors influencing cognitive and practical acceptance [7]:

a. The perceived simplicity of utilizing a technology is the degree to which an individual thinks that the technology will simplify their work;

b. The perceived benifit; specifically, the degree to which an individual believes that the adoption of a technology will enhance their overall performance.

2 Research Methodology

This quantitative research analyzes primary data from distributing questionnaires to one hundred BASARNAS volunteers called Potential SAR. Secondary data was obtained from interviews with elements of BASARNAS management, especially the Director of SAR Potential and other stakeholders. Based on the specifications of functional requirements and actors involved in the system, it can be modeled with a user interface design, as in Figure 1.

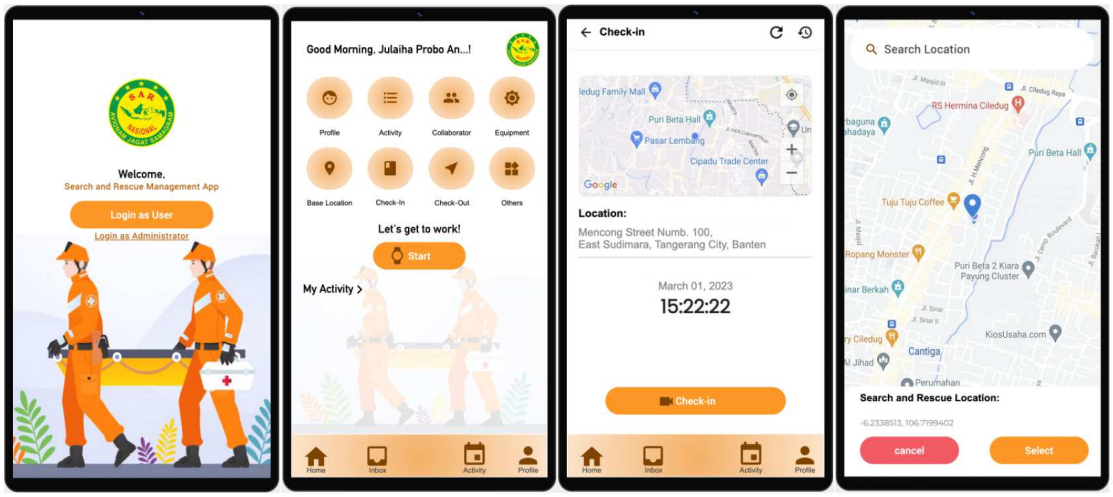

Figure 1: User Interface Design

After the application is developed, the research stage enters the evaluation phase of acceptance of the technology based on user assessments which are processed based on variable analysis from questionnaire results via SMART PLS software.

3 Results and Discussion

3.1 Validity Test Results

Average Variance Extracted (AVE) gauges the internal intercorrelation, specifically the correlation among indicators within the model. The benchmark for AVE measurement is a coefficient value greater than 0.5. The AVE values presented in Table 1 are as follows: According to the data in Table 1, it can

Table 1: Average Variance Extracted (AVE)

Variable	**AVE value**	**Status**
Perceived Usefulness	0.872	Valid
Attitude Towards Behaviour	0.851	Valid
Perceived Ease of Use	0.780	Valid
Behaviour Intention Use	0.833	Valid
Actual Technology Use	0.912	Valid

be elucidated that perceived usefulness, attitude towards behavior, perceived ease of use, actual technology use behavior each exhibit AVE values of 0.872, 0.851, 0.780, 0.833, and 0.912, respectively. This implies that all variables satisfy the evaluation criteria since the AVE coefficient values exceed 0.5.

3.2 Reliability Test Results

Table 2: Composite Reliability

Variable	**Composite Reliability**	**Description**
Perceived Usefulness	0.928	Reliable
Attitude Towards Behaviour	0.829	Reliable
Perceived Ease of Use	0.845	Reliable
Behaviour Intention Use	0.907	Reliable
Actual Technology Use	0.914	Reliable

From the information in Table 2, it can be derived that perceived usefulness, attitude towards behavior, perceived ease of use, intention to use behavior, and actual technology use all exhibit values of 0.928, 0.829, 0.845, 0.907, and 0.914, respectively. This indicates that the coefficient values demonstrate a substantial level of reliability, surpassing the threshold of 0.8.

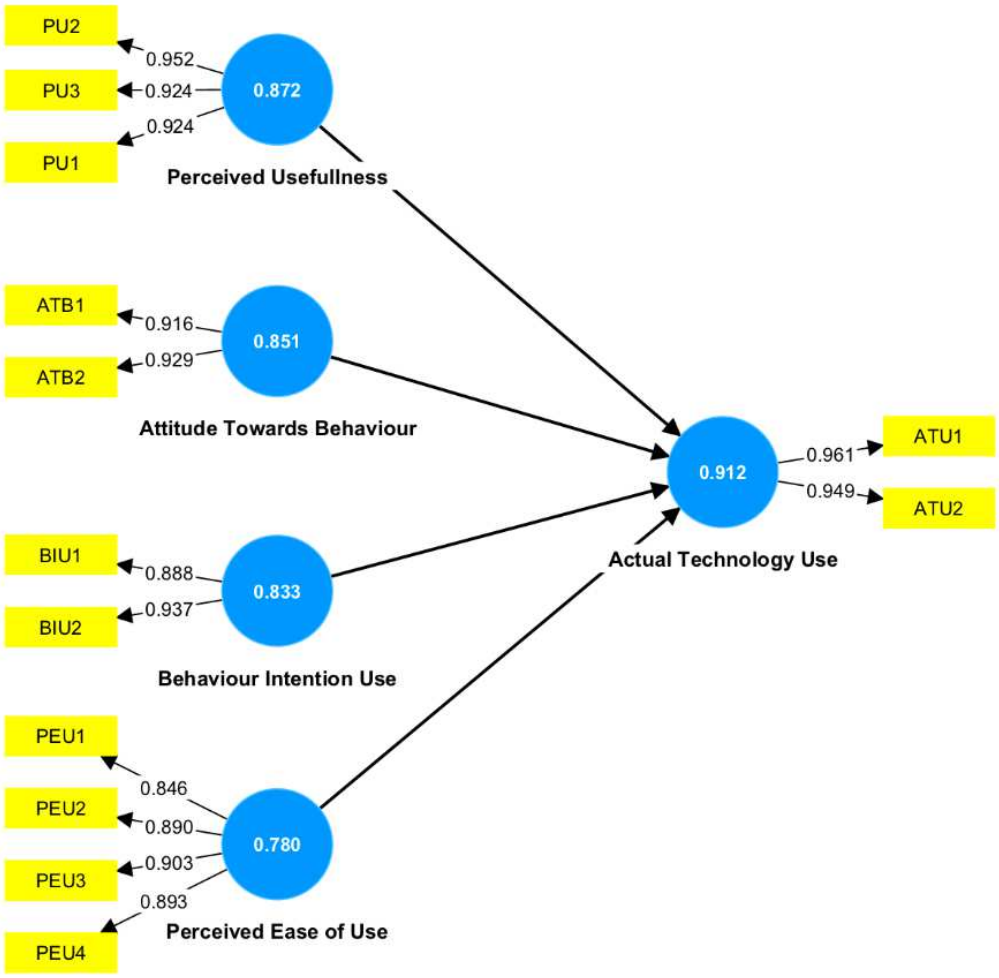

Figure 2: Output of Average Variance Extracted (AVE)

3.3 Hypothesis Testing

PLS hypothesis testing assesses the influence and significance levels of variables through T-statistics or P-values. The research model's success in hypothesis testing with the bootstrapping method is determined by evaluating direct effects to demonstrate variable effectiveness. Table 3 displays the outcomes of significance level examination observed via T-statistics or P-Values.

According to the information presented in Table 3, the examination of the Perceived Usefulness variable concerning actual technology use yields a T-Statistics value of 1.973 accompanied with a P-value of 0.049. Therefore, H_1

Table 3: Hypothesis Testing

Variable	**T Statistics** $> 1{,}980$	**P Values** $< 0{,}05$
Perceived Usefulness → Actual technology use	1.973	0.049
Attitude Towards Behaviour → Actual technology use	3.208	0.001
Perceived Ease of Use → Actual technology use	1.281	0.200
Behaviour Intention Use → Actual technology use	2.555	0.011

is accepted since the T-statistic is less than 1.984, and the P-values are below 0.05. The Perceived Usefulness variable significantly impacts the practical use of the aplotSAR application. Respondents acknowledge the application's benefits for volunteer activities, driven by an awareness of its advantages. Descriptive data from experienced volunteers support these findings, highlighting the application's value in supporting humanitarian efforts, particularly in search and rescue. The majority of respondents' actual usage of the aplotSAR application is significantly influenced by perceived usefulness.

The test results indicate that the Attitude towards using technology significantly influences the perceived usefulness of the aplotSAR system, with a T-Statistics value of 3.208 ($p = 0.001$). H_2 is accepted because the T-statistics value is more significant than 1.984 and the P-Value is smaller than 0.05. This acceptance is reflected in respondents' positive experiences during search and rescue activities using the aplotSAR application, leading to an acceptance of its existence. Therefore, the Attitude towards using technology plays a crucial role in influencing the actual technology use of aplotSAR.

The test results for the Perceived Ease of Use variable regarding actual technology use show a non-significant influence, with a T-Statistics value of 1.281 ($p = 0.200$). Consequently, H_3 is rejected, indicating that respondents did not perceive ease of use with the aplotSAR application. This perception is attributed to a limited socialization duration for accessing aplotSAR, especially for respondents aged over 45, who may find using new applications challenging. Therefore, the Perceived Ease of Use variable does not significantly impact the actual technology use of aplotSAR.

Respondents eagerly want to use aplotSAR, driven by the noble goal of optimizing search and assistance services. This selfless attitude, typical among volunteers, aligns with the application's capacity to expedite and improve coordinated search and rescue tasks. The strong interest in learning aplotSAR extends beyond individual users, motivating colleagues or collab-

orators facing application challenges. The study shows that the Behavioral Intention to Use variable significantly impacts the actual technology use of the aplotSAR application.

4 Conclusions

The TAM model assessed the acceptance and impact of the Potential SAR Activity Log Application (APLOTSAR). User needs' characteristics, particularly job relevance and trust, are significantly linked to the application's features. Results indicate that perceived usefulness, attitude towards technology use, and behavioral intention significantly influence actual technology use in the aplotSAR application. However, perceived ease of use does not affect usage, particularly during socialization events. The study suggests additional training and support for aplotSAR users to optimize its features in supporting Indonesian search and rescue activities.

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