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Smart Expo UMKM Based on Extreme Programming Method: Evaluating on Black Box and UAT

I Putu Agus Eka Pratama[1], Putu Veda Andreyana[2], Yogiswara Dharma Putra[3]
[1,2,3]Department of Information Technology, Faculty of Engineering, Udayana University, Jimbaran, Bali, Indonesia

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ABSTRACT

The rapid development of information technology (IT) and the post-Covid-19 pandemic conditions provide joint learning to provide an online service that allows a business expo event to be carried out virtually and online based on the web. UMKM or Micro, small, and medium enterprises (MSMEs), as the spearhead of the people's and regional economies, can utilize IT to improve product marketing and distribution through web-based virtual expos. For this reason, this study carried out the design and implementation of a web-based smart virtual expo using the Extreme Programming development method in a case study of the MSME business expo event in X Regency. The Extreme Programming development method was chosen to facilitate the adjustment of user needs to the virtual expo website developed through active communication with users during the development process and to make development possible in a relatively short time. This study uses a qualitative case study research method and the Black Box Testing method on the developer side and User Acceptance Testing (UAT) on the user side. The results of the study on Black Box Testing showed that all functionalities on the developed Smart Virtual Expo prototype can run well, and all users can accept the prototype well, with the largest age range at 41-50 years (56.8%) can use the prototype to access information and videos of products.

Corresponding Author:

I Putu Agus Eka Pratama,
Department of Information Technology, Faculty of Engineering,
Udayana University,
Jl. Raya Kampus Unud, Jimbaran, Badung, Bali, 80232, Indonesia.
Email: eka.pratama@unud.ac.id

1. INTRODUCTION

The Covid-19 pandemic that occurred in the period 2020-2021 had a negative impact on the economy of the community and regions, including micro, small, and medium enterprises (MSMEs). Expos, as one of the activities carried out by the government and MSMEs to introduce and sell products to the public, cannot be fully carried out offline due to the policy of limiting the number of visitors and strict health protocols during the Covid-19 pandemic and after the Covid-19 pandemic. In addition, offline expos have limited marketing reach. With the increasing development of information technology (IT), expos can be carried out online so that socialization, promotion, and marketing of MSME products to the public can be carried out more widely. This is also in accordance with the recommendations and recommendations of the central government through the Ministry of Communication and Information (Indonesia: Kementerian Komunikasi dan Informatika/Kemkominfo) in the form of the Digital Economy[1][2][3]. X Regency, as one of the regencies in Bali Province with the largest number of MSMEs (Indonesia: UMKM), engaged in the

culinary, tourist attractions, clothing, customs, and culture sectors, also has problems holding virtual and online expos. A system and service that can be accessed anytime and anywhere is needed, where MSMEs and the community can interact online and interactively related to product introduction and marketing can be done with a wider reach.

For this reason, this study proposes the development of a web-based smart expo software prototype using the Extreme Programming development method. The Extreme Programming development method was chosen considering the ease of support in adjusting user needs to the web-based smart expo software prototype that will be developed. This study addresses the gap in the existing literature on the use of Extreme Programming development methods along with Black Box and UAT testing methods in developing web-based Smart Expo for MSMEs.

2. RESEARCH METHOD

2.1 State of the Art

Several studies on the use of information technology to provide virtual exhibition applications and services with various methods, technologies, and case studies. The first study implemented a virtual expo service to digitize the work of architecture students' assignments into a web-based online service, using a descriptive and qualitative approach, so that the exhibition of student work products can be more informative, easily accessible, fast, and safe [4]. The second study implemented a virtual expo utilizing augmented reality (AR) technology to promote student work products in the 3D animation course, which is more interesting and interactive[5]. The third study was on the development of a virtual expo for a digital and online exhibition of artists' work based on the web during the COVID-19 pandemic due to government regulations to limit direct face-to-face meetings, where the system was created in the form of a 3D virtual exhibition website using the Rapid Application Development (RAD) method and Alpha Testing and Usability Testing, so that it can help artists to continue to be productive during the pandemic [6]. The fourth study developed a virtual expo based on Virtual Reality 360 to help the industry and experts in the field of Meeting, Incentive, Conference, Exhibition (MICE) tourism in holding virtual exhibitions during the COVID-19 pandemic [7]. The fifth study developed a virtual expo to help MSMEs learn entrepreneurship while promoting products online, where the prototype was developed using the Research and Development (R&D) method with the Analyze, Design, Development, Implementation, Evaluate (ADDIE) development model utilizing SketchUp, Enscape, and Blender tools[8].

The sixth study developed an interactive virtual exhibition prototype based on the Research and Development method to help students who run entrepreneurship (startups) during the COVID-19 pandemic to market their startup products and services online and easily[9]. The seventh study developed a virtual expo based on virtual reality to help architecture students exhibit easily and online[10]. The eighth study developed a virtual expo based on Extreme Programming for a case study of an exhibition in a college environment by combining QR Code technology and Black Box Testing [11]. The ninth study developed a web-based virtual expo using the Research and Development (RnD) model and the Borf and Gall method to assist teaching and learning activities in elementary schools, along with product validity testing [12]. The tenth study developed a virtual expo with the concepts of virtual reality (VR), 3D animation, analysis, design, development, implementation, evaluate (ADDIE) method, and occlusion-based method in a case study of online exhibition activities during the COVID-19 pandemic [13].

The eleventh study was conducted quantitatively through the implementation of virtual expo in small businesses in Indonesia during the COVID-19 pandemic in the form of virtual stalls, virtual events, and virtual tours, accompanied by Smart PLS analysis [14]. The twelfth study developed a virtual expo for the exhibition of goods and services in the case study of the Malaysian healthcare travel industry (Malaysia Healthcare) in 2022 in Jakarta and Surabaya [15]. The thirteenth study developed a virtual expo to help exhibit buildings and architecture online by utilizing the Multimedia Development Life Cycle (MDLC), 3D, Virtual Reality (VR), and Augmented Reality (AR) development models [16].

Several studies use the Extreme Programming development model in software development and prototypes with various case studies. The first study developed a web-based application to facilitate the registration process and implementation of selection tests to become participants in job training in the community using the Extreme Programming (XP) method to facilitate development adaptation to unclear requirements or very rapid changes in requirements [17]. The second study developed a web-based information system to help the clothing sales process in stores using the Extreme Programming method to speed up the website development process while facilitating communication with users during the development process [18]. The third research developed a web-based community training information system by applying the Extreme Programming method with the stages of planning, design, coding, and system testing using BlackBox for testing system features and User Acceptance Testing (UAT) for testing users in accepting the system [19]. The fourth study developed an online customer complaint service based on Extreme Programming so that development could be carried out quickly with a minimal number of team members and tested using the Black Box Testing method[20]. The fifth study developed an online public service information system based on extreme programming in Sodong Tigaraksa Village with a database design using an entity relationship diagram (ERD) [21].

The sixth study developed a fitness center class management and reservation application based on Extreme Programming by involving the identification of system requirements, application of application design and implementation principles, and evaluation of application performance through comprehensive testing, thereby effectively improving application quality, user interface responsiveness, and user satisfaction [22]. The seventh study developed a mutaba'ah monitoring information system based on the Agile Extreme Programming model in a case study of the Daarut Tauhiid Foundation in Bandung [23]. The eighth study combines Agile and Extreme Programming methods for the development of an online sales system E-commerce with the principle of business-to-customer (B2C), which is intended for sellers in the MSME sector in the North Musirawas Regency area online [24]. The ninth study developed a higher education academic information system using the Extreme Programming (PXP) method and the Blue Green Deployment Strategy method, including initialization, design, implementation, testing, and retrospective [25]. The tenth study developed an application for an English language test according to the Basic English Language Learning (BELL) program based on the web using the Extreme Programming (XP) method, CodeIgniter framework, PHP programming language, and MySQL database [26]. The eleventh study developed a web-based Intellectual Property Rights (IPR) management information system service using the Extreme Programming method with the adoption of Model View Controller (MVC) [27].

There is no research that combines the Extreme Programming method in a case study of web-based smart expo software development for MSMEs with the Black Box Testing method on the developer side and User Acceptance Testing (UAT) on the user side. For that, this study tries to develop a prototype of web-based smart expo software with the Extreme Programming method, accompanied by testing on the developer side with the Black Box Testing method and testing on the user side with the UAT method.

2.3. Research Method

The research method used in this study is a qualitative method. The qualitative method in this study was carried out through interviews with end users and direct observation or review in the field. Through interviews and direct reviews in the field, a clearer picture of the problems experienced will be obtained, as well as measuring the level of user acceptance of the proposed information technology-based solutions provided.

2.4. Research Methodology

The methodology used in this study is the Design Science Research Methodology (DSRM) as a research methodology in the field of information technology, one of which is in the development of software and information systems, which includes seven sequential steps, namely: literature study, research motivation, problem identification, solution design, prototype, demo, documentation, and publication[28]. DSRM is commonly used as a methodology in research

related to information systems and the development of software, prototypes, and information technology-based services[29]. Figure 1. shows the research methodology, which includes: literature study, research motivation, problem identification, solution design, prototyping, demo, documentation, and publication:

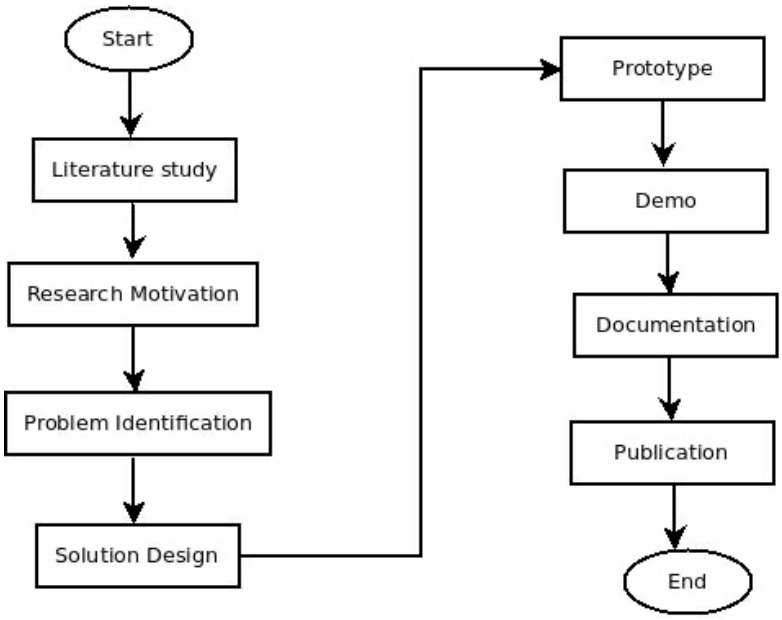

Figure 1. Research methodology

Based on Figure 1., the literature study was conducted utilizing a number of references from papers in scientific journals (national, international) and conference/seminar proceedings (national, international) that are related to the research topic to strengthen the state of the art of research. The research motivation is in the form of a desire to provide information technology-based solutions to solve problems that occur in the field. Problem identification is carried out through direct field reviews (observations) and interviews with users. Solution design is carried out using the Unified Modeling Language (UML) in the form of use case diagrams. Prototypes are carried out using the Extreme Programming development model. Demos are carried out on the developer side to test the prototype using Black Box Testing and on the user side using UAT. Documentation and publication are carried out in the form of a draft publication paper.

2.5. Extreme Programming Method

The software development method used in this research is Extreme Programming as a development model that simplifies development stages to be more efficient, adaptive, and flexible by prioritizing communication between developers and users and internal communication of the development team, confidence and integrity during development, simplifying the development process, feedback from users to the development team, and improving the quality of work during development, so that the focus not only covers the software development process but also the entire process in it[30]. There are four steps in software development using the Extreme Programming development model, namely planning, design, coding, and testing[31]. The following is a description of each step:

1. Planning.

At this stage, planning is carried out as the initial step in software development, where at this stage the process of identifying problems, analyzing needs, and determining the schedule for implementing software development is carried out. At this stage, user needs are also collected for the software to be developed so that a clear picture can be obtained regarding the main features, functionality, output, and business processes.

2) Design.

At this stage, the design is carried out on the proposal given in the form of design and prototyping of a web-based smart expo. Software modeling uses UML, while database modeling uses an entity relationship diagram (ERD).
3) Coding.
At this stage, the coding process is carried out based on the design that has been carried out at the design stage. Coding utilizes the selected programming language and library.
4) Testing.
At this stage, testing is carried out, namely testing the prototype that has been developed. Testing is carried out on the developer side using Black Box Testing and on the user side using User Acceptance Testing (UAT).

2.6. Testing Method

The testing methods used in this study are Black Box Testing on the developer side and User Acceptance Testing (UAT) on the user side. Black Box Testing aims to help developers and researchers in assessing the running of features and menus on the prototype application being developed so that it is in accordance with the design[32]. The Black Box Testing table is provided for developers to then conduct testing according to the test scenario[33]. User Acceptance Testing (UAT) aims to help developers and researchers in assessing the level of user acceptance of the software being developed with the design and objectives to be achieved and to obtain an overview of the extent to which users understand IT-based solutions in the form of systems or applications being developed[34].

3. RESULTS AND DISCUSSION

3.1. Sub section 1

The web-based Smart Expo display is shown in Figure 2. Black Box Testing aims to conduct testing on the developer/researcher side to be able to find out the functionality of the prototype being developed, using one or a number of test scenarios. Table 1. shows the Black Box Testing scenario and its results, including: accessing the UMKM Smart Expo web URL, clicking on the UMKM product image, clicking on the UMKM product video, logging in as UMKM, logging in as admin, inputting UMKM product image and information data, and inputting UMKM product video data, where all results show appropriate/valid:

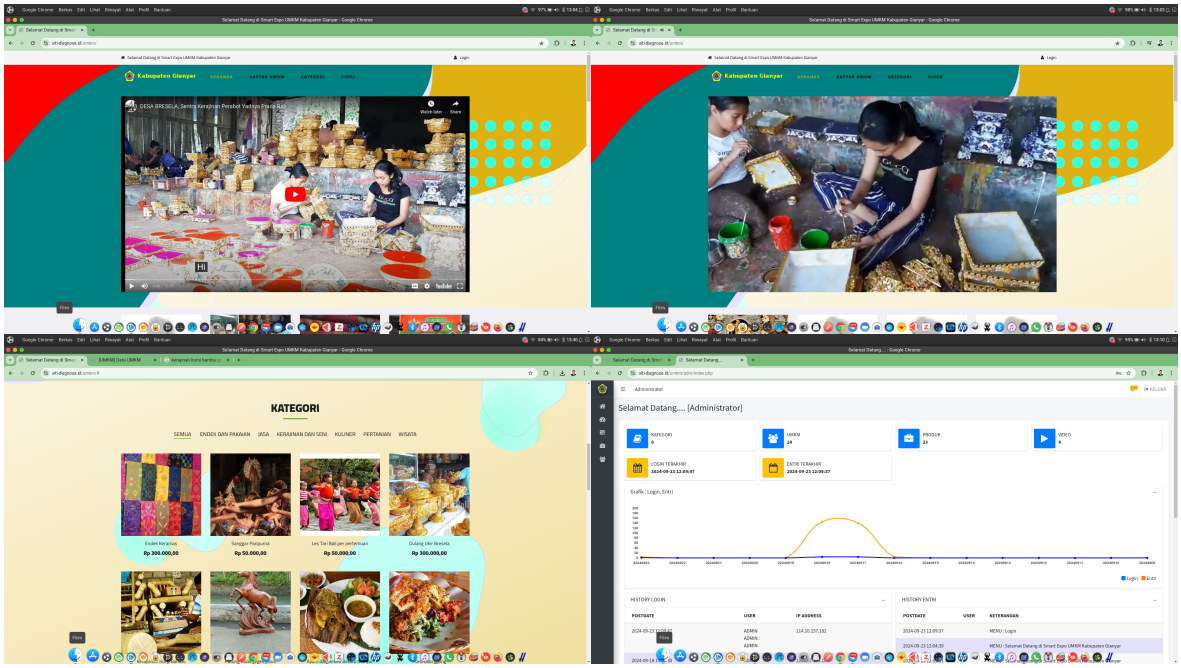

Figure 2. Web-based Smart Expo

Table 1. Black Box Testing

No	Testing Scenario	Expected results	Result
1	Accessing the Smart Expo UMKM web URL	Website can be accessed properly, web pages appear in web browsers	Appropriate/valid
2	Clicking on the UMKM product image	UKM product information is displayed in web browsers	Appropriate/valid
3	Clicking on the UMKM product video	UKM product information videos are displayed (streaming) in web browsers	Appropriate/valid
4	Login as UMKM	After successful login, users are redirected to the UMKM dashboard page	Appropriate/valid
5	Login as admin	After successful login, users are redirected to the administrator dashboard page	Appropriate/valid
6	Input UMKM product image and information data	UMKM product images and information are displayed on the Smart Expo UMKM web page	Appropriate/valid
7	Input UMKM product video data	UMKM product videos are displayed on the Smart Expo UMKM web page and can be streamed online	Appropriate/valid

3.2. User Acceptance Testing (UAT)

User Acceptance Testing (UAT) aims to conduct testing on the end user side so that a picture of user understanding can be obtained regarding the prototype solution provided, in this case the web-based Smart Expo UMKM prototype. The respondents selected were 85 people at the X Regency office. Based on the 85 respondents, two analyses were then conducted. The first analysis is demographic, while the second analysis is from the UAT test results. For demographic analysis, it is distinguished based on age range to distinguish young, middle-aged, and old respondents. Table 2. and Figure 3. shows the result of User Acceptance Testing (UAT) and Figure 4. shows a chart of the respondent age range:

Table 2. User Acceptance Testing (UAT)

No	Testing	Respondent (person)
1	Users are able to access the UMKM Smart Expo URL (as visitors)	85
2	Users are able to watch UMKM product expo videos (as visitors)	85
3	Users are able to log in as admin and use at least 3 menus in it	45
4	Users are able to log in as UMKM and use at least 3 menus in it	50
5	Users are able to check each product from UMKM (as visitors)	84

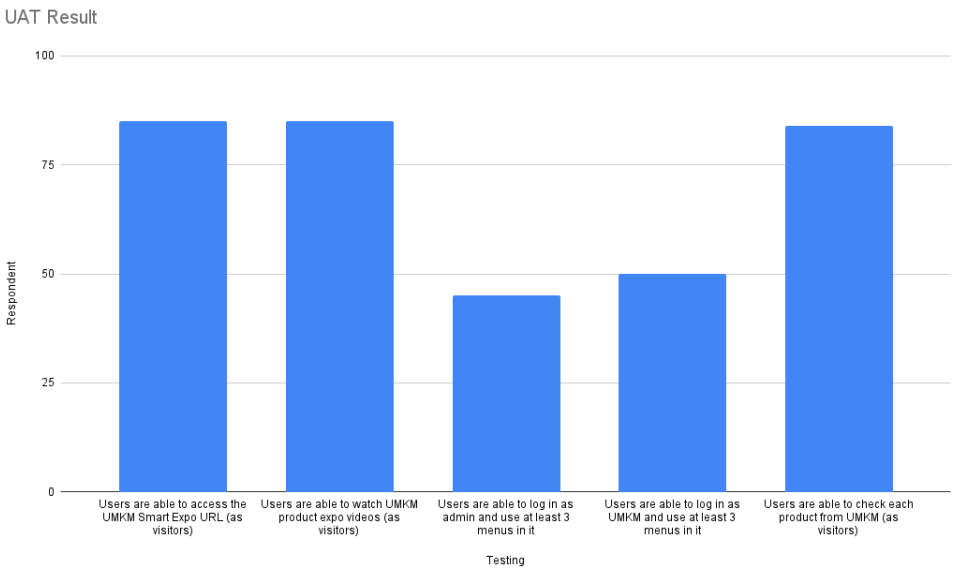

Figure 3. Graphic of UAT result

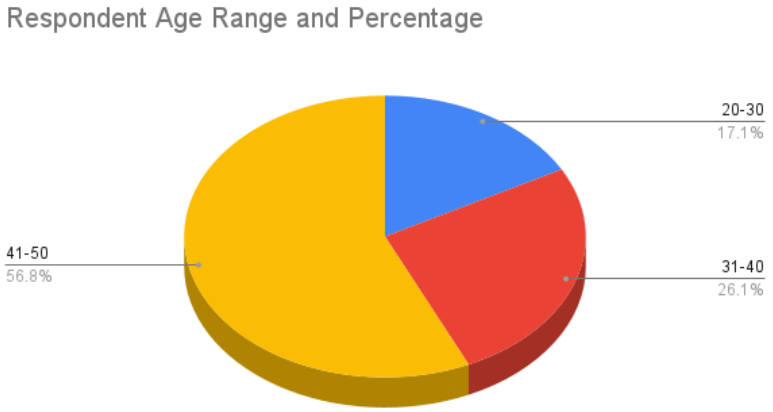

Figure 4. Respondent age range chart

Based on the UAT test table and the bar graph included above, it can be seen that technically, all respondents did not have any obstacles related to understanding how to use the Smart Expo UMKM prototype service from the perspective of ordinary visitors (accessing URLs, watching streaming videos, checking UMKM products). This shows that in terms of the menu from the application interface, or User Interface (UI), and user experience, or User Experience (UX), there are no obstacles from the diversity of user age levels. However, obstacles began to emerge when respondents began to be tested to be technically able to log in to the system as an admin (then try at least 3 menus provided in it) and log in as UMKM (then try at least 3 menus provided in it). No more than 50 users were technically able to complete the test as admin and UMKM. This shows that technical skills are needed, which tend to be more mastered by young or middle-aged respondents who are able to learn technical skills quickly.

The solution to this problem is to empower employees who have technical skills (who pass the UAT with perfect scores) to become admins who handle the administrator function on the UMKM Smart Expo website. Agencies and leaders need to provide policies and regulations that support the provision of prototype usage training to employees who have not been trained in order to improve services.

4. CONCLUSION

Based on the tests that have been conducted, it can be temporarily concluded that the web-based UMKM Smart Expo prototype that has been developed has run well in terms of functionality, as evidenced by the results of Black Box testing with appropriate/valid values and UAT test results where all users can accept the prototype well, with the largest age range at 41-50 years (56.8%). For use at the advanced user level (administrator), training is needed for a number of users to be able to adapt to the prototype.

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