Elicitation of Needs Using User Personas to Improve Software User Experience

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Abstract— **Tweets from users in the form of opinions about a product can be used as a company evaluation of the product. To obtain this evaluation, the method that can be used is sentiment analysis to divide opinions into positive and negative opinions. This study uses 1000 data from Twitter related to an internet service provider company where the data is divided into two classes, namely 692 positive classes and 308 negative classes. In the Tweet there are still many words that are not standard. Therefore, previously carried out the initial process or preprocessing to filter out non-standard words. Before doing the classification, the data needs to be divided into training data and test data with a ratio of 90:10, then processed using the Support Vector Machine and Naïve Bayes techniques to get the results of the classification of positive opinions and negative opinions. The level of accuracy in the classification using the Support Vector Machine is 84% and using Naïve Bayes is 82%.**

Index Terms— **Elicitation; HCI Technique; User Persona**.

I. INTRODUCTION

The development of technology is currently very fast and will continue to grow, it has a huge impact on various aspects that exist. Many industrial fields are finally competing to develop technology in these fields[1]. This is because it is very helpful to increase effectiveness and efficiency in work processes within a company or organization[2]. Thus, it can be concluded that today's information technology is very important in the success of an organization or agency management[3]. In order to create an effectiveness and efficiency, proper governance of information technology is needed[4]. Thus, "organizational and agency information technology is related to how top management of organizations and agencies gain confidence that the Information System Manager (Chief Information Officer) and IT organizations can provide returns or returns in the form of value for the organization or agency[5]." In other words, information technology can provide support to organizations/agencies in achieving the desired goals[6].

Information system analysis is very important to do, it is needed in order to produce a system that is easy, effective, efficient, and also appropriate for the users of the system. One model of information systems analysis by applying the concept of Human Computer Interaction (HCI)[7].

Techniques in software development are growing with the times, one of which is widely used, namely the Human Computer Interaction (HCI) approach. Producing a usable and safe system in the sense that the system can function properly is the goal of HCI, while also placing more emphasis on evaluation, design and implementation aspects. In several previous studies on HCI the HCI model can help analyze how users can interact with computers, so that they can describe behavioral models from various points of view[8].

The software development process is a phase that is often researched, including the excavation and requirements analysis phase. The purpose of this stage is to obtain specific requirements, both functional and non-functional. Several approaches have been carried out by several previous researchers. Requirements analysis is a process to get user requirements and constraints clearly and precisely[9], software requirements will be needed through intensive communication to get user needs[10], in order to eliminate ambiguity that often occurs due to the inability to explore these needs. or also because stakeholders (stakeholders) cannot properly express the desired needs.

Several approaches to exploring needs include group methods and individual methods, one of which is to group customer needs into 5 segments through adscore[11]. The group method is often used for several similar stakeholders and usually in large numbers, while the individual method focuses more on person to person within these stakeholders. Previous research conducted individual interviews from several experts with the aim of obtaining model requirements[12].

When developing an information system, the developer of the system must pay attention to the human-computer interaction factor. Human and Computer Interaction (HCI) is a scientific discipline that examines communication or interaction between users and systems. The main role of HCI is to produce

a system that is useful, safe, productive, effective, efficient and functional[13].

HCI focuses more on system design on the user or User Center Design (UCD), by paying attention to the users who will use the system, the system can be created according to and appropriate for the user. A system that is right for the user will provide comfort to the user when using the system so that the purpose of implementing the system will be achieved and will not fail[13].

In this case study, the needs analysis was obtained from stakeholders related to or related to the practicum module uploading system through infotech which is within the academic scope of the University of Muhammadiyah Malang. In this study, it involved stakeholders from students majoring in informatics class 2019 who took part in practicum activities, lecturers who were in charge of courses who had practicums, and laboratory assistants who supervised the practicum. The current practicum module uploading system is considered less effective due to the sometimes late uploading of practicum modules so that students or practitioners lack time to study and complete the given practicum assignments.

In this study, we will focus on exploring existing needs through the human-computer interaction (HCI) approach, then collecting data on characteristics from stakeholders related to the existing practicum module uploading system. Persona taken later will be in the form of characteristics and objectives based on the results of interviews and observations[14]. Quantitative and qualitative data will later become the basis for conducting analysis and synthetics to be collected as persona designs[15]. This method will produce an approach in various aspects of psychology, objectivity, motivation and existing habits, based on demographics and social.

II. RELATED RESEARCH

TABLE I. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Aspect	Acuna et al (2012)	Idoughi et al. (2012)	Aoyama (2007)
Persona Identification	X	X	X
Usage context/Environment	X	–	–
Psychological details used	X	X	X
Application /service	X	–	X
Need/Expectations	X	X	–
Skills/Previous Experiences	X	X	X
Goals	X	–	X
Segments	X	X	X
Special Needs/Accessibility	X	X	X
Relations/Interact ions with other People Problems Existing Solutions	X	X	X

In the table above, it can be seen that these characteristics are considered techniques for creating personas. Most of the given characteristics relate to the behavioral characteristics of the personas (Persona Identification, Psychological details used, Need/Expectations, Special Needs/Accessibility, and Relations/Interactions with other People Problems Existing Solutions), which describes the personal life and psychological details of each person. personas. These characteristics are useful for understanding users, but cannot identify possible application requirements.

Furthermore, for the characteristics of Application / service, Skills / Previous Experiences, and Goals can help identify possible application requirements. However, these characteristics are so general that they may present information that is not part of the application domain and may not result in the requirements. Attitudes and behaviors are important to describe in personas, they are needed to understand and identify possible requirements that are useful for application development[16].

Therefore, it can be identified that some of the limitations in the techniques listed in the table are:

- The technique focuses on understanding rather than identifying possible requirements

- Characteristics that help identify behavior are not focused specifically in the application domain, as these characteristics are described in general

So it is necessary to propose specifically the techniques used to guide the description of personas that focus on identifying possible requirements related to the application domain to be developed.

A. Data Crawling

Crawling is a method of collecting data from a source to be analyzed or processed. Crawling is the first stage that is usually used to analyze the sentiments of social media users towards a product or service. Crawling can also be interpreted as a method of quickly gathering large numbers of web pages into a local storage and indexing them based on specified keywords [8]. Sentiment analysis usually uses the Crawling method on Twitter social media by utilizing the features provided by Twitter, namely Application Programming Interface Systems (APIs) [9].

III. METHOD

A. Activity 1: State Hypotheses

State Hypotheses are formulated to identify the possibility of persona. This hypothesis helps to determine who will be the subject of the interview. This is the first stage in getting acquainted with users[17]. In addition, at this stage also carried out stages to design a formulation in the interview.

B. Activity 2: Identify Behavioral Variables

Identify a list of behavioral variables to characterize possible users taken from the results of the interview synthesis[17]. Which interview subjects will be easier to map if the range of values has been defined before mapping[16].

C. Activity 3: Identify Significant Behavior Patterns

Identify specific subject groups that appear in the range leading to the use of archetypes for personas and modeling users. The purpose of this activity will be to get a result in the form of two products, namely, the percentage grouping table and the arrangement of significant behavioral patterns, the percentage grouping table containing the percentage of interview subjects that have been mapped to each behavioral variable value[17].

D. Activity 4: Map Interview Subjects to Behavioral Variables

Represents how many subjects are grouped with respect to significant behavioral variables, which is the initial model of system users[17]. This activity aims to detect the grouping of certain behavior patterns with the existing range of values[17], so that they can be made significant and become the basic pattern of the persona.

E. Activity 5: Synthesize Characteristics and Relevant Goals

This activity generates a basic persona document. In short, the description of the relevant characteristics and goals reflects the personality of the created persona. This document is an end-user model document[17].

F. Activity 6: Check for Redundancy and Completeness

Examine the redundancy, completeness, mapping, characteristics and goals of personas to find out if there are important gaps[17]. To do this, we check that the essential identification and aspects are fully defined in the created personas. Looking for important information from the previous activity stages.

G. Activity 7: Expand the Description of Attributes and Behaviors

Extends Attribute and Behavior Descriptions in a narrative manner. Narrative is a clearer way to convey or communicate people's attitudes, needs and problems. Many aspects of the Persona Document are obscure, and useless for this task as Narrative[17]. The narrative can also be with additional data by interviewing stakeholders

H. Activity 8: Designate Persona Types

Determine the persona we want to create by determining the primary and secondary types[17]. After describing all the personas in a narrative, in the next activity we need to determine which persona is the main target of the system being built. We must define only one of all the personas whose needs and objectives can be met and represented in one interface without upsetting the other personas. To determine which persona will be the main target of the system, we must divide the persona into 2 types, namely primary and secondary personas. The primary persona is the persona that represents the main needs & objectives of the system development. While the secondary persona is a person who has additional needs that are not in the primary persona.

I. Activity 9: Build Use Cases

The activity that must be done after the persona that is the main target is clear is to create a use case. Use cases are made based on the persona in the basic document as well as in the narration as well as information from users obtained from previous activities[17]. Use cases are made in the form of diagrams like use case diagrams in general, which are made using annotations that show the relationship with primary and secondary personas. And also made a use case scenario or the flow of the prototype that we will make in the next stage.

J. Activity 10: Mockup

Implement and Evaluate Prototypes. We have used the use case developed in Activity 9 to implement the prototype. Creating mockups designed by stakeholders[17]. Mock Ups are made based on use cases and also various needs that have been recorded in basic documents in previous activities. Then from the mock-up that is made, we evaluate the environment in which the system will be implemented, because there we will find potential users of the system being built.

IV. RESULT AND DISCUSSION

A. Activity 1: State Hypothesis

The purpose of this activity is to identify the variables that can be created, to find out the differences between users based on their needs and behavior.

TABLE II.   STATE HYPOTHESIS

Hypothesis	Personas	Explanation
H0	College student	Requires sufficient time to complete and understand

		assignments and practicum materials
H1	Lab Assistant	Difficulty getting lecturer approval regarding modules
H2	Lecturer	Helping students to easily understand the material that has been given

From the table above shows a list of hypotheses for each persona, from the results obtained, it can be identified and made personas synthesize between students, lab assistants and lecturers to assemble the necessary needs.

B. Activity 2: Identify Behavioral Variables

The results of the interviews will be given a range with values that have been defined before the mapping is made.

Fig. 1. Identify Behavioral Variables

From the table of behavioral variables above, it can be identified various characteristics of each persona. Which is included in the range of values that have been set in an infotech system access activity, which is in accordance with the existing problem.

C. Activity 3: Identify Significant Behavior Patterns

At this stage, each variable from each range of values will be grouped. From the results above, the percentage will be made to get a significant grouping of each behavior pattern of the existing respondents. To get the percentage, the results of the values obtained from each subject will be calculated in comparison with the total number of existing subjects.

TABLE III. IDENTIFY SIGNIFICANT BEHAVIOR PATTERNS (STUDENT)

Observed behavioural variable	Scale	Result	Percentage
How many times to use Infotech	Very Often	5 People	100 %
	Often	0 People	0 %
	Normal	0 People	0 %
	Infrequently	0 People	0 %
	Never	0 People	0 %
Features Used			
Access Module	Very Often	0 People	0 %
	Often	5 Orang	100 %
	Normal	0 People	0 %
	Infrequently	0 People	0 %
	Never	0 People	0 %
Attachment	Very Often	0 People	0 %
	Often	0 People	0 %
	Normal	5 People	100 %

	Infrequently	0 People	0 %
	Never	0 People	0 %

For the results of respondents' answers taken from students, in the first variable the higher percentage is very often, then for the second variable the higher percentage is often, and for the last variable the higher percentage is normal.

TABLE IV. IDENTIFY SIGNIFICANT BEHAVIOR PATTERNS (LECTURER)

Observed behavioural variable	Scale	Result	Percentage
How many times to use Infotech	Very Often	0 People	0 %
	Often	0 People	0 %
	Normal	0 People	0 %
	Infrequently	5 People	100 %
	Never	0 People	0 %
Features Used			
Access Module	Very Often	0 People	0 %
	Often	0 People	0 %
	Normal	2 People	40 %
	Infrequently	3 People	60 %
	Never	0 People	0 %
Attachment	Very Often	0 People	0 %
	Often	0 People	0 %
	Normal	0 People	0 %
	Infrequently	0 People	0 %
	Never	5 People	100 %
Evaluation	Very Often	0 People	0 %
	Often	0 People	0 %
	Normal	0 People	0 %
	Infrequently	0 People	0 %
	Never	5 People	100 %

For the results of respondents' answers taken from students, in the first variable the higher percentage is Infrequently, then for the second variable the higher percentage is Infrequently, then for the third variable the higher percentage is never, and for the last variable the higher percentage is.

TABLE V. IDENTIFY SIGNIFICANT BEHAVIOR PATTERNS (LECTURER)

Observed behavioural variable	Scale	Result	Percentage
How many times to use Infotech	Very Often	0 People	0 %
	Often	0 People	0 %
	Normal	0 People	0 %
	Infrequently	5 People	100 %
	Never	0 People	0 %
Features Used			
Access Module	Very Often	0 People	0 %
	Often	0 People	0 %
	Normal	2 People	40 %
	Infrequently	3 People	60 %
	Never	0 People	0 %
Attachment	Very Often	0 People	0 %
	Often	0 People	0 %
	Normal	0 People	0 %
	Infrequently	0 People	0 %
	Never	5 People	100 %
Evaluation	Very Often	0 People	0 %
	Often	0 People	0 %
	Normal	0 People	0 %
	Infrequently	0 People	0 %
	Never	5 People	100 %

For the results of respondents' answers taken from students, in the first variable the higher percentage is often, then for the second variable the higher percentage is normal, then for the third variable the higher percentage is never, and for the last variable the higher percentage is Often.

D. Activity 4: Map Interview Subjects to Behavioral Variables

At this stage, fragment mapping will be carried out from the answers given from stakeholders based on the behavioral identification that has been made. Of the cases that have been identified, there are 5 respondents each from each stakeholder who have provided answers.

Fig. 2. Student Mapping Fragments

In the mapping fragment image above, the results of each variable choice for student respondents are obtained. For the first question, how many times have you used infotech, the answer is very often, because all UMM informatics students in each semester must take at least 1 course that has a practicum. So they need to access infotech for practical needs such as accessing modules to study and do assignments from the given practicum, this is because the modules that are distributed sometimes have not been uploaded so some students need to check whether the modules have been uploaded or not. There is also the use of the file attachment feature which is commonly used by students to collect practicum assignments.

Fig. 3. Lecturer Mapping Fragment

Furthermore, for respondents from lecturers. For the first question, namely how many times have used infotech, the answer is infrequently or only occasionally. Furthermore, for the features used, namely module access which is sometimes used to view modules so that they can be taught a little to students.

Then the attachment feature is never used by lecturers because they do not collect practicum assignments and upload modules. And the last one is the assessment feature where every lecturer never uses this feature because the practicum assessment is submitted to the lab assistant who will later pay the grade to the lecturer.

Fig. 4. Lab Assistant Mapping Fragment

The last one is the lab assistant respondent. For the first question, namely how many times have you used infotech, the answer is often, because the lab assistant is responsible for carrying out the practicum of each practitioner. Furthermore, the features used are module access which is often used to view the modules that will be used by the practitioner when doing practicum. Then for the use of the attachment feature, the lab assistant uses the attachment feature to upload the module, but sometimes only the CO of the lab assistant from each class uploads the module. And the last is the assessment feature, this feature is often used by every lab assistant when conducting practicums to assess practitioners.

E. Activity 5: Synthesize Characteristics and Relevant Goals

Fig. 5. Synthesize Characteristics and Relevant Goals (Student)

In the picture above, the results obtained from each choice of variables for student respondents. For the first question, how many times have you used infotech, the answer is very often, because all UMM informatics students in each semester must take at least 1 course that has a practicum. So they need to access infotech for practical needs such as accessing modules to study and do assignments from the given practicum, this is because the modules that are distributed sometimes have not been uploaded so some students need to check whether the modules have been uploaded or not. There is also the use of the file attachment feature which is commonly used by students to collect practicum assignments.
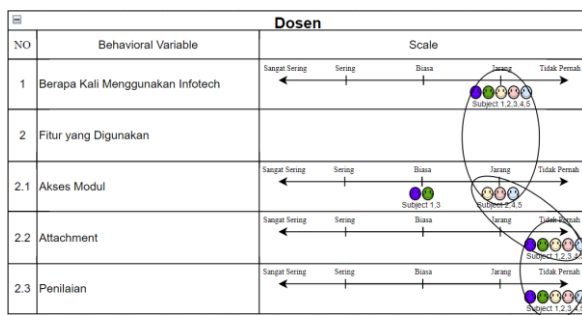
Fig. 6. Synthesize Characteristics and Relevant Goals (Lecturer)

Furthermore, for respondents from lecturers. For the first question, namely how many times have used infotech, the answer is infrequently or only occasionally. Furthermore, for the features used, namely module access which is sometimes used to view modules so that they can be taught a little to students. Then the attachment feature is never used by lecturers because they do not collect practicum assignments and upload modules. And the last one is the assessment feature where every lecturer never uses this feature because the practicum assessment is submitted to the lab assistant who will later pay the grade to the lecturer. From the four questions that have been given, it can be seen that there is one fragment that shows the significance of the choice of all respondents. For the existing fragments, the significant respondents chose the seldom choice and never chose the option.
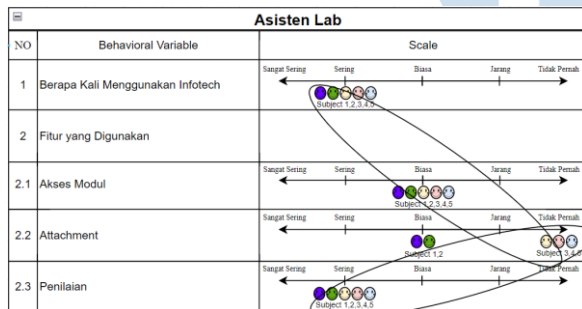

Fig. 7. Synthesize Characteristics and Relevant Goals (Lab Assistant)

The last one is the lab assistant respondent. For the first question, namely how many times have you used infotech, the answer is often, because the lab assistant is responsible for carrying out the practicum of each practitioner. Furthermore, the features used are module access which is often used to view the modules that will be used by the practitioner when doing practicum. Then for the use of the attachment feature, the lab assistant uses the attachment feature to upload the module, but sometimes only the CO of the lab assistant from each class uploads the module. And the last is the assessment feature, this feature is often used by every lab assistant when conducting practicums to assess practitioners. From the four questions that have been given, it can be seen that there are two fragments that indicate the significance of the choices of all respondents. For the existing fragments, the respondents consistently chose

the frequent choice, the usual choice and the never choice.

F. Activity 6: Check for Redundancy and Completeness

At this stage, a check will be carried out regarding the behavioral variables that have been made by adjusting the results of the behavioral variables that have been carried out with the behavioral variables from the new respondents. This is done to find out whether the needs analysis carried out is appropriate or still requires additional additions.
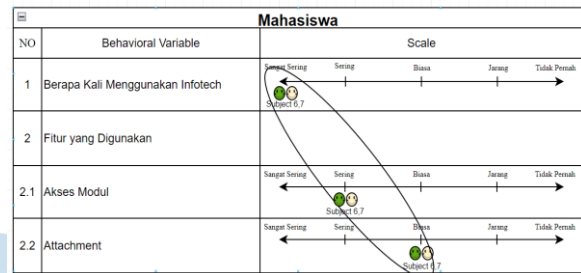

Fig. 8. Behavioral Variables to Check For Redundancy And Completeness (Student)
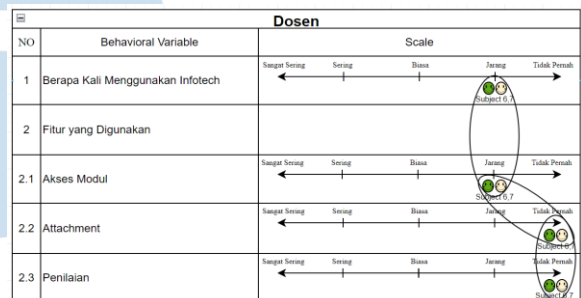

Fig. 9. Behavioral Variables to Check For Redundancy And Completeness (Lecturer)
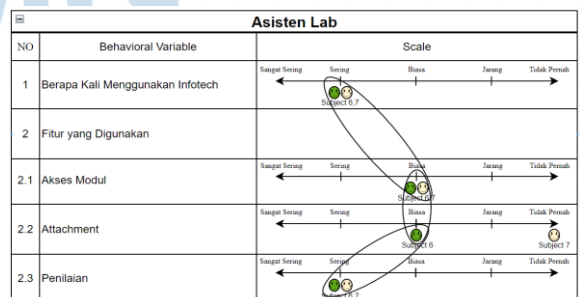

Fig. 10. Behavioral Variables to Check For Redundancy And Completeness (Lab Assistant)

In the picture above, there is a table of Behavioral Variables to complete Redundancy And Completeness, there are 3 types of respondents, namely Students, Lecturers and also Lab Assistants. From the three types of respondents, 2 people were taken each to be respondents.

G. Activity 7: Expand the Description of Attributes and Behaviors

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PERSONAS FOUNDATION DOCUMENT

1. PERSONA IDENTIFICATION
   • Name : Ibnu Jahsy
   • Age : 21
2. ROLES & TASKS
   • Ibnu Jahsy adalah seorang mahasiswa informatika angkatan
     2019 di Universitas Muhammadiyah Malang
   • Kegiatan regularnya adalah bermain game dan belajar
     membuat game
3. OBJECTIVES
   • Untuk objectives jangka pendek dan panjang adalah menjadi
     game developer
4. SEGMENT
   • Dia sekarang tinggal di malang
5. SKILL & KNOWLEDGE
   • Ibnu Jahsy menggunakan laptop untuk kegiatan seperti kuliah
     dan membuat game
   • Ibnu Jahsy menggunkan aplikasi Unity dan Unreal Engine
6. CONTEXT & ENVIRONMENT
   • Motivasi yang dimiliki adalah ingin membuat game yang
     bagus, dan ingin menjadi game developer
   • Ibnu Jahsy suka bermain Game
7. PERSONAL AND PSYCHOLOGICAL
   • Ibnu Jahsy adalah seorang yang sulit menghadapi kegiatan
     atau tugas yang tiba – tiba.
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Fig. 11. Stakeholder : Student

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PERSONAS FOUNDATION DOCUMENT

1. PERSONA IDENTIFICATION
   • Name : Ilyas Nuryasin
2. ROLES & TASKS
   • Ilyas Nuryasin adalah seorang dosen yang mengajar di
     Universitas Muhammadiyah Malang
3. OBJECTIVES
   • Untuk objectives jangka pendek dan panjang adalah menjadi
     pengajar yang baik dan dapat memberikan pembelajaran yang
     berkualitas
4. SEGMENT
   • Ilyas Nuryasin sekarang tinggal di malang
5. SKILL & KNOWLEDGE
   • Ilyas Nuryasin menggunakan laptop untuk kegiatan seperti
     mengajar
   • Ilyas Nuryasin menggunkan aplikasi zoom untuk mengajar
     ketika kelas online
6. CONTEXT & ENVIRONMENT
   • Motivasi yang dimiliki adalah ingin menjadi pengajar yang
     baik dan dapat memberikan pembelajaran yang berkualitas
7. PERSONAL AND PSYCHOLOGICAL
   Ilyas Nuryasin, S.Kom., M.Kom adalah seorang dosen yang baik,
   menerapkan cara mengajara dengan melibatkan mahasiswa
   dalam setiap pertemuannya.
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Fig. 12. Stakeholder : Lecturer

H. Activity 8: Designate Persona Types

TABLE VI.   USER PERSONA

| Ibnu Jahsy |
|---|
| • 21
 • Malang
 • Student
 • Universitas Muhammadiyah Malang

 Ibnu Jahsy is an informatics student from the class of 2019 at the University of Muhammadiyah Malang, his daily habit is making and playing games. For the short and long term objectives are to become a game developer, the motivation is to want to make good games, and to become a game developer. In doing this, respondents use laptops to open the Unity application so that they can make games, respondents often use their laptops to play and make games. For fear and the feared challenge is the sudden assignment of. |

I. Activity 9: Build Use Cases
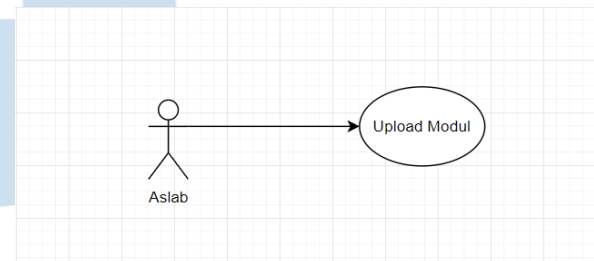
Fig. 13. Use Case

There is a document that describes details of the activities carried out for each use case. Specifications are described in the form of use case descriptor that provides a description more about use case, result of use case descriptors are described by Table VII.

TABLE VII.   IDENTIFY SIGNIFICANT BEHAVIOR PATTERNS (LAB ASSISTANT)

USE CASE: Aslab Mengupload Modul
Principal Actor: • Lab Assistant (Aslab)   Stakeholders and Goals: • Lab Assistant: Want to Easily Upload Modules   Principal Success Scenario:

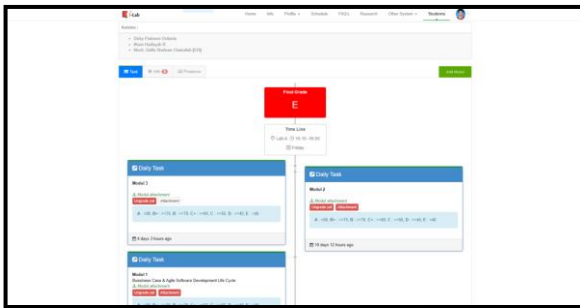| No.	Step
1.	Masuk ke website infotech
2.	Tekan menu login
3.	Login dengan menggunakan nim dan password
4.	Pilih menu student
5.	Pilih kelas praktikum
6.	Pilih menu upload modul
7.	Input modul yang ingin diupload
8.	Masukkan waktu publish dari modul yang diupload
9.	Tekan tombol save
10.	Modul di publish sesuai waktu

J. Activity 10: Mockup
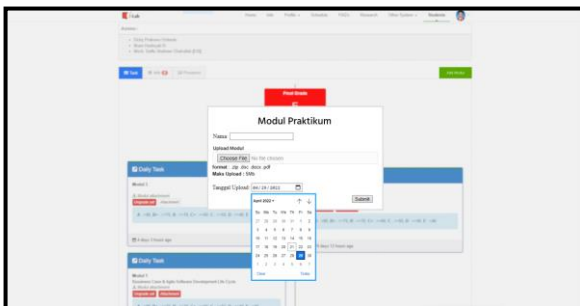

Fig. 14. Homepage Mockup

Fig. 15. Module Upload Mockup

The final results at the research stage that have been carried out are made in the form of a mockup according to the evaluation carried out with the related persona. In Figure 12 is the start page where there is a button to upload the practicum module. Then in the 13th picture, after the button to upload the module is pressed, a menu for uploading the practicum module will appear and also a menu for setting the schedule for uploading the practicum module so that the practicum module will be uploaded according to a predetermined schedule.

V. CONCLUSIONS

In the research conducted, it was found problems related to the module uploading system through infotech, namely the upload of the practicum module which is sometimes late and also the absence of a notification feature when the practicum module has been uploaded. practice has been uploaded.

To overcome this, a solution that might help is needed is the addition of a scheduled upload feature so that later the practicum module uploader can be done automatically according to a predetermined schedule and also the addition of a notification feature when the practicum module has been uploaded.

REFERENCES

[1] Y. I. Maulana, P. Studi, and M. Informatika, "Perancangan Perangkat Lunak Sistem Informasi Pendataan Guru Dan Sekolah (SINDARU) Pada Dinas Pendidikan Kota Tangerang Selatan," J. Pilar Nusa Mandiri, vol. 13, no. 1, pp. 21–27, 2017.

[2] A.. M. Djohan, "Penilaian Tingkat Kematangan Strategic Alignment Bisnis Dan Ti Menggunakan Cobit 4.1: Studi Kasus Universitas Xyz," Semin. Nas. Sist. Inf. Indones., no. September, pp. 1–8, 2014.

[3] V. Sahfitri, "Perguruan Tinggi Swasta Di Kota Palembang," pp. 1–7, 2014.

[4] A. S. Hidayat, W. Ubleeuw, A. Fauzi, and P. M. Akhirianto, "Sistem Pengolahan Data Nilai Berbasis Web Pada Sekolah Menengah Pertama (Smp) Karel Sadsuitubun Langgur," J. Teknol. Inform. dan Komput., vol. 5, no. 2, pp. 13–23, 2019.

[5] L. A. Purwanto and T. Dirgahayu, "Pengukuran Tingkat Kematangan Tata Kelola Pengelolaan Permasalahan Sistem Informasi Menggunakan Kerangka Kerja COBIT 4.1 (Studi Kasus: Sistem Informasi Akademik Universitas Muhammadiyah Purwokerto)," JUITA J. Inform., vol. 5, no. 2, p. 103, 2018, doi: 10.30595/juita.v5i2.1629.

[6] R. Carneiro, Discovering the treasure of learning. 2011.

[7] Haryoko, S. (2012). Penerapan Sistem Human Computer Interaction (HCI) Pada Website E-Learning. Inspiration: Jurnal Teknologi Informasi Dan Komunikasi, 2(2). doi:10.35585/inspir.v2i2.20

[8] Z. He, T. Chang, S. Lu, H. Ai, D. Wang, and Q. Zhou, "Research on Humancomputer Interaction Technology of Wearable Devices Such as Augmented Reality Supporting Grid Work," Procedia Comput. Sci., vol. 107, no. Icict, pp. 170–175, 2017, doi: 10.1016/j.procs.2017.03.074.

[9] A. Safwat and M. B. Senousy, "Addressing Challenges of Ultra Large Scale System on Requirements Engineering," Procedia Comput. Sci., vol. 65, no. Iccmit, pp. 442–449, 2015, doi: 10.1016/j.procs.2015.09.116.

[10] T. Alsanoosy, M. Spichkova, and J. Harland, "The influence of power distance on requirements engineering activities," Procedia Comput. Sci., vol. 159, pp. 2394–2403, 2019, doi: 10.1016/j.procs.2019.09.414

[11] R. Chen, Q. Wang, and W. Xu, "Mining user requirements to facilitate mobile app quality upgrades with big data," Electron. Commer. Res. Appl., vol. 38, no. August, p. 100889, 2019, doi: 10.1016/j.elerap.2019.100889

[12] H. Scherer, A. Albers, and N. Bursac, "Model Based Requirements SINTECH Journal | 99 Engineering for the Development of Modular Kits," Procedia CIRP, vol. 60, pp. 145–150, 2017, doi: 10.1016/j.procir.2017.01.032

[13] Prihati, P., Mustafid, M., & Suhartono, S. (2011). Penerapan Model Human Computer Interaction (HCI) Dalam Analisis Sistem Informasi. JSINBIS (Jurnal Sistem Informasi Bisnis), 1(1), 01-08. https://doi.org/10.21456/vol1iss1pp01-08

[14] B. Ferreira, G. Santos, and T. Conte, "Identifying Possible Requirements using Personas - A Qualitative Study," *Proceedings of the 19th International Conference on Enterprise Information Systems*, vol. 2, no. Iceis, pp. 978–989, 2017.

[15] Å. Blomquist and M. Arvola, "Personas in action," Proceedings of the second Nordic conference on Human-computer interaction - NordiCHI 02, 2002.

[16] A. Cooper, R. Reimann. "About Face 2.0: The Essentials of Interaction Design, Wiley Publishing, Indianapolis", 2004.

[17] S. T. Acuña, J. W. Castro, and N. Juristo, "A HCI technique for improving requirements elicitation," in Information and Software Technology, vol. 54, no. 12, pp. 1357–1375, 2012.