Title: Ethical User Stories : Industrial Study

Ethical User stories: Industrial study

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Abstract

In Port terminals a progressive change is underway in digitalizing traditional systems to SMART systems with the aid of AI. This study follows one of such progressions, the SMARTER project. SMARTER is a sub research and development project of the Sea for Value program of DIMECC company, Finland to create replicable models for digitalization for future terminals which involves the use of AI enabled tools. AI and Autonomous Systems (AS) are the direction that software systems are taking today. But due to ethical challenges involved in the use of AI systems and increased emphasis on ethical practices in the use and design of AI systems, our study provides an ethical angle, Ethical User Stories (EUS). We use an ethically aligned design tool the ECCOLA method to transfer ethical requirements into EUS for non-functional requirements for an aspect of the logistics system, passenger flow. Over the span of six months, 125 EUS using the ECCOLA method were collected through a series of workshops for the passenger flow use case and the findings are revealed in this paper. This project is in the field of maritime industry and concentrates on digitalization of port terminals and this particular paper focuses on the passenger flow. Results are positive towards the practice of Ethical User Stories.

Keywords

Digitalization, Artificial Intelligence, SMART systems, Ethics, User Stories, Passenger Flow, Port terminal

1. Introduction

The benefits of AI enabled digitalization in reaching desired goals in development projects across industries, the environment, and society in general is increasingly influencing many development projects. One area of interest for digitalization and SMART systems is in logistics, especially logistics in port terminals. Digitalization of traditional port terminal to a future

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SMART terminal has now been under development in Finland and witnessed in this particular study, where the research empirical data is explored in a research and design (R&D) influenced industrial project called the SMARTER [1].The project aims for digitalization and an increased level of autonomy [2], where the target is to create replicable models for the digitalization of future terminals.

State of the art technology like Smart or/and AI/AS Systems' impact assessment, within AI ethics, has recently been under the interest of various institutes, organizations and governing bodies producing different sets of guidelines, principles and even some regulations.[3] AI ethics can be approached from several points of view and when designing these artifacts the Dignum paradigm [4] presents one way of consideration. There, ethics and AI are related in three levels as in Ethics by Design, Ethics in Design, and Ethics for Design. In this context, Ethically Aligned Design (EAD), is one of the approaches that has slowly gained a foothold in modern technology design. EAD aims to align the ethical principles and values in the design process to receive the full benefit of AI/AS technology. [5] Our research is located in the middle ground of Ethics in and for Design, as we develop tools to transform ethical principles to practical and concrete means in EAD in AI.

One of the tools that has risen from our studies is Ethical User stories [6]. Ethical User Stories relates to Agile requirements engineering, where requirements for Software Engineering (SE) are processed through a User story process using a framework of ethical principles that are connected to technology design or development. At the moment, a few similar kind of idea building of ethical user stories exist in research, but without an empirical evidence supporting the idea. [7, 8] On the other hand values, that relate to ethics, have recently been studied in the context of software development and requirements engineering by Perera et al (2021). [9] In a scenario based survey for practitioners the results indicate that the impact of implementing human values to the early stages of requirements engineering help the practitioners build connections between software features and human values. Now, the preceding study [6] describe that: "[..] ethical user stories could be one way of making (AI) ethics a part of the workflow of developers." So, in order to study more the ethical user stories in practise, we conducted an exploration in an industrial setting in the previously mentioned study project to give more understanding of the phenomena. Regarding the framework of ethical principles, our research has, for several reasons, used scientifically proven method ECCOLA method[10], in this study to filter ethical requirements in the development work flow. Reasons for ECCOLA alternative are elaborated more in section 3.

This article is motivated by the program objectives and the growing trend of AI-enhanced smart systems, where the impact of utilization of these systems is requiring concrete actions from research towards EAD and trustworthy smart system environment. Inspired by the field's will for EAD towards AI/AS systems development and by the practitioners' need for tools to conduct their work towards EAD, the main research questions were unfolded to How to make ethical user stories? and What are the ethical requirements in the Maritime industry, especially in port terminals when switching over to SMART terminals? This is the first article published in the series of three similarly structured and content-wise articles and based on the project's division of development work. This article reports and shares the outcome of a passenger flow use case study in terms of ethical requirements towards the project research. The project and the division of work are described more in detail in section 3.

The article is organized as follows: section one introduces the research motivation and main goal for the study. Section two provides the theoretical background for the research, while section three goes through the research framework and study setting. Section four then elaborates the results and section five concludes the article with a discussion on the research outcome.

2. Theoretical Background

2.1. Passenger Flow

As the number of people using transport systems increases, the flow of passengers is critical to the success of an effective transport system as it affects movement through different service points. Passenger flow (PF) involves navigating passengers (people, vehicles, cargo, ships, machinery, and all the associated operations); and consists of the experience at each touchpoint in the process. PF is becoming vital for resource scheduling, planning, public safety, and risk management in transport systems [11]. Some of its critical application areas include prediction and forecasting to enable transport systems to significantly manage their operations and resources [12]. One of the main applications of PF is as a prediction tool in urban transport, where it forms part of an essential technological resource for enabling sustainable and steady development in transportation [13]. As a prediction tool, PF tends to study patterns of crowd travel behavior and form real-time traffic operation state evaluation, which can contribute to schedule resources in traffic management [12].

Passenger flow can be affected by various dynamic and complex factors, including dynamic traffic routes, upgrade of transportation facilities, multifaceted transfer flows, rush hour, and external influences such as bad weather [11]. However, dynamic changes in global transport infrastructure alongside the widespread adoption of digital technologies are increasingly influencing how passenger flow is designed [12]. The continuous growth of Industry 4.0 coupled with unprecedented challenges such as COVID-19 means that the traditional methods of designing passenger flow systems can no longer suffice and need to be replaced or complemented with digital options in new technological spaces [14]. Part of this innovative way of designing PF systems involves implementing intelligent technologies to help manage operations and maintain facilities safely, securely, and environmentally friendly [15].

This change in design approach from statistics to technologies such as Artificial Intelligence (AI) has resulted in most studies in the review of the literature to focus on Machine Learning (ML) and Deep Learning (DL) techniques to enhance PF [16, 12, 17, 18]. While some studies have explored simulation approaches [19], most have embraced AI and associated technologies in designing PF systems. As a result, PF systems are becoming an interconnected smart environment involving big data, the Internet of Things (IoT), and AI that facilitates autonomous practices [20].

However, designing AI-enabled passenger flow systems can be challenging due to the ethical concerns connected with AI and associated technologies, such as ML. ML practices operate mindlessly with no conscious understanding of the broader context of their processes and cannot contemplate their actions' ethics [21]. In addition, the opaque nature of ML-powered AI systems may create a challenge in apportioning responsibilities or explanations to relevant

actors in a case of redress or failure in sensitive situations resulting in diminished customer confidence. Privacy and bias represent critical ethical challenges that developers tasked with designing AI-enabled PF systems may encounter [22]. Privacy and trust issues may emanate from unethical customer data collection, violating users' privacy [23]. Users of the system may question the various surveillance systems such as videos and cameras engaged in collecting passenger flow data as invasive and their application. In addition, AI reportedly has a history of unfairness regarding ethnicity, gender, and race [24], which may spark ethical concerns about the quality of data and the bias that may ensue from its application. The EU analyses that sustained use of AI systems could lead to breaches of fundamental human rights if ethical issues remain unrestricted [25].

2.2. Ethically Aligned Design

With the increasing calls for EAD, several organizations, governments, and research bodies have attempted to tackle ethical AI concerns. One of the results is the principles approach, where principles serve as guidelines in developing and deploying AI systems [26]. However, developers still struggle to transition principles to practice due to a lack of actionable tools and methods [10]. Furthermore, there is also a risk for unethical AI behavior at the design stage, raising the issue of which ethical principle should be considered pertinent in designing and managing AI-based systems[27]. As a possible solution to address these concerns, the ECCOLA method has been developed to action principles to practice as a tool that aids the EAD of AI systems [10]. ECCOLA was created by distilling fundamental AI ethics principles to guidelines for AI developers at the design and development stages [10]. In addition, ECCOLA can be instrumental in producing (ethical) user stories to help define high-level requirements and, in the process, translate ethical principles to tangible design requirements for developers of AI systems [6].

In addressing the ethical challenges associated with designing AI-enabled PF systems, the ECCOLA method can serve as a solution for translating high-level requirements to system requirements for developers in the form of user stories [6]. ECCOLA as a user story tool can prove instrumental in facilitating communication in defining high-level requirements for AI systems developers. This practice can also serve as an ethical guide to help determine which principles are applicable in a particular context and ensure that these guidelines translate into action in the development of the AI-enabled system [6]. As explained earlier, most research on AI-enabled PF design focuses on improving the functionality as a prediction tool or metric to measure passenger flow volume. A study by [28] outlines the need for a value-centered approach in the ethical design of autonomous systems; however, it is not specific to AI ethics [10]. Therefore, there is currently no research on using ethical development tools like ECCOLA to generate user stories that can aid the EAD of an AI-enabled PF system.

2.3. From User Stories to Ethical User stories

In software engineering practice, user stories are industry-driven research (Agile Development) and share some academic research of the area. Practically, user stories are a few sentence lines of high-level customer requirements formed by the customer or by the developer team. They

are written on index cards, post-it notes, or predefined template that follows the same structure, which is elaborated below in more detail. Sometimes a product owner is named by the developer team to form user stories. These software requirements define the functions that are needed for the software to work. Non-functional requirements define the needs that are vital for the software to work e.g. reliable, and that it is experienced usable, consistent, and safe to use, and among others, it is ethically aligned.

The developer team creates many user stories, where ready user stories are prioritized and the most valuable user stories towards the customer, are used in the first sprint of software development, where they are picked from the product bag log. [29] When the non-functional requirements define the need that is vital for the software to work e.g. reliable and safe, themes shared with the ECCOLA method, we can exploit the non-functional requirements categorization towards Ethical User story practice and describe that ethical user stories relate to non-functional requirements. In detail, the user stories are divided into two main sections. The first section describes the particular requirement which is formulated: "as a [user], I want to [capability], so that [receive benefit]".[29] The second part will offer the resolution for the requirement: "What needs to be done". [29] As an example of Smart terminal Ethical User stories: "As a data analyst (or the appropriate role) using the bought data for the system, I would like to know that the data are of good quality and not biased so that I can provide an effective and unbiased service for users of the system." What needs to be done", part is a customer-driven (acceptance) tests that give the customer requirement a practical mean to form a real-world software feature. Sometimes the agile requirements team uses a ready formula for the acceptance phase that follows a pattern of,[Given][When][Then], which gives the acceptance test a context, action to be carried out, and consequences to be obtained. [30] For the given example above, the acceptance criteria could be: "Documentation and logs of data sources for traceability are kept."

3. Research Framework

This section will go through the research in a more concrete grip by explaining the research framework and methods used, the research context within the study project in question, and the concepts of passenger flow and EAD in more practical terms. This article studied the phenomena of ethical user story development and reports the content of one a use case (the Passenger Flow).

3.1. Study Background

The research philosophical background is positioned into interpretative qualitative research as the research aims to understand the context or/and process of the Information System (IS). [31] IS in this sense comprise the concepts of AI/AS and Smart systems. The research itself was conducted as an experiment, where the steps in the experiment process [32] is approximately followed in the line of this research. The research scope was determined by the project (this is explained more in the following chapters), but the rest for the research execution was planned for this experiment according to [32]. The empirical material was collected according to study design in Figure 1. in a six (6) month timeline in 2021. Several activities and group sessions were arranged in that period to collect the empirical material. Raw data, consisting of 300+ notes, were documented in three (3) workshops during summer 2021, held by the research group.

Participants invited to the workshop were mainly from industrial and institutional partners that were assigned for the first phase of the project.

The project in question produces and shares information between ten (10) industrial partners and five (5) research institutes with the lead of an R&D company. University of Jyväskylä (JYU) was responsible for the EAD, where the main target of the study was to introduce the requirements for EAD in Smart terminals. The leading company had divided the development work into three (3) use cases: Ship Turnaround, Truck Traffic, and Passenger Flow (PF). PF is further polarized into two sub-use cases: PF with and without a vehicle. As mentioned earlier, this article concentrates on the passenger flow with and without a vehicle.

In practical terms, the use case passenger flow in the study project is targeting the optimization of passenger flow in their end-to-end journey by improving different sub-systems by providing concrete research-based recommendations on business, data usage & sharing utilizing e.g. situational awareness. [2] This research group has approached this mission and concrete recommendations through software development methods, more precisely Agile software development. Through the practice of Ethical User Stories (EUS), the study project will receive a tangible outcome of the EAD study, the research-based recommendations.

Section EAD described the ECCOLA method applicability. In practice, ECCOLA is a method that uses gamification technique that empowers ethical thinking in the product development process, especially AI/AS systems. It has 21 cards to choose from with content of AI ethics principles, 8 themes with each theme holding 1-6 card topics, also AI ethics principles. According to ECCOLA Game Sheet, the method is intended to be used during the entire design and development process in three steps: 1. prepare, as choosing the relevant cards, 2. review, as keeping the chosen cards in hand during a single task, and 3. evaluate, as reviewing to check if all planned actions are taken.[10] Ethical user story practice can use any ethics-related design/development framework from the field of engineering or technology design, but as ECCOLA is developed particularly to AI software development, traditional SW is deterministic and AI is probalistic [33] and in the perspective of agile software development, for us, it was natural to use this method that fits to the study context.

3.2. Data Collection and Study Design

The process of making user stories based on EAD, using the ECCOLA method was multi-staged, evolving ad hoc. The study design is witnessed in detail in figure 1, where the data collection took place. The three (3) use cases were managed in three (3) virtual workshops and were individually processed.

3.2.1. First phase

In the first phase, the use case owners were asked to choose themes to suit best in their context use case. In Passenger Flow the themes of the chosen ECCOLA cards are listed in Table 1. Cards were placed on an online whiteboard for reference. Each workshop took 1,5h to 2h, where the themes and topics of the cards were processed separately in 5 sprints, every sprint taking around 10 minutes. To enhance discussion participants were divided into break-out rooms with a facilitator from the AI Ethics lab. Participants were trained with EAD and ECCOLA

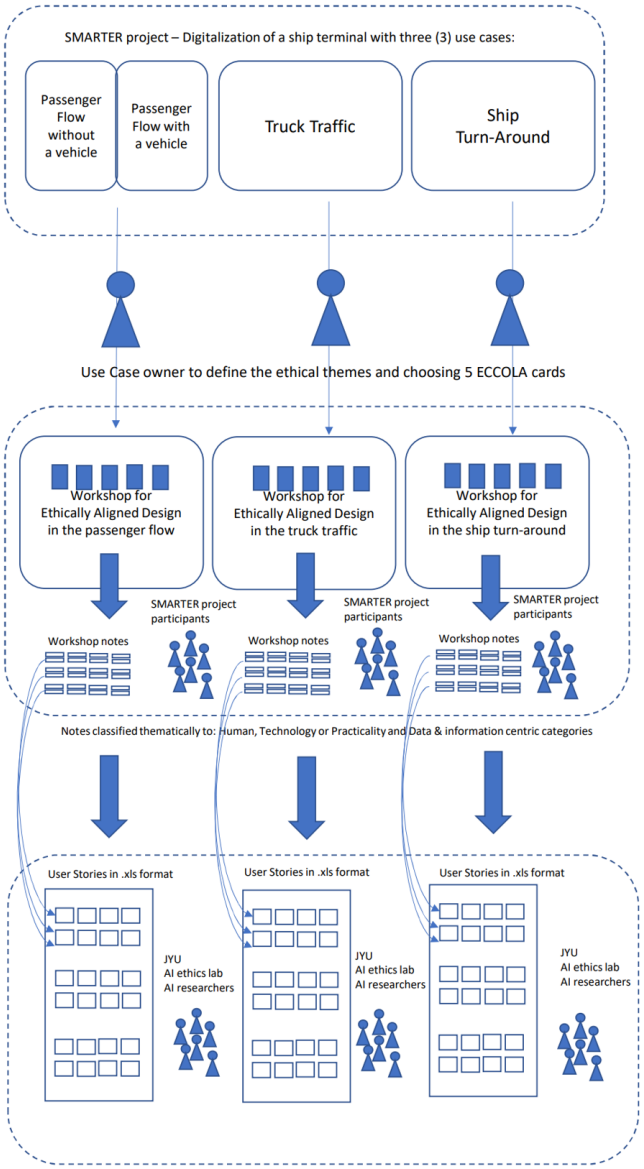

Figure 1: Ethical User Story process in the context of SMART terminal -project.

methods and also instructions were given to make notes on the whiteboard. The idea of the workshop was to process any ethics-related concerns or issues that weren't addressed earlier in the project.

Participants made notes based on the discussion or based on their previous experience in the project and the notes were then later on transferred to a matrix in a spreadsheet for thematical classification. Card topics were placed in the horizontal column and the following categories in vertical column. As the notes were previewed by one researcher, the overall experience of the

Table 1
Chosen ECCOLA cards in Passenger Flow Use case

Passenger Flow Card Deck			
Theme	Card #	Card Topic	Card Motivation
Transparency	#5	Traceability	Why AI acts the way it does
Data	#7	Privacy and Data	Relates to data misuse reveals and General Data Protection Requlation (GDPR)
Safety & Security	#12	System Security	Cyber-physical systems can cause fatalities by malicious actors
Safety & Security	#13	System Safety	Considering risks and their concequences, when thinking ahead to the operational life of the system
Accountability	#18	Auditability	Good to have audit mechanisms in place before hand towards regulations affecting AI and Data and in case of system damage

review concluded into three (3) main categories for all the use cases:

- Human-centric;
- Technology or Practicality-centric;
- Data & Information-centric;

The purpose of the categorization refers to the following phase, the second study phase.

3.2.2. Second phase

Due to developers' different backgrounds, the idea of the categorization was to ease the development of ethical user stories. Developers could choose the most convenient note for their expertise. So, in the second phase, researchers from the AI Ethics Lab, altogether twelve (12), were invited to the activity. Eight (8) developers accepted the virtual activity to create ethical user stories from the workshop notes. With different professional and academic backgrounds, the development team proceeded in several sprints and met several times online to proceed with the flowing assignment, meaning that the recurring meeting was taken as many times as the applicable notes were left on the spreadsheet. Demographic details are listed in table 2. To study more about the phenomena from the developers' perspective the Ethical User Story development team was interviewed at the end of the process about their experience on the activity and the study content/design. Questions are listed below:

- How did you experience this Ethical User Story activity?
- How did you experience the process of creating this Ethical User Story activity?
- Feedback on the activity.

3.3. Data Analysis

Qualitative data analysis was used to interpret the empirical material. The grounded theory method (GTM) was chosen as a coding method for analyzes of the data collected. The ethical

Table 2
Ethical User story Developer group

Ethical User story Developer group					
Developer code	Academic degree	Working environment	Work experience in the field of software engineering / development	Work experience in Agile development	Work experience in writing user stories
D1	Ph.D. 4th year student	AI ethics lab	1-5 years	1-5 years	1-5 years
D2	Ph.D. 1st year student	AI ethics lab	None	None	1-5 years
D3	Ph.D. 1st year student	AI ethics lab	None	1-5 years	1-5 years
D4	Ph.D. 4th year student	AI ethics lab	None	1-5 years	1-5 years
D5	Ph.D. 2nd year student	Practitioner	5-10 years	1-5 years	1-5 years
D6	Ph.D. 2nd year student	AI ethics	1-5 years	1-5 years	1-5 years
D7	Ph.D. 4th year student	Practitioner	None	None	None
D8	Post-Doc researcher	AI ethics lab	5-10 years	1-5 years	1-5 years

User story is a novel research area so the GTM was the most suitable method to use in the research as there are no previous studies of the subject so far [34]. GTM method is also suitable when conclusions are inductively drawn from the data instead of in traditional research, deductively.[34] GTM coding technique *Memoing* was used to note ideas or insights of the empirical study [34]. Notes from the first phase were categorized using thematical classification. As mentioned in the second phase of data collection, the developers were chosen from the same research group as it was convenient for the study to continue in a reasonable time frame. The method used, convenient purposeful sampling [35], is described to be implemented studies where participants are chosen for their ease access to the study[35]. Developers used the same strategy (convenient purposeful sampling) in note processing to the point where saturation was achieved. Primary Empirical Conclusions (PEC) illustrate the discoveries made during the study to report the research findings.

4. Reporting the Results

Ethical user story development progressed according to the theory[29] and is witnessed in the walkthrough of Ethical User stories found from appendix 1. and in examples in table 4. The study revealed several focus areas that were relevant to the assigned research questions and mostly, the study concentrated in how to make ethical user stories and the study proved that in

practice a model approach was the main discovery during the study.

This results section reports the ethical user story development outcome with numerical data, following PEC's that are introduced in table 3 and reviewed below. 65% of the the passenger flow use case workshop notes were applicable and altogether 125 ethical user stories were made. As discussed earlier in the data analysis section, the second phase, user story development, continued as long as the data was reaching the saturation point, where nothing new was discovered from the material.

Table 3
Primary Empirical Contributions

Number	Description
PEC 1	Ethical framework is an essential instrument in the ethical user story development model as it distill the ethical consideration to functional thinking of the domain area
PEC 2	Ethical User story model is an enjoyable learning process for developers where the Ethical framework is streamlined to developers to progress in the process efficiently, liberated from the ethical theoretizising
PEC 3	Ethical user story model is at least two-phased, where the first phases creates avenue for ethical discussion and second phase documents the outcome of the discussion with an ordinary developer artefact (user story)
PEC 4	Ethical requirements can be achieved to a large extent with the Ethical user story model
PEC 5	Roles and task are studied in the beginning of each development case to make the ethical user story validation phase part of the ethical user story model

According to the reported discoveries, altogether five (5) PEC's from the study were documented. First, *PEC1* ECCOLA, which was utilized here as an ethical framework is a thinking tool, which succesfully lead to operationalizing the ethical principles through the user story development. Developers experienced that when the process was ready to set up, it took the pressure out of making ethical user stories and was considering doing "plain" user stories, which eventually helped the development work. In previous AI ethics related studies developers experience that considering ethical aspects in the developers workflow is not in their zone of expertise. According to [36] developers consider ethics as important in principle, but impractical and distant from the issues they face in their work and address in [37] that "A product owner's responsibility is to make sure that sprint backlog items have ethical user stories included."[37]

PEC2 In this study, the developers described their experience in the activity in a very comprehensive manner. First, developers reported that it was a great avenue to learn as the process was an easy hands-on session, even though a little bit ad-hoc in character. Also, it was much more understandable to see it in practice as one of the developers expressed: *"Being a participant of developing ethical user stories, it was much easy to understand how exactly someone could put it into practice."* Second, conversations taken after each sprint was experienced good, as some of the ethical user stories were revised to follow the theory base of user story practise and to clarify the ethical user story content. Third, overall feeling about the development of user stories was experienced as a very effective way of doing ethical user stories. Only the downside was that it was challenging to write user stories when the context was unknown. On the other hand, it gave freedom to be more creative when the mind wasn't set into any particular environment or

Table 4
Examples of ECCOLA theme Transparency and card #5 Traceability

Examples of ethical user stories			
Example	Authentic Note	Ethical User Story	Acceptance criteria
Example 1	Before a person with a vehicle enters the port, they are given explanation of what information will be handled, for example at the stage of making a reservation when they agree to give the necessary information of their vehicle.	As a passenger, I want to know exactly what information about my vehicle and implicitly, me, is being processed by the port, so I can feel safe and informed.	Before a person with a vehicle enters the port, they are given explanation of what information will be handled, for example at the stage of making a reservation when they agree to give the necessary information of their vehicle.
Example 2	Why are you asking my data and for what?	As a passenger using the terminal services, I want to know what data is collected of me and why, so that I can feel secure that my information is safe.	A detailed document explaining the extent of the system's data use should be prepared and available to customers upon request.

scenario. Also, sometimes it was not that easy to produce user stories out of the workshop raw data due to notes' open-ended character and were regarded as unusable as they had unclear content or vagueness in context. Lastly, participants noted that it was interesting to see the further steps in the process.

PEC3 The study design in Figure 1. was one of the main focus areas in the research question execution and central factor for reporting study results. The documented Ethical user story development model was unfolding to a two-phased process model that was experienced as a pleasant approach to ethical user story development. What became the essence of the Ethical User story model was the instrument used in the process first phase, meaning the ethical framework that functioned as a filtering thinking tool in the process. [38] introduces a framework for method adoption in software development, where the preceding tools in operational tools are the thinking tools, ECCOLA being the thinking tool and ethical user story practise the operational tool.

PEC4 As there are no corresponding empirical research of ethical user stories, we could not make any scientific conclusion about the numerical data. Instead, the documented work that we were engaged with the study project, did get a large amount of research data, the ethical requirements, as we managed to develop 125 ethical user stories, for this particular use case. This large amount of ethical user stories gave rise to further development needs with the ethical user story development model as it didn't take into account the ethical user story validation phase. Validation process is a task that the customer team is responsible for [29].

PEC5 Development of the model roles and task is one area of concentration in the future. In the current study, e.g. the study project (use case owner) provided the ethical themes via ECCOLA method, for ethical requirement elicitation and the developer team made the ethical user stories. In the long run, as the project follows, the use case owner then validates the user

stories. In theory the validating usually is effective during the user story development that the customer team makes [29]. In the current study, the roles and tasks are different. Also, some minor lessons-learned discoveries were made after the study of the afore mentioned roles and tasks refinement. E.g. as the recurring development meetings took place, any logs of attendance wasn't kept and developers' participation to the ethical user story development was carried out alongside other work. Project context and the use case environment were glanced at the beginning of the user story sprints to give a picture of the environment, but if the developer missed the opening meeting the developer might have experienced difficulties relating the development context. Like, developers expressed, this was not only negative observation, it also gave positive reaction to ethical user story development.

5. Conclusions and Discussion

In this section, we will elaborate on the meaning, relevance, and importance of the results. The results indicate that findings from the study are promising towards ethical user story practice. The following research questions were addressed: "How to make ethical user stories?" and What are the ethical requirements in the Maritime industry, especially in port terminals when switching over to SMART terminals? The formation of these research questions was influenced by the research framework, where the qualitative research methodology and qualitative data gave a direction for researching the study design to data analysis and further on findings discovery.

The Ethical User Story practice, meaning the process, where the EAD tool ECCOLA was used in the research framework, empowered and released the developers from the heavy burden of ethical consideration. Through the Ethical User story process, the project received research-based recommendations on business, data usage sharing, and much more with ethical consideration. This ethical user story process can be considered ad-hoc and developed as the project evolves but follows the utilized AI ethics principles powered design tool, ECCOLA.

The research was motivated by the industry, where EAD is challenged. The challenge referred to the missing tools for operationalizing the principles in EAD to the workflow of software engineers[5]. A novel idea of ethical user stories has been introduced by research groups globally [7, 8, 6] and this research in question took, in the forefront, the novel idea into practice in the current study project.

The first question was unfolding to study the process of how the make ethical user stories. The study proved that the model in figure 1 is a starting point for the process of making ethical requirements. It was discovered that when the experts of the context field develop the ethical user stories, the second phase validates the user stories. The third phase is required when the experts of the context field are not present validating them. This implies that there is room for ethical user story model development, but the tool, for implementing ethical principles into practice exists with this novel approach. This is not a surprise as the phenomena of ethical user stories are first time explored in the current study. Implications from the [39] study state that large-scale implementation of ethical AI standards and certification, is yet to happen and points out that the field of AI ethics is in a formative stage.

AI research has laid their concerns of AI-enabled SW systems [24, 21, 23] and in this study

context particularly, in the PF [22]. The second question of ethical requirements in the current study untangled the call for ethical requirements with an outcome presented in appendix 1. This proves that the call for AI ethical concerns has been heard and this state-of-the-practice tool, especially for AI SW practitioners, manages to turn ethical principles into industrial requirements for further development. The experiment provides new insight into the major trending technological projects that are concerned with the implications when transferring from traditional to modern, digitalized systems. With AI ethical tools, findings are significant for industry and research as:

a. Manageable, usable, and efficient tool for implementing ethical principles to the workflow of SW engineers exist with the ethical user story model

b. The field of AI ethics is forming towards practical research especially with SW engineering

This was a pilot study project towards ethical user story development. More similar kinds of studies are needed to find out the right model to make validated ethical user stories applicable in modern SW system development. It would be interesting to see the model in different domains of AI systems development. We are suggesting that several SW companies take the initiative to test the model in practice to get more scientific data for the ethical user story development model.

5.0.1. Acknowledgments

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A. Online resource 1

Online resource is found here for appendix 1. https://doi.org/10.6084/m9.figshare.19073963