The Issues for Improving Usability

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ABSTRACT

The purpose of this study is to investigate degree of recognition and application for promoting installation of HCD process to interactive system development area. The questionnaire results by about 600 developers shows that known ratio about HCD is about 25% and applied ratio is about 50% in known ratio. The ratio of upper phase, development phase and evaluation phase that requirement definition related usability are similar. From them, it is important to increase degree of recognition of HCD and to promote usability requirement definition and evaluation in development area by using Common Industry Format for usability in SQuaRE series.

Keywords: Human centered design, Usability, Common industry format, User requirements, SQuaRE

INTRODUCTION

Human centered design (HCD) is a traditional human Factors and Ergonomics concept. About the end of last century (1999), HCD is firstly standardized as process. It is rare case that the HCD which is not academic system is continued to discuss. The reason is considered that HCD is not used at development area. By ISO 9241-210: 2019(ISO 9241-210, 2019), the purpose of applying HCD are as follows:

a) increasing the productivity of users and the operational efficiency of organizations
b) being easier to understand and use, thus reducing training and support costs
c) increasing usability (effectiveness, efficiency and satisfaction)
d) increasing accessibility (for people from a population with the widest range of user needs, characteristics and capabilities)
e) improving user experience
f) reducing discomfort and stress
g) providing a competitive advantage, for example by improving brand image
h) contributing towards sustainability objectives

They are dependent each other. However, it is not clear whether interactive system developers understand the meaning of HCD or not. If the ratio of recognition of HCD is low, it is difficult to apply HCD to developing

area. The purpose of this study is to investigate degree of recognition and application for promoting installation of HCD process to interactive system development area for improving usability and to clarify the issues and propose ways to solve this HCD problem.

SURVEY

Questionnaire was carried out by web system to 1065 persons who engages interactive system development (valid responses are 644, response rate is 60.5%). The breakdown of respondents and survey items are shown below.

Table 1. Classification of an official position of panels.

	N	%
TOTAL	644	100.0
General staff	278	43.2
Assistant manager	149	23.1
Manager	116	18.0
Senior Manager	51	7.9
Officer	20	3.1
Executive	21	3.3
Others	9	1.4

Table 2. Classification of tasks of developers (multi answer).

	N	%
TOTAL	644	100.0
Marketing	35	5.4
Planning, design, development of system	546	84.8
operation and maintenance of system	275	42.7
Manufacturing, production control, quality control	61	9.5
Others	14	2.2

Survey items:

1. What is your role?
2. Do you know the term "usability"?
3. Do you know "user experience (UX)"?
4. Do you know "design thinking"?
5. Do you know "Human centered design process"?
6. Do you know the activities from understanding the context of use to evaluation (they are not development process)?
7. Does your organization apply these activities to the development process?
8. Do you indicate your team members to apply these activities?
9. Do you know the International Standards related system and software quality requirements and evaluation "System and software product quality requirements and evaluation (SQuaRE series) (ISO/IEC25000, 2014)"?

RESULTS

The questionnaire results by about 600 developers shows that known ratio about HCD is about 58% (Table 3) and applied ratio for in known ratio is about 42% (152 developers: Table 4). However, overall, only 23% are covered. If HCD is recognized, nearly half of it will be applied, so it is important to raise overall recognition.

Table 3. Do you know HCD process?

	N	%
TOTAL	629	100.0
Known	154	24.5
I have heard (seen) about it	209	33.2
Unknown	266	42.3

Table 4. Do you apply HCD process to the development process?

	N	%
TOTAL	362	100.0
Applied	152	42.0
Not applied	182	50.3
Unknown	28	7.7

The ratio of upper phase, development phase and evaluation phase that requirement definition related usability are similar. However, the ratio of deciding usability requirement in upper phase is only 13% (Table 5). The ratio of evaluating usability requirement before specification is only 10% (Table 6).

Table 5. Decision phase of usability requirement (multi answer).

	N	%
TOTAL	141	100.0
Before requirement definition	88	62.4
Design phase	78	55.3
UI design	65	46.1
Not decided	18	12.8

Though the ration of recognition for HCD is not so low, many developing areas cannot decide usability requirement before requirement definitions. It is guessed that almost developers do not know how to decide usability requirements.

To confirm this question, the other study was carried out. The ratio of use of Common Industry Format for usability (CIF: ISO/IEC 25060, 2010) is about 39% (Table 7). The number of developers to apply CIF to development is about 90. It is only 14%. The CIF is the format for applying HCD process

Table 6. Evaluation phase for usability requirements (multi answer).

	N	%
TOTAL	141	100.0
Specification phase	67	47.5
UI development phase	78	55.3
Integration test phase	74	52.5
Before release	31	22.0
Non	15	10.6

to development process which is standardized in ISO. This standard series is belonged in Standard series for software quality called SQuaRE (System and software Quality Requirement and Evaluation). As the range of recognition for SQuaRE series is about 43% (Table 8), it is necessary to spread CIF to software development areas.

Table 7. The ratio of using CIF.

	N	%
TOTAL	231	100.0
Using	90	39.0
Not using	121	52.4
Unknown	20	8.7

Table 8. Degree of SQuaRE series.

	N	%
TOTAL	629	100.0
Known	105	16.7
I have heard (seen) about it	170	27.0
Unknown	354	56.3

DISCUSSION

To verify the effectiveness of CIF, CIF is applied to self-driving bus system (Fukuzumi and Wada, 2021). Firstly, a high-level description of the context of use shown in the context of use description (ISO/IEC 25063, 2014) was made for a usual bus (Table 9) and self-driving bus system (Table 10), respectively. After that, user needs and user requirements were extracted based on high level description (Table 11). This process shows that it is easy to extract user requirements before requirements decision phase by using the CIF.

However, it is found that management level does not understand the importance for the role of upper phase activities by this time investigation. For this reason, it seems that the ratio of recognition of HCD. It is necessary for improving usability to spread HCD, CIF and SQuaRE much more.

Table 9. High level description of context of use description (a traditional bus).

Elements of Context of use	Contents (situation)		
System, product or service	Public bus		
General title of user group	Passenger	Operating and monitoring	Pedestrian
Example job titles (if relevant)	Moving	Operating a car to realize passenger transportation	Walking
Demographic data (if relevant) (Age, gender, specific physical attributes)	------	Unknown	----
Goal	Ride on a bus stop and ride off a destination stop	Pass designate route on time as possible with keeping safety inside and outside of the car	Walk on sidewalk. Across a pedestrian crossing keeping her/his safety
Assumed tasks to be supported and assumed task competence	- Guidance when ride on / off - Support by a driver accordance with specific physical attributes - Keep safety during in the car - Claiming you need help - Training for ride on /off a self-driving bus	- Answer questions by a passenger or support when ride on / off - Cameras to reduce blind spots. - Drive according to traffic law - Correspond to obstacles (avoidance, stop)	- Training and experience for moving a bus near a narrow sidewalk or a pedestrian crossing. - Capability of checking safety
Assumed organizational / social environment		- Responses of surrounding cars and pedestrians to avoiding on-street parking near bus stops	- Distinction between sidewalks and roads, indication of bus routes
Assumed physical environment			
Assumed equipment used for task completion			

Table 10. High level description of context of use (self-driving bus).

Elements of Context of use	Contents (situation)		
System, product or service	Public bus		
General title of user group	Passengers	driver	pedestrian
Example job titles (if relevant)	Moving	Passenger transportation	Walking
Demographic data (if relevant) (Age, gender, specific physical attributes)	-----	- Age: 21+ and more than 3 years after obtaining a normal driver's license - physical attributes: Must be specified by law and not impede safe operation	----
Goal	Ride on a bus stop and ride off a destination stop	Pass designate route on time as possible with keeping safety inside and outside of the car	Walk on sidewalk. Across a pedestrian crossing keeping her/his safety
Assumed tasks to be supported and assumed task competence	- Guidance when ride on / off - Support by a driver accordance with specific physical attributes - Keep safety during in the car	- Answer questions by a passenger or support when ride on / off - Mirrors to reduce blind spots, cameras in the driver's seat. Ability to check surrounding cars and pedestrians and drive safely	Check moving the bus or intention of a driver by eye-contact or gesture on a narrow sidewalk or a pedestrian crossing
Assumed organizational / social environment		- Responses of surrounding cars and pedestrians to avoiding on-street parking near bus stops	- Distinction between sidewalks and roads, indication of bus routes
Assumed physical environment			
Assumed equipment used for task completion			

CONCLUSION

This study investigates recognition ratio and application ratio related HCD process to interactive system developers and discuss methods to raise their ratio based on the recognition of CIF. From these results, it can be shown that it is necessary to raise not only HCD but also the ratio of software quality. To the future, management area data will be analysed and application of HCD from the viewpoint of executive and management will be discussed

Interactive system to be designed	Reference to the context of use	Identified user need(s)	Resulting user requirement(s)
Self-driving bus	Comply with traffic laws and follow the prescribed route. Stop when outside objects (including pedestrians) enter the danger zone. Passenger: Stop at the bus stop and get on and off when the door opens. Some may have wheelchairs and various characteristics Operator: Although it is remotely monitored, it does not always have a 360-degree view. We are ready to respond to passenger inquiries Pedestrian: Walk on sidewalks or shoulders, cross pedestrian crossings. Be aware of cars and watch drivers in narrow spaces and pedestrian crossings	Passengers want to confirm by conversation whether the bus goes to the destination they want to go. Even if she/he use a white cane or a wheelchair, you want to get on and off while interacting with a responsible operating company. She/he wants the bus to stop immediately when it is about to pass the intended stop. Operation organization wants operators to be able to detect passenger movements and issue advance alarms so that they can quickly communicate passenger needs. Pedestrian: She/he wants operator to make decisions such as stopping or slowing down based on your own movements and intentions.	Prepare an interface that realizes normal conversation via an avatar, etc. without turning on/off the microphone switch. In the case of a passenger who needs support... (for example), if the camera detects that the target person is in the bus stop perception, contract with a nearby store and provide support (responsible is important) Prepare an interface that conveys intentions to pedestrians by issuing an OK or wink sign when pedestrians and actions are recognized

Figure 1: Context of use, identified user needs and generated user requirements (self-driving bus).

by using ISO9241-220 (Ergonomics of human-system interaction — Part 220: Processes for enabling, executing and assessing human-centred design within organizations) (ISO9241-220, 2019) and the other process assessment models.

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