Interaction Design to Enhance UX of University Timetable Plotting System on Mobile Version

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Interaction Design to Enhance UX of University Timetable Plotting System on Mobile Version

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Abstract. Goal of this research is to introduce how the implementation of Interaction Design can solve problem of UI/UX in mobile devices. The method used here is Interaction Design, the study of designing interactive digital products with user-centered approach to deliver engaging and better user experiences (UX). One of interesting interactive product is University Timetable Plotting System, an application used to manage course scheduling that produces busy screen with large timetable. Problems occurred because this system have inadequate support for user with relatively low resolution (like smartphone) compared to desktop thus affect negative UX. Interaction design workflow begins with collecting data to establishing requirement, following with designing alternatives. Based on usability evaluation, Instruction approach proved to produce high satisfaction rating rather than direct manipulation approach. This research proved that Interaction Design could be utilize on the process of creating Interactive Products. In conclusion its challenging to convert plotting UI into mobile version and this paper demonstrate that Interaction design successfully guides developer and UI designer to design better UI/UX experiences.

1. Introduction

Interaction Design had been known as a workflow to guide developer and designer to create Interactive Products, such as University Timetable Plotting System (UCTP) which create weekly schedule throughout semester that satisfies its stakeholder (mostly student and lecturer) [1,2]. This system produce busy screen with large timetable, and obviously affect negative UX on mobile devices. Excellent application interface have to build with human orientation in mind, that eventually will make good user experiences or simply known as UX [3-6].

Previous workflow model of designing interactive product have been described briefly by several research. There are several approach and workflow about conceptualizing problem into working solution. Waterfall method proved ineffective and too rigid when implemented on design process [7]. In matter of facts there are another software methodology proposed by previous research, which are Agile UX, Skeuomorphism, Five Design Sheet (FdS), and Interaction Design. Agile UX is one of software methodology that infuses designer and developer on process of product development [5]. Each set of tasks called sprint and have fluid behaviour. Designer has more flexibility to work on selected task and honoured based on task value. More features could be added in the middle of project without disrupt the main goals. However according Nielsen, UX and Agile does not collaborate well. Agile processes ignore resources needed to produce user-centered products [6]. Another development methodology is Skeuomorphism. The core concept of Skeuomorphism is how an UI component have

high resemblance with real-world counterparts both behaviour and aesthetic aspect. Skeuomorphism goal is to create interface well-acquainted therefore make user feels positive and attached to products. Some research against Skeuomorphism stated that mimicked UI could make interface look confused and meaningless to users [8]. Five Design Sheet (FdS) actually more related with prototyping methodology. FdS introduce more structured and formal way to develop low-fidelity prototype especially in paper format. FdS begins with brainstorming ideas, continue with three design sheets, and eventually converge all into one final design. The goal of FdS is delivering user-centered design and appropriate visualization design according to products specifications [9].

In Order to make plotting system produce good UX, its essentials that developer must understand user needs and build system to accomplish that. In the fields of human computer interaction, this system produces busy screen with large timetable and utilize direct manipulation to interact with objects (course, time slot, etc). There are perceptible processes in this system, beginning with setting up class and lecturer availability. Additionally, system must set hard or soft constraints based on current semester. The main focus of plotting system is how lecturer plotting their course that follow all constraints. Direct manipulation interaction types proved to be the best solution to this activity [4]. Approximately 75% screen compromise of table with lots of column and rows. Each column represent of class name, and each rows represent of time slot. Courses item can be drag around to find suitable time slots. On each frame time, system constantly generates feedback based on constraint checking. The process of drag and drop used here feels natural and reflect just like real plotting on books or whiteboard [1].

2. Research Methods

Interaction design is highly critical on conceptualizing design that satisfies user expectation according to latest standard in HCI field. Interaction design (IxD) is the discipline principle of designing interactive digital products with user centered approach and involve user in every workflow. Interaction design workflow consists of four phase which are establishing requirement, designing alternatives, prototyping and evaluating. IxD offers flexibility comparable to AgileUX but still emphasize on user oriented because IxD is iterative process. From the designer side, the IxD workflow makes it easy for designers to form UIs with variety of design alternatives. Additionally, user engagement at each stage will make it easier to evaluate the final product results. IxD accentuate system resource therefore developers and designers understand the aesthetic and systemic aspects of the system. Unlike skeuomorphism, IxD is more concerned with aspects of usability, so UI components and behaviour do not always have to imitate real world. At the prototyping stage, IxD offers freedom in prototype creation, using the term low-fidelity and high-fidelity prototype. FdS does not matter if applied to this prototyping phase. In conclusion, IxD is recommended on developing interactive digital products that emphasizes on UX and its best practice to develop system that follow flexible development methodology. This research focused on how interaction design methodology could be used to enhance UX of University Timetable Plotting System on mobile version [10]. Details of each phase displayed on figure below (Figure 1).

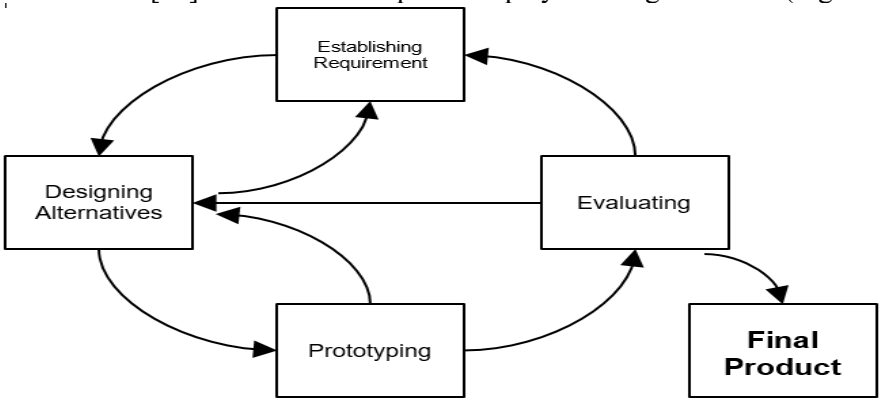

Figure 1. Interaction Design Lifecycle Model.

The main goal of establishing requirement is to understand problem space. User needs, wants and activities need to be analysed, justified, refined, and rescoped. Data gathering and analyse technique are common methods to elaborate and determine requirements. Eventually these processes help shaping the application requirements. Overall process could be iterated with minor or major adjustment. The outcome of establishing requirements is a solid foundation for next process on IxD in the forms of scenario, personas, use case and hierarchical user task. Scenario is an informal narrative feature that tells story of interaction between personas and system. Furthermore, conceptual table model is created to set the idea about how application organizes and operated. This table consist of object, attribute, and operation that bring more details to designer as base foundation for later phase. Other function of conceptual table model is to setup interface metaphors. This term related with how a collection of UI components, behaviour, and functionality that user already familiar with. Interface metaphor can help user learn how to use the application faster [10, 11].

Designing alternatives focused on creating different kind of UI on specific user task. The goals of this phase is to provide alternative options among standard UI. This phase must involve expert user and targeted user with different capability and domain, therefore the result would be “out of the box”. Prototyping is a process to produce small scale model of the actual application. Using prototype, stakeholders can interact with application easier and faster. Prototype also encourages reflection and answer question and support designer designate preferable UI. There are two types of prototypes which are low-fidelity and high-fidelity prototype. Low-fidelity prototype uses medium that not really resemblance of final product. Examples of low-fidelity are sketching, storyboards, card based, and wizard of oz prototype. High-fidelity prototype uses material that high resemblance of final product. This kind of prototype have complete functionality, fully interactive, look and feel like final product [12]. Iterative design &evaluation must be conducted in IxD lifecycle model. The obvious benefit is checking user requirements compliance and evaluates user experiences. There are three types of evaluation: 1) controlled setting; 2) natural setting; 3) setting without user. Controlled setting is usability testing with controlled and preconfigured environment. Natural setting is usability testing with real world condition to ensure the authenticity and functionality. Setting without user is used to predict user behaviour by exploit expert knowledge and experiences that related on specific topics. Usability guidelines according to Jacob Nielsen describe 11 heuristic evaluation which are: 1) Visibility of system status; 2) Match between system and real world; 3) User control and freedom; 4) Consistency and standard; 5) Error prevention; 6) Recognition rather than recall; 7) Flexibility and efficiency of use; 8) Aesthetic and minimalist design; 9) Help user recognize and reclaim from error; 10) Full complete documentation.

3. Results and Discussion

Desktop timetable plotting system is capable of displaying full screen timetable model that possess high visibility. Timetable contains course information that has been plotted to a specific schedule. The plotting process begins the user to drag the course object into the available empty schedule. The system will provide periodic feedback by checking 13 hard constraints for time slot selection (Andre). Example of hard constraint are lecturers could not teach at the same time, subjects that are in the same semester should not be scheduled on the same hour, subject must be adjusted for their capacity, there are certain courses that must be placed in special class (e.g. lab). Figure 2 shows the timetable plotting system on the desktop web version. Each colour represents different course department. Yellow for multimedia department, red for information system department, green for dual degree program department, and so on (Figure 2).

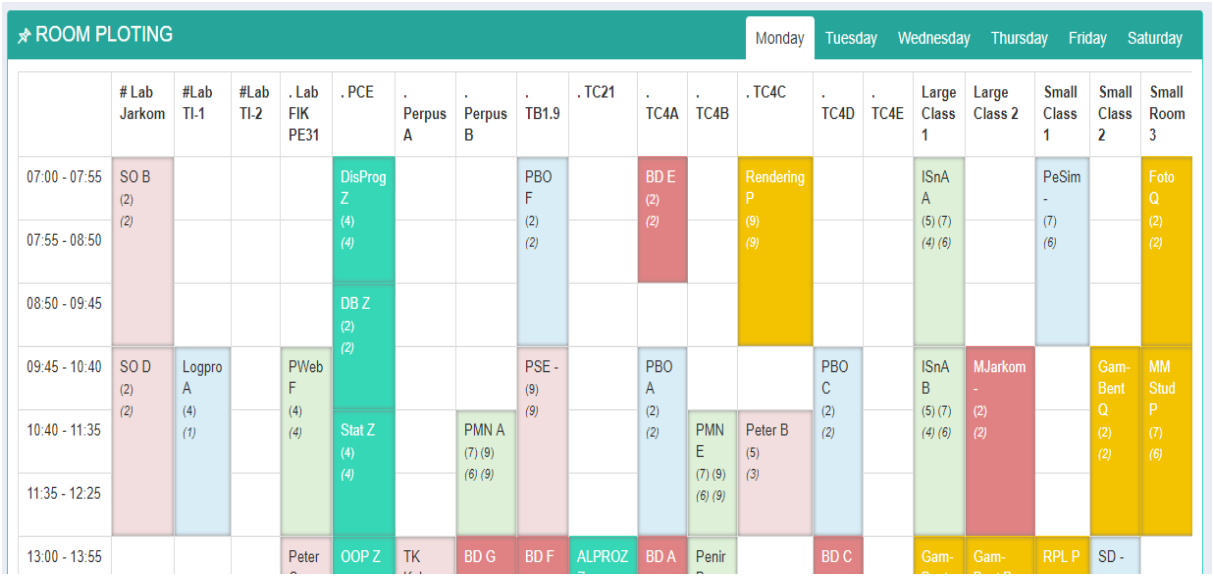

Figure 2. Room/Course Plotting Screen for Desktop Version.

Based on the interaction design stage, the first step is to determine the requirements. The process is done by interviewing and distributing questionnaires to lecturer and staff. The analysis results formulate claims and assumptions that form the foundation for the next stage. One of the main claims is that the user needs a user-friendly plotting system that support device with small screen. While the assumption used is the user does not need to know other subjects other than his/her own courses in timetable. Of course, this is debatable unless system can ensure every unavailability slot has been discarded from user view. Then based on claims and assumptions, more detailed structure generated as table conceptual model. Conceptual table model useful for detailing objects, attributes, and operations contained in the application. For example, the time slot object has the hour, minute, and status attributes that indicate the availability of the slot. Operations related to this object include display status slot and constraint check. Time slot status must be self-explanatory to indicate whether the time slot is available or invalid. In addition, when a course is plotted into the time slot, the system should check the various hard constraints and provide feedback on the validity of the course placement.

The conceptual table model specifies the interface metaphors used in the application. For instance, the operation of timetable panning which related to how user move around the content of timetable used metaphors that resemblance with how user read article in mobile apps. Swipe gesture implemented in these metaphors that could perform large timetable panning navigation. Available time slot should have displayed with striking colours with minimal design. Another metaphors interface used is to display a wizard-like button that shows the action steps that will be done. After formulating the conceptual model table, the next flow is developing prototype.

The first phase prototype uses a low-fidelity method, where the UI is sketched, and navigation line drawn between pages. The goal for the designer is to understand the application navigation structure properly. Low-fidelity also slightly describes how the plotting and timetable panning process works. Subsequently, two designs are generated for alternative purpose. First UI developed with instructional interface type, and second UI uses more direct manipulation interface type. Alternative design was tested using A / B testing which is called "two-sample hypothesis testing" that is popular in recent study case on medium scale projects. Basically A / B testing separate user on testing two different UI on completing particular actions UI is better on delivering UX. Example as in figure X shows plotting task using direct instructing interaction types. In this case the user is given step by step instructions about how to choose time slot (Figure 3).

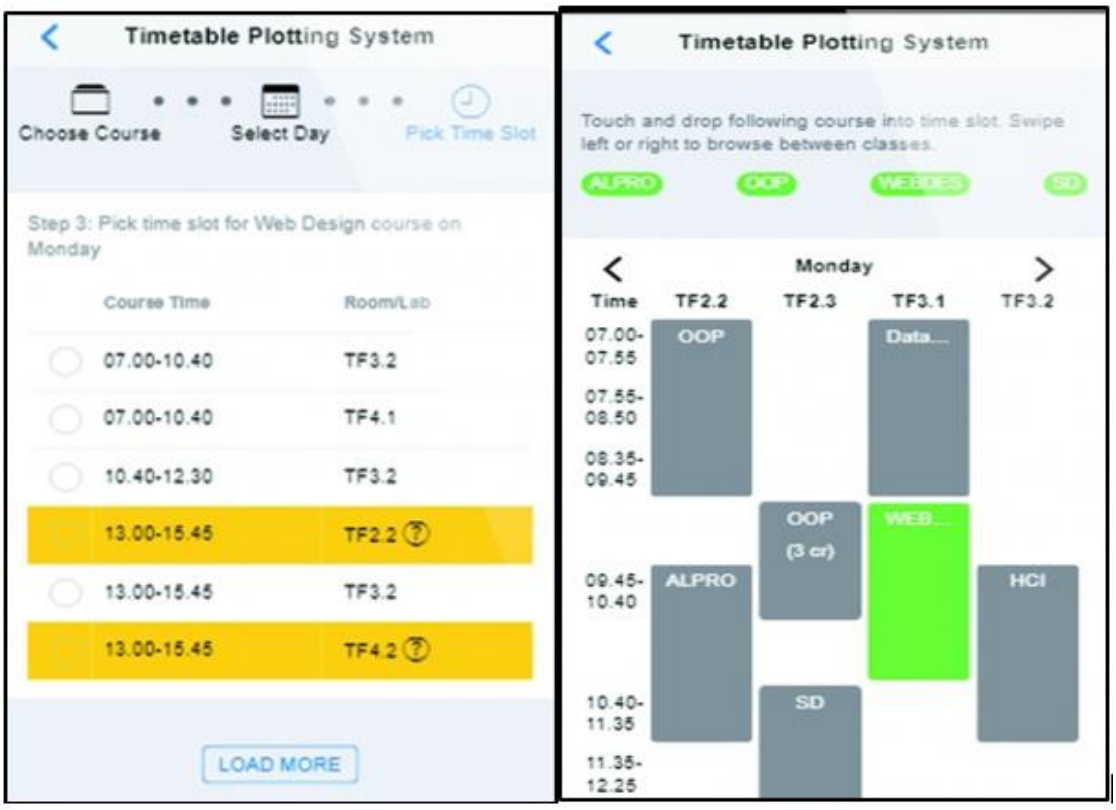

Figure 3. High-fidelity mock up for interaction UI. (Left: Instructional UI; Right: Direct Manipulation UI).

In Figure 3 shows the UI with the instructional type. Plotting process guided with step by step action that visible on the top of pages. The plotting process begins by selecting the course that want to plot. Next the screen displays the select day option and the amount of time slot available on each day. The number of timeslots is calculated exclusively based on lecturer and course constraints. The next screen displays the time slots in the available classes. Finally it shows a list of classes to choose from. Timeslot status is presented with colour coding i.e. white, yellow, and red. White code means empty and valid time slot. Yellow means there is 1 soft constraint on the time slot. While red means there are more than 1 soft constraint on the time slot. Other design alternatives like in left of figure 3 use UI with direct manipulation type. The timetable displayed full screen with clear visibility. The courses list is displayed at the top, while the timetable contains columns and rows that could be plotted. The process of plotting is by dragging from the above course list into the time slot inside the timetable. Every time the object is moved, the system will perform periodic checks of constraints. Colour encoding used as visual indicator that inform the schedule availability. For example, the colour yellow means valid, while the red colour is a violated hard constraint. Figure 3 on the right displays successful courses plotted into timetables.

Next workflow according on the IxD is evaluation. Data gathered using interview and qualitative questionnaire method with questions are tailored to Nielsen's 11 usability guideline [13,14]. Questionnaire is distributed to 20 respondents. The form of user satisfaction level diagram of the two UI models. Based on the evaluation result of UX satisfaction level above, it can be concluded that instructional UI model produce better UX and usability than direct manipulation UI. The consistency usability component gets the highest level of satisfaction than any other. The dynamic occurred during designing and developing produce interesting findings. Lack of communication between developer and UI designer makes some feature on the prototypes will not work in real condition. For example, in Instructional model prototype, the design could affect overall performance as explained before and this issue is inevitable. According to Borchers, communication between interdisciplinary departments could

produce major problem in HCI and suggested that each involved department should plan their best practices, methodology and value into form of pattern language [15]. Similar research tries to combine agile software methodology and UX development to produce product with good UX have been briefly explained in literature study. However, this integration has major problems, which focused on lack of big picture on the final product. Team must have defined precisely the projection of the output/final product [16].

4. Conclusions

Developing timetable plotting on mobile version is challenging. It's related to how to pack busy screen into small screen devices. IxD workflow successfully guides designer and app developer to create new improved UI of timetable plotting on mobile version. Alternative UI approaches were created to investigate the user interaction on understanding system in more details. Delivering mock-up with low fidelity version produce better insight on common UI flaw. Moreover, high fidelity prototype produces a near and final product, that could be used on evaluation steps. Usability test based questionnaires and interview could formulate better understanding of how UX could be enhanced. Interaction design workflow is an iterative process that each phase and component could be revised and refined until system considered final especially on University Timetable Plotting System.

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