Research Proposal on Participatory Innovation

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1 Background Literature

1.1 Human computer Interaction

Human Computer Interaction is an area of research and study which deal with analysis, design of interactive applications by involving its users in the design process; and focuses on the interaction between Human and computer applications. In some cases, HCI is also known as man-machine interaction (MMI) or computer-human interaction (CHI). According to Dix et al. [2], HCI is concerned with looking into the relationship between human and computer systems and applications that people use on their everyday life. In the any HCI design process, User should be emphasized first and then the other key aspects are firstly what tasks users want to perform when using the system; secondly which characteristics of the user could have a significant effect on their performance with the system; thirdly developing the system which meet the user's needs and finally the evaluation of the developed system should check if it meets users' needs as well as satisfying to use and getting users' feedback which helps to develop updated version of the system.

1.2 User centered design

User-centered design process (UCD) is also called human-centered design process. Human centered design processes for interactive systems, ISO 13407 (1999), states: "Human-centered design is an approach to interactive system development that focuses specifically on making systems usable. It is a multi-disciplinary activity" [8].

In UCD, all "development proceeds with the user as the center of focus"[6]. Rubin depicts the User-Centered Design Process as follows:

- The users are in the center of a double circle.
- The inner ring contains: Context; Objectives; Environment and Goals.
- The outer ring contains: Task Detail; Task Content; Task Organization and Task Flow.

"User-Centered Design (UCD) is a user interface design process that focuses on usability goals, user characteristics, environment, tasks, and workflow in the design of an interface. UCD follows a series of well-defined methods and techniques for analysis, design, and evaluation of mainstream hardware, software, and web interfaces. The UCD process is an iterative process,

where design and evaluation steps are built in from the first stage of projects, through implementation"[4].

User-Centered Design (UCD) method is used to develop product and system with high quality and usability from the perspective of users [5].

1.3 Participatory design

Participatory design (PD) is a design method and philosophy that supports the direct participation of users and other stakeholders in the system analysis and design phase. Participatory design provides a set of methods for bringing users' knowledge and valuations directly into the design as well as concerns a range of techniques that are supposed to be easy-to-learn and put low demand on the users' beforehand knowledge. General techniques include ethnographic methods, questionnaires, future workshops, mock-ups, and prototyping [5].

1.4 Machine learning

Machine learning is a type of artificial intelligence (AI) that provides computers or any program some ability to learn without being explicitly programmed. Machine learning focuses on the development of computer programs that can teach themselves to grow and change when exposed to new data. The process of machine learning is search through data to look for patterns. Machine learning programs detect patterns in data and adjust program actions accordingly [1].

1.5 Adaptive and Intelligent HCI

Nowadays, intelligent and adaptive HCI are going to famous; intelligent and adaptive system has the ability to learn from the environment and work accordingly to reach its goal. Intelligent technologies are used to achieve the intelligent and adaptive HCI but the goal always remains the same which is to improve the communication between users and machines. Several techniques are used to achieve this goal like intelligent input technology, user modeling, and user adaptively, explanation generation. An adaptive HCI might be a website using regular GUI for selling various products. This website would be adaptive -to some extent- if it has the ability to recognize the user and remembers his searches and purchases and intelligently search, find, and suggest products on sale that it thinks user might need. Most of this kind of adaptation is the ones that deal with cognitive and affective levels of user activity [7].

1.6 Big Data

Big Data as the three Vs: Volume, Velocity, and Variety and that is the most venerable and well-known definition still now. It is very fast rising research field of open source technologies such as Hadoop and other NoSQL; ways of storing and manipulating data. Now the data are in everywhere; the record of transactions, interactions, and observations. If we want to get benefit those data, we need to make it information which helps us to take decision through machine leaning method like pattern recognitions, clustering [3].

2 Motivation

In a technology-oriented and information-intense world, nowadays one of the great challenges is structuring, arranging, manipulating and delivering the information in a coherent, efficient and usable manner. There are a lot research going on the above mentioned field such as artificial intelligent especially machine learning handling big data through complex algorithm to provide the system its own intelligence using previous experiences and real time data; Human computer interaction especially user centered design, participatory design and sometimes adaptive & intelligent HCI helps to build such successful application or finds user requirements as much as close matching of requirements and adopted technologies. Aiming at comprehensively acquiring user requirements to improve the total quality of the application and user satisfaction to use the system.

I have strong interest in Adaptive and Interactive HCI especially in Participatory design and how to use the machine learning techniques to increase adaptive functionalities to improve the user satisfaction and system performance.

3 Details of Proposed Research

Since I am interested in HCI, PD, Machine Learning, Adaptive, Intelligent and Interactive HCI, Big Data; I will propose and design a system which will solve a real life problem of our daily life.

3.1 Research Topic

Tentative Research Title: Proposed and Designing an Intelligent, adaptive and interactive system (Which will handle and big real data) for based on participatory design approach.

Field of Study: Participatory design, User centered design, Human computer Interaction, Machine learning, Real time data, Big data, Intelligent and adaptive system.

3.2 Research Questions

The research questions will be as follows and I will try to figure out the research methodology and a best approach (HCI, Participatory design and Machine learning) to design an intelligent, adaptive and interactive system which will handle real time data or big data based on participatory design.

1. How to solve a real life problem using HCI and participatory design?
2. How technology can help us in case of solving that problem?
3. How efficiently use machine learning techniques which help to design interactive, adaptive and intelligent system based on participatory design methodology?

3.3 Research Objectives

The goal of this research is to develop a system based on participatory design methodology which will solve a real word problem. And the system will handle real time data as well as big data efficiently using machine learning techniques. Finally, the objective of the research will be find out a perfect design methodology based on participatory design which will gives an adaptive, intelligent and interactive system interface and system functionalities using machine learning algorithms.

3.4 Methodology

The methodology here I proposed which based on participatory design. First of all, I will find out a real life problem which will be solved by technologies. Then I will define the problem statements and extended the research questions and simultaneously I will study literature review to figure out the best approach for design such a system. The different stakeholders will be found out and developed a set of questionnaires to collect various data such as qualitative and quantitative data. The questionnaires will be helpful for user study, interviews, focus group and workshops to find out a set of stable requirements. After getting all response and result, I will analysis the collected data for proposed the system; namely use case and class diagram of

the system. Before design the system, tested some machine learning algorithms for best fitted with the system which will basically provide adaptive and intelligent functionalities. Then I will design a interactive prototype of the system for evaluation. The designed prototype could be mid fidelity or high fidelity which will decide at development time depend on research activities. Finally, I will do various evaluation processes; usability evaluation, user study. Depend on users feedback improvement of the design will be done and tested that design will fulfill user's needs and requirements. Finally, the system will be developed such a way its satisfy usability and users goals.

4 Research Plan

In the bellow sections, the research plan for participatory innovation is presented.

4.1 Literature Review (Jan – Jun 2013):

In the first part of the study, an extensive review on Participatory design in adaptive system development using machine learning will be carried out. The comprehensive review will be defined a specific system and title of thesis, review on such kind of system, analyzed and implemented that system based on participatory design. The study will be started with the literature review of existing system which using Adaptive techniques, machine learning algorithm and handle big data. Journals, books, and other relevant international publications including the documents published by universities, research institutes; will be examined throughout the study.

4.2 Questionnaire Design (May – Jun 2013):

The study will be complimented with designed questionnaires addressing to key stakeholders in the proposed system. The stakeholder questionnaires are designed to find out functional requirements of the system. The inquiry will be made on stockholder needs and goals. Since the response of the questionnaire drives to define functional requirements so in participatory design or Interaction design, building a stable questionnaire is very important. So this phase is very essential as well as important too.

4.3 Field Survey and Interview (Sep – Oct 2013):

Field study and users' interview are another efficient and important phase in participatory design. To find out stable requirements field survey and interview gives qualitative and quantitative data.

4.4 Data Analysis and Design (Nov – May 2015):

Data analysis is very complex and time consuming part in participatory design methodology since user questionnaire response could be qualitative as well as quantitative data. After analysis these data, a set of stable requirements, use case and class diagram of the system have to derive for going to design phase. Design of the propose system should be as much as simple, interactive and ensure maximum usability. My goal is to design a mid fidelity prototype of the system.

4.5 Evaluation (Jun – Jul 2015):

The evaluation phase is very important part in interactive system development lifecycle. It will ensure the usability of the system; user study could be evaluated using different methodology such as task analysis, cognitive walkthrough and questionnaire. Analyzed users' feedback, the design of the system would be improved and the system will make more usable as much as possible.

4.6 Revision and thesis writing (Aug – Dec 2015):

The research study is expected to produce academic papers to be published in local and International Journals, and to be presented in relevant conferences. The publication of the result of the study would contribution to the research field of HCI and Participatory design where the feedbacks will help me to write my final thesis.

5 Expected Outcomes

The expected outcomes of the proposed study are as follows:

1. Contribute some new techniques of machine learning algorithm in HCI.
2. Find a PD methodology to design a system that handles real time data and big data.

3. Help to HCI community in adaptive HCI system design.

4. Target Conferences

   (a) SIGCHI CHI 2015 — April 17 - 23, Seoul, Korea 2015.

   (b) HCI International 2014 22 - 27 June 2014 - Heraklion, Crete, Greece.

   (c) Mobile HCI Denmark 2015.

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