Recent Advances In Studies Of Self Service Technology For The Development Of Interactive Kiosk Services

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Abstract— The purpose of the paper is to analyze and explore the scope of Self-Service Technology (SST) to develop standalone kiosks which can aid humans in their day to day activities. SST has already replaced humans in various commercial and medical fields as product dispenser, ticket vending machine, information desks, remote disease diagnosis, manufacturing kiosks, navigation tool and so on. Factors determining the adaptability, acceptance, degree of usefulness and usability are analyzed using various techniques. Effectiveness of multiple-user kiosk is examined against single-user kiosk for commercial purposes. The data collected through various studies and experiments are analyzed to generate as well as refine the existing algorithms to provide precise and accurate feedback. The paper can provide a quick peek into various phases in the field of kiosk development during the last few years and its effect on various realms. The study assist technology aspirants to bridge the technological gap and develop highly efficient interactive self-service kiosk models.

Index Terms— Self-Service Kiosk, Kiosk, Self-Service Technology, SST, Human-Computer Interaction, SSK

1 INTRODUCTION

Recent year have seen a tremendous rise in the usage of interactive technology to solve human problems and make life effortless and less complicated. Self-Service Technology has now evolved into a separate field of study and has gained enough popularity in almost all fields in the world such as telecommunication, transport stations, medical and educational institutions. It has even replace help desk as well as information counter in various domains. Kiosk used as a survey platform is gaining wider popularity. Figure 1 shows the types of kiosk that are in use.

1.1 Kiosk As A Product Dispenser, Navigator and Survey Tool In Medical Field

Medical industry, clinics and hospitals are now equipped with medicine dispensing kiosk which can provide prescription as well as over the counter medicine. Medicines are stocked and assorted based on the demand shown by data collected through survey which may include factors like the trending medicinal brand, combinations of chemical constituents, predominant age group in a particular region and the most common ailment for which the medicine is sought after. The stocking and dispensing are monitored online and the customer data is also saved in a database. Even the out of stock situations are properly managed either by cancelling the order request or by transferring the medicine to home pharmacy.

The major problem faced in hospitals is the rush in the emergency department and problems that it could lead to such as delayed appointment, dissatisfaction in care received and the long-time duration spend under physical pain and mental stress. Causalities and emergency departments are employed with interactive kiosk diagnosis system so that medical cases can be easily addressed and diagnosed using an intelligent database rather than waiting in an overcrowded environment. Large hospitals and shopping mall have kiosk for navigation purpose that provide graphical and audio assistance to assist the visitors in reaching their target location. These kiosk can be designed to perform the function of a single-user as well as multi-user kiosk.

1.2 Kiosk Assistance in Transportation Field

Another commercial domain that demand the use of technological assistance to reduce human effort to a great extend is the transportation industry such as airport and train stations. People seems too much stressed while waiting in queue and the problem gets solved by using the kiosk facility for check-in at the airport and ticket vending and verification at the train station. Even the car parking is now monitored with help of kiosk technology and have automatic ticket vending machine that calculate the time and assign a fees. Railway have kiosk to check the booking status, to tack the train and timing details of various trains.

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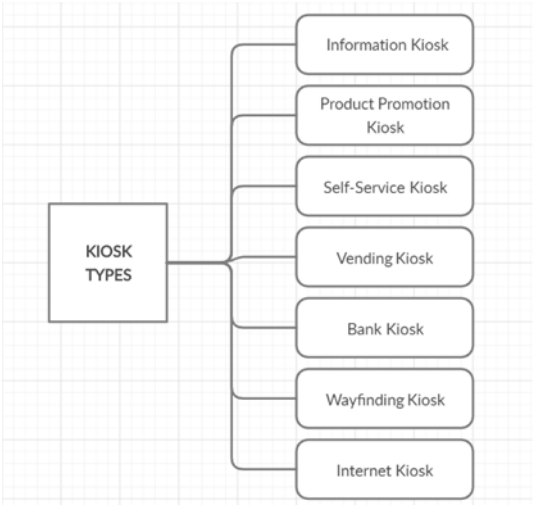


Fig. 1. Types of Kiosk Services

1.3 Kiosk Assistance In Educational And Entertainment Domain

In the business and educational fields kiosk can be used to impart knowledge by using dedicated educational kiosks as an information source and by providing technical solution for queries. Internet powered kiosk can be implemented in colleges and school where the students can interact with equipment to get technical clarification and move on by clearing their doubts.

Entertainment domain has witnessed the usage of kiosk in cinema theatres to view the details of movies and book the tickets using various payment methods. Fast food industry uses kiosk to display the food details to allow customer to take quick order and payment rather than waiting on a long queue.Shopping mall filled with gaming facility have kiosk to assist the gameplay and payment process whereby avoiding the need to have long conversation with the service staff.

1.4 Factors Affecting The Technology And Its Effects On The User

There are various features or factors that make a kiosk appealing to the user. The customer value which determine the degree of ease of use and usability plays an important role in determining the acceptability of the kiosk among different population. Kiosk has to be kept simple to such an extent that it remains user friendly to people with an average reading ability and even to people under the influence of alcohol. Usage of symbolic graphics and animations could serve this purpose. The input method like touch screen or keyboard has to well-designed such that "fat finger" effect is avoided where a person tend to tough multiple option while choosing a single option.

Kiosk hygiene is an important factor that determine the acceptability of the kiosk. Studies shoes that numerous people availing the use of kiosk can cause a pathogens and virus getting attached to the equipment surface which can cause diseases that target lungs and stomach. Proper measure should to taken to keep the kiosk clean and hygienic. Another important factor that determine the acceptance of kiosk is the environmental condition in which it is kept. Kiosk can be kept in air-conditioned cabins in places where the temperature seems to high. Even the aroma plays an important role in the ambience provided by the kiosk. Proper lighting is another important factor that affect the kiosk usability. Kiosk are supposed to be kept at safe and secure places providing a comfortable workspace to the user. People seems to enjoy the kiosk interaction when they feels safe.

Based on the responsiveness kiosk processing has to be refined to serve the purpose in given time. Ticket vending machines should have strict time constraints and are supposed to be quick to avoid missing the show, missing a flight or train. Where some kiosk need not have strict timing constraints. Any self-service equipment has to designed to provide maximum information in the most simple fashion by avoiding confusion and ambiguity.

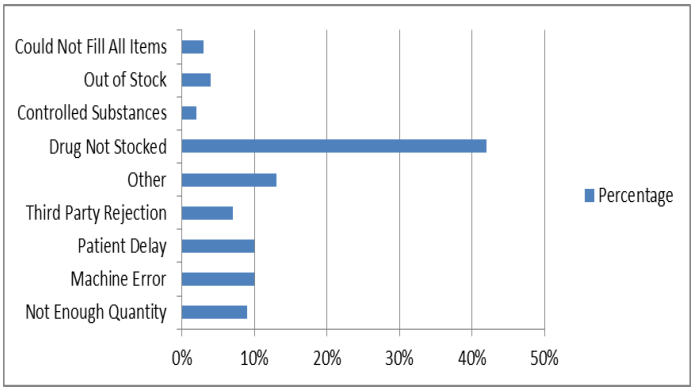
The self-service technology help the customer to get things done at a quicker pace whereby a lot of time and effort gets saved. It also helps the service employee or the agency by speeding up their service rate and reduced requirement for service staffs. Continuous analysis and feedback from the customer will also allow the maintenance department to upgrade and enhance the efficiency of the service provided by the kiosk.

2 Kiosk as a Self Service Technology and Factors Affecting Efficiency

2.1 Kiosk As A Product Dispenser

Gohram Baloch and Fatma Gzara explain the development of a standalone kiosk technology called MedCenter that provide pre-packaged medications as well as non-prescription medicine anytime to the customer[1]. The aim of the kiosk is to ensure that optimum quantity of the medication are delivered to customer in desired quantity. They deal with problems such as deciding upon the required capacity for storage , the assortment methods and the amount of medicine to be stocked inside the kiosk. They also keep track of the substitutes introduced by the supplier for an existing medicine. Test using various mixed integer optimization model using demand randomness against the sales data was done to obtain stable results. Table 1 shows various reasons for failed transactions. Numerous tests were done using real as well as random samples under variety of replacement guidelines and refilling rules and expected demand techniques. The study showed that up to 9% storage capacity can be relieved using the supplier driver medication replacement keeping in mind the service and features expected from the widely sought after medicine or product. To decide upon the stocking and medicine replacement three models of optimization were generated. Heuristic solution based on column-generation obtained a near-optimal result having 1.1% optimality gap and increased the computational speed by three times. Their future study aims at developing much better stocking and efficient product replacement techniques.

TABLE 1
REASON FOR UNSUCCESSFUL TRANSACTIONS



2.2 Kiosk As Diagnostic Tool

Asos Mahmood , et al conducts an experimental study on the effectiveness of autonomous self-diagnosing kiosk against the waiting time spent by the patients in the emergency departments(ED) in hospitals[2]. The study began by gathering the wait time data registered between 2015 to 2016 in the National Hospital Ambulatory Medical care Survey. The obtained 40528 emergency department visit data is then analysed. A multivariable linear regression model is constructed to obtain log-transformed waiting time data as the result which is then used to calculate the variations in wait time .The experiment proceeded by employing nine percentage of emergency departments in US with kiosks. The study indicated 56% shorter wait time at emergency departments compared to the ED without kiosk facility.

S Grossman, et al focuses on an interactive standalone follow up kiosk for Canadians who have pacemaker implanted due to various cardiac conditions.[3] Patients who had implants were supposed to visit Guelph hospital for follow ups which seemed hectic but the situation got difficult when they transferred the services to hospital in Kitchener. Instead of in-hospital approach patients were asked to continue their follow ups using interactive the kiosk. Total number of patients were categorised into two based on kiosk and in-hospital follow ups. Medical data related to implantation as well as general information like distance travelled for follow up and its frequency was recorded. All the information stored prior to follow up and diagnosed data are analysed to study the patient's condition to give proper feedback. Cost related to the clinic environment including the space and equipment used for clinic as well as the Staff expenses are compared with expense caused by the kiosk follow up. Kiosk follow ups were observed to be safe, more cost effective and has positive impact on patient safety and resource distribution.

R.G. Maunder and J.J. Hunter has created a self-diagnostic kiosk for to assess the mental and overall health of the patients that can also provide a proper feedback. The kiosk collect data to create hypothesis on the health and test it to analyse the device's feasibility[4]. With the permission from Research Ethics Board the kiosk got installed on a dedicated internet platform to survey the subjects to be diagnosed. The analysis was backed by verified database collected prior to kiosk installation. The characteristics of the user and diseases that include a wide range of related assessment parameters was carefully collected ,stored and analysed. The data was also categorised based on age, education and income for better analysis. Number of users availing the service showed a linear curve and more that 50% were diagnosed with specific medical condition. More percentage of analysis showed a significant rate of psychological problems in the subjects and the value was closed to the previous surveys. Even in the absence of significant popularity the kiosk gained the support of new subjects steadily over its beginning stage. The tool got categorised into analysis instruments based on characteristics of the illness with each having own variables. The technique of separating the diagnostics helped more specific analysis and feedback to the user in terms of disease identification and analysis. Yongqiang Lyu, et al has tried to model and enhance a healthcare Self-Service Kiosk(SSK) to diagnose and obtain health parameter measurements and to device all possible solution as feedback[5]. The measurements taken individually as well as collectively for a population was refined for better accuracy and was tested individually for the degree of dependability. The measurement variations seemed less compared to previous studies and the measurement device was found to be dependable and optimized.

2.3 Kiosks In Manufacturing Industry

Ashif Sikandar Iquebal , et al studies about kiosks that are dedicated for cyber manufacturing devices and also proposes a new technique to overcome the complication of standalone laser kirigami process. The self-controlled monitoring of the equipment function and the tool movement of the laser kirigami in order to create component of varying forms is proposed to be achieved using peel-and-stick sensors that can be embedded on the precursor sheets used[6]. The dihedral angle in between the facets that are being bent is estimated and analysed using image processing. The sensors mounted on the surface of the sheets will act as a swarm of remote sensors and provides data on the position and angle of the sheets that are being formed. The data is obtained and used to study the progress using properly fixed cameras. The observed data is studied to generate control signals for process criteria like transverse feed frequency as well as the intensity of the laser being projected. The technology is observed to increase the quality of the products and reduce the error rate related to the process state to less that 2% at 10 fps(Frames Per Second).

2.4 Kiosk As An Information Platform

Mehmet Ilker Berkman and Adem Karahoca explains about a multiple-user kiosk using a table-top touch screen information system. The study concentrate on the degree of variation in the effectiveness of usage when the information desk is handle by

a single user and by a group of user[7]. One way Multivariate Analysis of Variance(MANOVA) highlighted a notable significance between the groups while there seems to be no difference in the time taken to finish the job. Results indicated that the kiosk has more success rate when used as a multi-user equipment due to cooperation between the users in device operation. Camille Kamga, et al has implemented a similar interactive touchscreen kiosk at NY(New York) transportation facilities to serve as an information counter[8]. The information provide an insight into the user experience and expectation. The paper and the study explain the strategies that can be implemented and changes that can be brought out for an effective implementation of an interactive kiosk.

2.5 Kiosk Hygiene

Heba Alhmidi MD, et al argues that there is a high risk of infection from pathogens and viruses that target lungs and stomach while using public SSTs like kiosks[9]. Since hand sanitizer fails to achieve its hand hygiene purpose to a good extend they propose an automatic disinfection method. An automatic sweeping systems radiates ultraviolet-C over the entire touchscreen surface as the current user leaves to make sure the radiation only affect the screen and not the user.

2.6 Kiosk As A Navigation Tool

Patricia Wright, et all discusses an interactive kiosk design that navigate the visitors to 16 target destinations within a hospital using dialog boxes with voice assistance , map animations and photographs. The kiosk uses pre stored computer logs, observation data of kiosk user and interview details with the reception staff. The technique proved to be useful for clients visiting a hospital and the same information can be provided through internet along with the appointment form[10].

2.7 Surveys on Kiosk Technology

Muhammad Shahid Iqbal, et al studies how the services assisted by technology affects the attitude and satisfaction of the customer. With the help of LISREL, Structural Equation Modelling is implemented using the data collected during the survey [11]. The results clearly expressed the positive and welcoming attitude the consumer have toward self-service technology. Eoghan Considinea and Kathryn Cormicana does a similar study to understand the customer interaction with the self-service technology in the realm of business where technical workers interact with a dedicated kiosk to absorb technical services[12]. Keeping design, functionality, security and customization as prime aspects data are collected from consumers to bridge the gap existing between theoretical studies and practice.

2.8 Factors Affecting Kiosk Acceptance

Sungwoo Choi , et al starts the study by comparing the effects of styles of language usage on service agents like human , robot and kiosk. The two significant styles taken into consideration are literal and figurative language styles[13]. To study the various factors and its effects they put forward three hypothesis .To test the hypothesis they conducted a 2 x 3 ANOVA on the language style effect, service encounter and on perceived credibility. The study says that the effect mainly depend upon the agent of service used , and customers are more impressed with the usage of literal language while interacting with the human agents .It further indicated that the presence of anthropomorphism make the service robot more convenient to user when it is incorporated with human like literal language. The lack of human like features in service kiosk makes it less affected by the varying language styles. To confirm these they put forward three hypothesis .To test the hypothesis they conducted a 2 x 3 ANOVA on the language style effect, service encounter and on perceived credibility.

Nursyuhada Taufik and Mohd Hafiz Hanafiah conducts an analysis on the usefulness and simplicity of self-service kiosk technology like check-in kiosks at airports[14]. To check the adaptability of the technology and the convenience provided by the kiosk to the passenger the concept of technology acceptance model(TAM) is used. Need for human interaction is also included as a moderator to evaluate its effect on passenger attitude towards the kiosk , how it affects parameters like Perceived Ease of Use (PEOU) and Perceived Usefulness(PU).Kuala Lumpur international Airport 1 and Airport 2 was chosen as the region of study on passenger perception by employing standalone kiosk. The studies showed that the PEOU (the degree of usefulness) and PU(degree to which the effort to be taken seems negligible) have a strong impact on the customer acceptance of features and services provided by the service kiosk. The study also provide a deep insight into various factors which can improve the behaviour of standalone service kiosks from a customer point of view. Various factors affecting kiosk acceptance is shown in Figure 2.

Yulia Vakulenko, et al explains about the consumer related key values for a kiosks with self-service capability. They integrated the value groups(four) and customer value(three) elements into a frame work for SSK (Self Service Kiosk) customer value[15]. The disconnected and conflicting nature of the previous studies are addressed and an attempt is made to bridge the gap that exist in the field of self-servicing kiosks. These findings aids the various stages of SSK kiosk in the decision making process from the birth of a new idea to its applications and development of the self-service technology and helps to make it more efficient and advanced in terms of servicing as well as kiosk management. The study will help those industry like airport and railways where people seems more excited with technology and hope for more self-servicing solutions. The study focus from small details like aroma and appearance to complicated parameters like quick response time and immediate feedbacks and how it aids customer satisfaction and perceived usefulness and ease of use. The analysis clearly indicated that the each element has a unique influence on performance and characteristics of the SST(Self Service Technology) kiosk regardless of the value groups. The study consider various parameters as elements of values. A new group of values aspects are also adopted along with this

to analyse the extant technologies and its development. The main limitation is due to the fact that the acceptance level of the kiosk among the customer seems to be subjective. The next limitation is the lack of a generalised framework structure that can be applied to any type of kiosk.

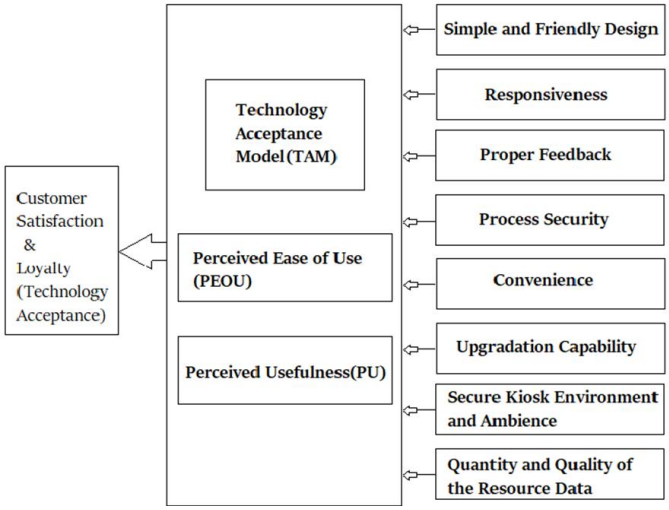


Fig. 2. Factors Affecting Kiosk Acceptance

3 Limitations and Discussions

Kiosks tends to be a simple solution to all customer problem when data collected for development of kiosk are extremely reliable and through which it recognize the intentions of the customer so as to generate a specific feedback. Lack of informal discussion can make people uncomfortable in situation where the kiosk information is incomplete. Kiosks developed into educational and technical information desks should have attractive features to make sure learning is not boring but amusing. Kiosk language style has to be made into a generalised format such that it is conceivable by most population regardless of age group and literacy level. Generalised kiosk features faces problem when the customers view vary to a large extent. Hence each dedicated kiosks must study its target customer to decide upon the features it should incorporate. Various measuring instruments provided with diagnosis kiosk should be properly calibrated to get accurate output to provide a reliable feedback to the patients and hence maintenance has to be given higher priority. Kiosk used as a multi-user tool provides more result due to the cooperation between the user in helping each other. Kiosk hygiene remains a greater challenge since most kiosk requires interaction through touch and can be a potential reason for transfer of pathogen and viruses like corona virus into the touch interface or the keyboard.

4 Conclusion

Self-Service Kiosk technology proves to be of immense potential providing information, solution and services at fingertips. Through continuous data collection and efficient research, the capability can be refined and enhanced to serve human in myriads of industries. The kiosk technology has to made more secure to make sure that the data collected is not manipulated and user information remain safe. The advent of cloud storage to store and manipulate massive amount data could serve as a strong boost to the Self-Service Technology. Kiosk technology has a promising future to accomplish complicated tasks through simple steps in a secure way if the technology is studies and developed in a systematic method.

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