Towards the Development of a Usability Evaluation of A Pregnancy Health Monitoring System Using IoT

Mary Jane C. Samonte
School of Information Technology,
Mapúa University, Manila, Philippines, mjcsamonte@yahoo.com

Bea Shaneal Francesca F. Franco, Helisha A. Ocampo, and Mauryn Angela F. Rodriguez
School of Information Technology
Mapúa University, Makati City, Philippines
bsfffranco@mymail.mapua.edu.ph, haocampo@mymail.mapua.edu.ph,
mafrodriguez@mymail.mapua.edu.ph

Abstract

Pregnancy health monitoring systems enable women to have access to remote quality care during pregnancy. The integration of wearable devices has had a positive impact on maternal health care monitoring technologies. Maternal health requires a comprehensive structure that permits pregnant women to be closely monitored in a continuous manner. As a result, the necessity to assess its usability grows. In order to identify what features and processes implemented in existing applications aid in overcoming the usability challenges of pregnancy-related apps, related studies involving pregnant health care monitoring systems, pregnancy-related apps, and their usability evaluation were found and examined in this literature review. From the literature reviewed, there are several usability issues that are frequently found in pregnancy health monitoring systems such as the lack of ability to provide better health outcomes and lack of improvement in health monitoring. The analysis showed that these issues stem from the lack of effectiveness and ultimately result in negative impacts on user experience. This was likewise the most prominent usability challenge found in the literature reviewed. Other usability challenges found include the lack of interest in the applications, having too much incomprehensible information, and apps being non-user-friendly. In addition, the study identified that IoT-based process flows are helpful in recording data and maintaining user engagement. With this, the study proposed the development of a pregnant health monitoring system based on IoT-based processes. A usability evaluation was planned for the proposed system to test and assess its usability.

Keywords

Pregnancy Health Monitoring System, Usability Evaluation, IoT Wearables, Usability Challenges and Process Flows.

1. Introduction

Electronic health (eHealth), according to the World Health Organization, is the utilization of information and communication technologies (ICT) cost-effectively and securely in health-related fields (World Health Organization 2022). Forms of interventions were found to have been increased within the grounds of the emergence of eHealth systems (Sherifali et al. 2017). Furthermore, eHealth technologies are found to be beneficial for women's reproductive health care. Meanwhile, Internet-of-things (IoT) is defined as, the control of hardware and software combined with the utilization of the Internet. It is likewise used for exchange as well as the association of data through sensors and actuators (Priyanka et al. 2019). Li et al. (2020) investigated the impact of IoT on maternal healthcare monitoring technologies. The study proved that IoT had a huge impact on pregnancy care as women favored wearable devices such as smartwatches and bracelets during pregnancy. Many studies regarding the development of pregnancy health monitoring systems or maternal monitoring systems have incorporated IoT wearables in the applications. Sarhaddi et

al. (2021) stated that there is a need for maternal health to have a thorough structure or framework that allows pregnant women to be monitored continuously. A pregnancy health monitoring system involves monitoring of the pregnant woman's health state as well as the fetal heart rate (Hema et al. 2020).

Furthermore, Overdijkink et al. (2018) stated that pregnancy applications could be helpful to a healthy lifestyle during pregnancy since it is a critical important learning in the lives of young women. Application use is often associated with intentions to change diet and physical activity. Moreover, exposure to potentially harmful apps and participation in studies using non-evidence-based mobile apps should be carefully considered, especially during pregnancy when women are sensitive to external influences. Therefore, information on usability and effectiveness is crucial for implementing new apps in pregnancy health care. With this, the study would like to identify what features and processes implemented in existing applications aid in overcoming the usability challenges of pregnancy-related apps.

1.1 Objectives

This paper focuses on reviewing related studies regarding usability evaluation of pregnancy-related applications. The goal of this literature review is to identify the following: (1) challenges in the usability of pregnancy-related applications, (2) identify essential features and processes implemented in pregnancy-related apps and (3) recommend ways to improve process flows through the use of IoT and evaluate system usability to address previous challenges.

2. Literature Review

The discussions presented below contain information that are significant to the study, and to its objectives. The literature presented is divided into two main parts which are "Pregnancy Health Monitoring System" and "Usability of Pregnancy-related Applications", in order to address the first two objectives of the study.

2.1 Pregnancy Health Monitoring System

2.1.1 Pregnancy-related Applications

Monitoring a pregnant woman's health state using instrumental methods with automated questionnaires designed to quantify initial current health state comprise the remote dynamics of a pregnancy health monitoring system. This allows for the early detection of negative trends in a woman's health during pregnancy, as well as the possibilities of pregnancy complications (Ryu et al, 2021; Hema et al, 2020). Pregnant women have been found to likely access mobile apps for health information throughout their pregnancy, claiming that it brought aid in maintaining a healthy lifestyle. A study in China revealed that almost half of their respondents used pregnancy-related apps to monitor fetal development, and their nutrition and diet. Being able to access evidence-based information, expert opinions, and tailored advice were highly appreciated for it kept them informed about their own health and allowed them to improve and maintain their adopted lifestyle (Wang et al. 2019; Frid et al. 2021; Liu and Wang 2021). The success in implementation and deployment of pregnancy apps lies in the usability as rated by the participants. The study by Woodworth (2021) expressed that the ability of an application to employ information design while decreasing the cognitive load has helped users to better understand the informational contents of the app. In doing so, it is important to take note that making the app accessible and usable for all populations - may they be the underserved, non-native English speakers, or others who are not as knowledgeable when it comes to medical data - necessary. Additionally, social support was found to be a useful feature in pregnancy apps since many tend to seek communication with others to find someone that they could relate to. Pregnancy apps nowadays not only focus on delivering health information, but also push users towards a healthy lifestyle. The Kegel Exercise Pregnancy Training (KEPT) app was evaluated with regards to feasibility and usability by Jaffar et al. (2022). The application aimed to utilize pelvic floor muscle training (PFMT) to treat urinary incontinence (UI). Results revealed that using the app allowed them to adhere to the PFMT and that the system was credible in disseminating information and exercises that helped them work on their UI problem. Indeed, pregnancy apps are a huge help for pregnant women. However, with the advancements being made in the health and IT industry, the use of pervasive technologies has contributed a lot in providing sensitive medical information to medical professionals. In terms of pregnancy, using wearables and IoT created a breakthrough by allowing users to cater to pregnancy care management while reducing possible risks and complications, and providing

seamless communication among users. Such applications have had ratings of quality, usability, and usefulness on a high level, and the incorporation of pervasive technologies have brought significant benefits to all actors in the system. With this, better patient-physician communication was enabled. It also allowed doctors to have an improved version of existing patient health records. More importantly, these apps have recorded a high usage, mainly because users were requested to enter pregnancy-related parameters on a daily basis (Bjelica et al. 2021; Liu and Wang 2021).

2.1.2 Process Flows of Pregnancy Monitoring Systems

The use of IoT in telemedicine has been widely used to deliver critical data such as blood pressure, pulse, oxygen, heart rate, and weight. It has allowed the healthcare industry to cater to all people, providing cost-effective solutions and allowing everyone to maintain good health. In a study conducted by Das (2020), a wearable system wherein a fetal doppler, pulse sensor, and temperature sensor was connected to a smart phone to monitor the mother and fetal heart rate, and temperature was developed. The process flow of the wearable system starts with the mother accessing the system, and wearing the above-mentioned devices. Monitoring will commence afterwards. The temperature and heart rate will be gathered at the 5th week of gestation since the baby's heart begins around this time, with its heart rate similar to their mother's. The fetal heartbeat can be monitored using a doppler as early as 10 weeks, depending on the doppler being used. By the 18th week, the biometry parameters for both the mother and the child are also measured. The following data gathered from the devices will be displayed in the app, and shall be forwarded to the local midwife for monitoring.

Meanwhile, the process flow by Hema et al. (2021) is divided into four levels. The first level indicates the usage of portable medical devices in which biomedical signals are sent and collected. To reduce medical error, the data collected from the first level is structured at the second level. This is also where the automated questionnaire regarding the initial assessment of the current health state of a pregnant woman is answered. At the third level, monitoring and predicting the health state based on the quantified data obtained from the assessment. The remote dynamics of a pregnancy health monitoring system include monitoring a pregnant woman's health utilizing instrumental approaches with automated questionnaires meant to measure initial current health condition (Ryu et al. 2021). This aids the physician in making a decision on how to approach the medical situation of a pregnant woman, which is represented at the fourth level.

2.2 Usability of Pregnancy-related Applications

2.2.1 Usability Challenges in Pregnancy-related Applications

Pregnancy-health related applications have been deemed useful but its users are controlling and taking note of their health and lifestyle. Such applications have had positive reviews based on usability evaluations by the respondents. However, it is normal that there will be challenges to be faced since limitations remain present in every system. Overdijkink et al. (2018) did a systematic review on the usability and effectiveness of mobile health technology-based lifestyle and medical intervention apps for pregnant women. 29 studies were included in their study, and though most reviews were positive, some respondents thought otherwise. Most respondents have shown their interest and intention in using mHealth apps. However, after 10 weeks of participation, a 24% drop in the response rate was observed. As for applications that featured smoking cessation, 24% of the users thought that the texts that they were receiving were annoying, and 26% of them felt like they were receiving too many texts. Meanwhile, in an application that focused on gestational weight gain, no significant difference in the mean gestational weight for those who completed intervention with an initial weight of 6 pounds or less was seen. Overall, the said study recommended for future works that further investigation on usability evaluation must be conducted in terms of effectiveness. On the other hand, a study conducted by Yee et al. (2020) did a usability testing of SweetMama, an application for the pregnant which provides diabetes education and support. Even though users found the system to be highly user-friendly, informative and engaging, the study recommended improving the effectiveness of the app to improve maternal and neonatal diabetes-related outcomes. Hussain et al. (2018) also had an issue with effectiveness, together with efficiency and learnability. As they were evaluating the mobile usability of the Amila Pregnancy app, participants showed trouble in understanding the

iconography, executing tasks, and navigation throughout the app. Participants also expressed that the main menu was mainly hard to locate since the position and size of icons and buttons were unnoticeable. In line with this, it is also important to take note of the medical information and advice that is being placed in the app since some may struggle with understanding the provided information (van Beukering et al. 2019). In Finland, a study was done to evaluate the feasibility of smart wristbands for continuous monitoring during pregnancy and postpartum. The smart wristband was concluded to be feasible with pregnant women in their 2nd and 3rd trimester using them consistently. However, the usage dropped during postpartum. Other challenges were also observed wherein some respondents expressed that they were not able to wear their wristbands at work. 19 participants claimed that using the wristband did not contribute anything significant to their behavior, while some of them found it hard to charge and synchronize with other devices. Some reported that it was uncomfortable, and that viewing of data in the wristband was unreliable, while also expressing their fear that they might scratch their babies with these devices (Grym et al. 2019). Even though pregnancy apps are useful, it is essential to apply improvements onto these apps based on the HCI perspective. Developers must consider usability issues that users might experience. Improving usability by enlarging fonts for headers, placing meaningful titles and labels for every interface, providing simple and easy navigation, application of necessary pop-up or hover messages, and maintaining design consistency and proper mapping should be taken into consideration in order to deliver a user-friendly application offering users a good experience (Kundu et al. 2020).

2.2.2 Usability Evaluation Methods

Numerous applications are being developed, catering to pregnancy health. With this, usability evaluations have become an essential for it aids the developers in improving the interface and usability of the app. Usability evaluations using Nielsen's usability principles, Nielsen's severity scale, and system usability scale are commonly used by researchers in identifying the performance of their developed app. In a study conducted by Hussain et al. (2018), the Amila Pregnancy app was evaluated, following the five usability qualities in line with Jakob Nielsen's usability principles which are effectiveness, efficiency, learnability, memorability, and satisfaction. In the study of Overdijkink et al. (2018), they also utilized effectiveness as a usability principle to be considered in evaluating the app's usability, together with the acceptability and feasibility. Yee et al. (2020) also evaluated the usability of their developed app together with the user satisfaction. A user interaction metric was utilized to further measure the app's usefulness, ease of use, ease of learning, and satisfaction. Meanwhile, a mobile health app which aimed to disseminate pregnancy-related work advice was tested by 12 working pregnant women wherein they performed 9 tasks. The study utilized the Nielsen severity scale in rating the usability problems. They also made use of the Intrinsic Motivation Inventory (IMI) score and the System Usability Scale (SUS) questionnaire in the evaluation of the value of the app (van Beukering et al. 2019). A study in Bangladesh assessed the usability of pregnancy tracker applications that were developed for the locals. A heuristic evaluation was accomplished based on Bertini et al's heuristics. Another evaluation method, semiotic evaluation, was utilized wherein the interface elements such as buttons, icons, symbols, links, and images were evaluated by the respondents (Kundu et al. 2020). As for the study of Grym et al. (2019), interviews were conducted with the participants, utilizing a Liker scale with 1 being the worst, and 5 being the best. Users were interviewed for every trimester and during postpartum. The study tabulated and evaluated participant's experiences with the wristband based on its functionality, wearability, need for assistance, and parameters of interest.

3. Methods

The methods will be centered on obtaining related literary works that are relevant to the research. Among the databases employed in the study's selection procedure, notably in the identification stage, were IEEE Xplore (Institute of Electrical and Electronics Engineers), Semantic Scholar, PubMED, AJOG (American Journal of Obstetrics and Gynecology), and MDPI (Multidisciplinary Digital Publishing Institute). The literature will next be assessed for relevance to the study. Finally, the literature will be screened and the studies that have been included will be reviewed. The flow of procedures for this literature review is depicted in Figure 1.

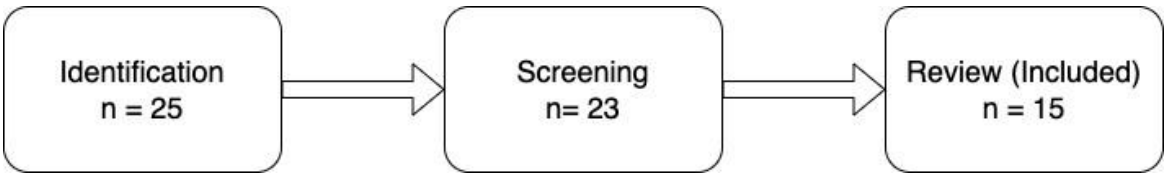

Figure 1. Procedures Flow

4. Data Collection

To collect data for the first objective, which is to identify the challenges in the usability of pregnancy-related applications, studies relevant to usability evaluation of such apps were selected from different databases namely IEEE Xplore (Institute of Electrical and Electronics Engineers), Semantic Scholar, PubMED, AJOG (American Journal of Obstetrics and Gynecology), and MDPI (Multidisciplinary Digital Publishing Institute). In the identification stage, the first step is to define the keywords that will be used to find relevant titles. The keywords "usability evaluation," "pregnancy health monitoring system," and "pregnancy app" were used in the search. The selection process of the literature review for the second and third objective is similar to the process of the first. Keywords for these objectives are defined in the identification stage. An additional keyword “IoT wearables” was added. A total of 25 studies were chosen and filtered based on the keywords. Second, titles were chosen for the screening stage based on the relevance of their abstracts. A total of 23 studies were chosen at this stage. The studies from the screening stage were filtered for full-text screening in the third and final stage. From this, the studies were narrowed down to 15, which are to be reviewed and analyzed. Figure 2 presents the data collection process of the study.

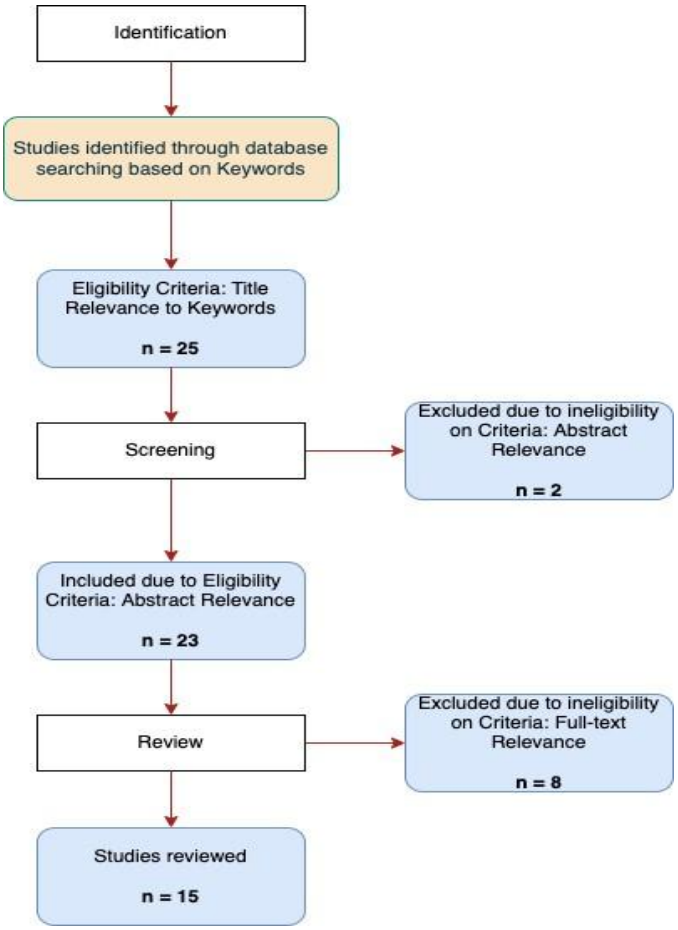

Figure 2. Data Collection Procedure

5. Results and Discussion

Out of 25 studies that were initially collected and identified, 15 studies were chosen for full-text review and analysis. Eligible studies about usability challenges of pregnancy-related applications were discussed in Literature Review. Furthermore, this chapter presents the results of the qualified studies and was analyzed to fulfill the objectives accordingly. Usability challenges and process flows of previous studies were analyzed and evaluated to address them in the proposed system.

5.1 Numerical Results

To answer the first objective, literature regarding usability evaluation of pregnancy-related applications were identified. The Literature review, under the subheading Usability Challenges in Pregnancy-related Applications, contains a thorough discussion of the identified literature. Table 1 presents the tabulated results of the different challenges found in different pregnancy-related applications. Out of four challenges presented in Table 1, lack of effectiveness was the most challenging usability quality in pregnancy-related apps. This indicates that future pregnancy-related apps and studies should focus more on improving their effectiveness.

Table 2 presents the included studies in which identified features and processes implemented in the literature about the pregnancy health monitoring systems. Specifically, the table highlighted the features found commonly in studies aforementioned. From this, it is indicated that IoT integration in pregnancy health monitoring systems are helpful in recording data and maintaining user engagement in consistent usage of the app.

Table 1. Identified Usability Challenges in Pregnancy-related Applications

Usability Challenges in Pregnancy-related Applications	No. of Studies	References
Lack of Interest in Application	2	Overdijkink et al. (2018); Grym et al. (2019)
Cognitive Overload or Incomprehensible Information	2	Overdijkink et al. (2018); van Beukering et al. (2019)
Lack of Effectiveness	5	Hussain et al. (2018); Overdijkink et al. (2018); Grym et al. (2019); van Beukering et al. (2019); Yee et al. (2020)
Hard To Navigate and Not User-friendly	2	Hussain et al. (2018); Kundu et al. (2020)

Table 2. Identified Features and Processes Implemented in Pregnancy Health Monitoring Systems

Identified Features and Processes Implemented in Pregnancy Health Monitoring Systems	Number of Studies	References
Monitoring Pregnancy Health Through Wearables and Sensors	4	Bjelica et al. (2021); Liu and Wang (2021); Das (2020); Hema et al. (2021)

Health Information Access through Social Support and Remote Consultation Modules	5	Wang et al. (2019); Woodworth (2021); Bjelica et al. (2021); Liu and Wang (2021); Hema et al. (2021)
Health Interventions Through Educational Videos	1	Jaffar et al. (2022)
IoT-based Process Flows	2	Das (2020); Hema et al. (2021)

5.2 Proposed Improvements

The findings above indicated gaps and opportunities in the area of usability evaluation of pregnancy-related apps, including studies that suggest the use of IoT wearables in such systems. The primary concerns revolve around the application's user experience, such as the lack of certain features such as real-time data transfer from IoT components, social support community modules, and direct medical advice engagement. In addition, the need to incorporate user experience by improving user interfaces was one of the highlighted results of the literature review. With this, the study proposes to develop a pregnancy health monitoring system with the use of IoT in vital sign tracking and evaluate the usability of the web application, focusing on the effectiveness, efficiency, memorability, learnability, and satisfaction based on Nielsen's 5 usability principles. Figure 3 reflects the proposed process flow of the proposed system. The process involves two users: doctor and patient. The process will begin with signing up, profiling, and booking the appointment. Afterwards, the assessment will take place wherein the generation of prescription will follow. The health monitoring involves the utilization of a smartwatch and a fetal doppler to monitor the vital signs of the patient.

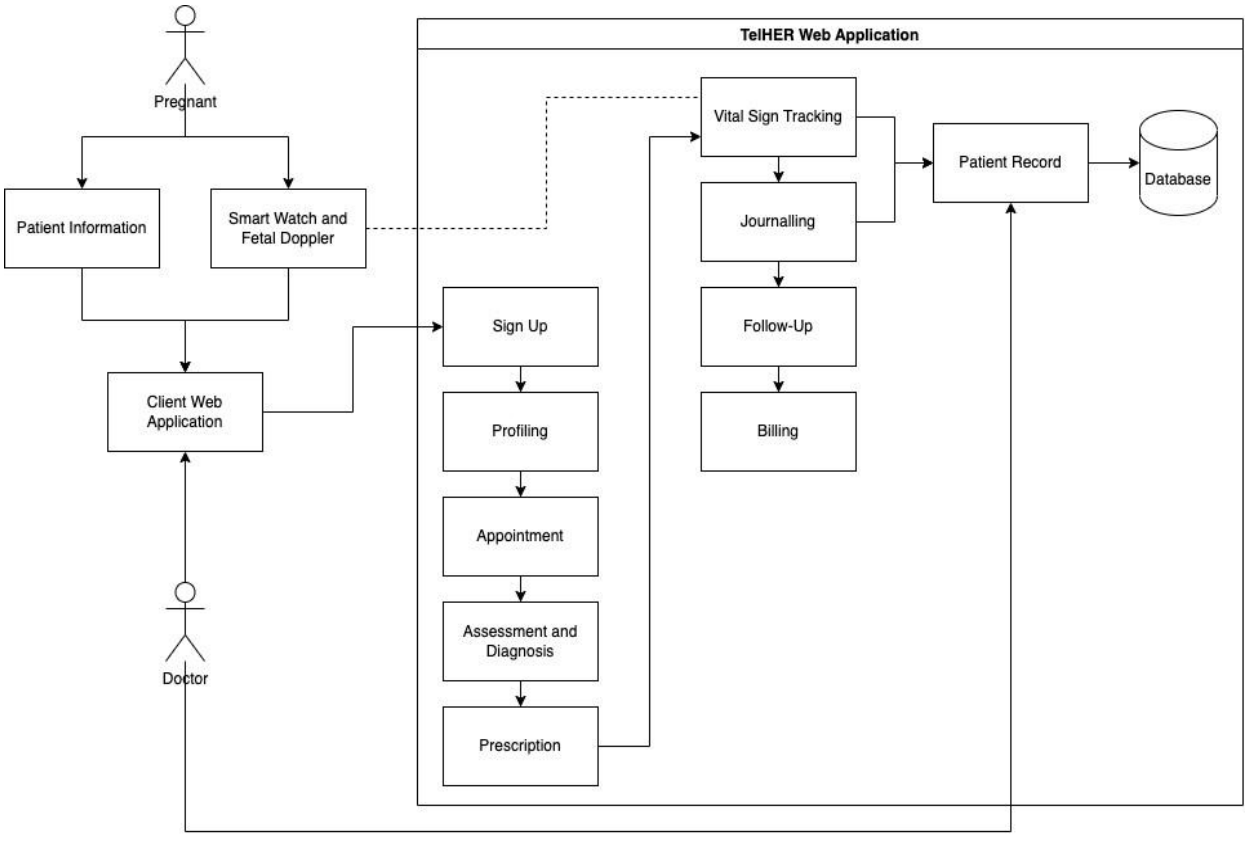

Figure 3. Proposed Process Flow of the Proposed System

Meanwhile, Figure 4 indicates the conceptual framework of the proposed study. The application consisting of the different components are laid out in the diagram. Since the proposed application will be a pregnancy monitoring system, journaling, with the doctor's advice through teleconsultation, will serve as one of its features as it is known to be a tool that allows pregnant women to better identify triggers for poor health, keep track of good and bad days, and put their experiences into context (Godfrey-Isaacs 2019). In implementing IoT wearables, their APIs will be integrated into the application for vital sign tracking. This collected data from the wearables are included in journaling where the patients log their vital signs in along with their comprehensive entry of experiences. In line with that, index-repeating features contribute in tracking the patient's progress through the journal entries a patient logs in. Index repeating is a mechanism that uses the difference between two indexes to enable future broadcasts. TelHER, comprising all the entities aforementioned, will be undergoing usability evaluation where it will be tested for five usability principles: effectiveness, efficiency, memorability, learnability, and satisfaction.

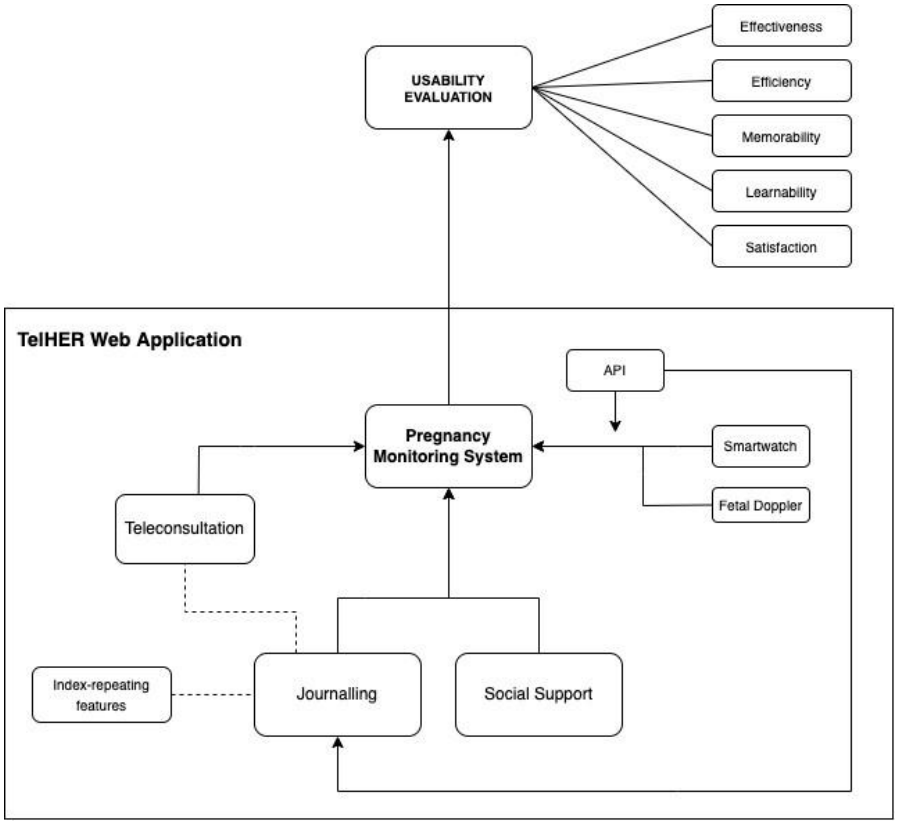

Figure 4. Conceptual Framework of the Proposed System

6. Conclusion

Upon further analysis, there were several usability challenges found in the gathered pregnancy-related applications that required further improvement and testing, and most of them expressed the system's lack of effectiveness. Features and processes of existing pregnancy health monitoring systems were also identified which served as bases for the proposed system of the study, utilizing Nielsen's usability principles to evaluate the system usability to address previous challenges encountered by past studies.

References

Bjelica, D., Bjelica, A., Despotović-Zrakić, M., Radenković, B., Barać, D. and Đogatović, M., Designing an it ecosystem for pregnancy care management based on pervasive technologies, *Healthcare*, vol. 9, no. 12, 2021.

Das, S., Wearable fetus monitoring: an iomt approach, *Journal of Scientific Research*, vol. 64, no. 2, pp. 389-393, 2020.

Frid, G., Bogaert, K. and Chen, K., Mobile health apps for pregnant women: systematic search, evaluation, and analysis of features, *Journal of Medical Internet Research,* vol. 23, no. 10, 2021.

Godfrey-Isaacs, L., Maternal journal how creative journaling can support pregnant women, new mothers, and those that birth, with a history of mild to moderate mental health problems, *Perspectives in Public Health,* vol. 139, no. 3, pp. 119-120, 2019.

Grym, K., Niela-Vilen, H., Ekholm, E., Hamari, L., Azimi, I., Rahmani, A. M., Liljeberg, P., Löyttyniemi, E. and Axelin, A., Feasibility of smart wristbands for continuous monitoring during pregnancy and one month after birth, *BMC Pregnancy and Childbirth*, vol. 19, no.34, 2019.

Hema, L. K., Amalna, Atil, A. and Kanya., Pregnant women of health monitoring using embedded system, *IOP Conference Series: Materials Science and Engineering,* Kancheepuram, India, April 22, 2020.

Hussain, A., Mkpojiogu, E., Fadzil, Najdawati., Hassan, N. and Zaaba, Z., A Mobile Usability Evaluation of a Pregnancy App, *Journal of Telecommunication, Electronic and Computer Engineering*, vol. 10, no. 1-11, pp. 13-18, 2018.

Jaffar, A., Muhammad, N. A., Sidik, S. M., Admodisastro, N., Manaf, R. A., Foo, C. N. and Suhaili, N., Feasibility and usability of kegel exercise pregnancy training app (kept app) among pregnant women with urinary, *International Journal of Environmental Research and Public Health*, vol. 19, no. 6, 2022.

Kundu, S., Kabir, A. and Islam, M. N., Evaluating usability of pregnancy tracker applications in Bangladesh: a heuristic and semiotic evaluation, *2020 IEEE 8th R10 Humanitarian Technology Conference (R10-HTC),* pp. 1-6, Kuching, Malaysia, December 1-3, 2020.

Li, X., Lu, Y., Shi, S., Zhu, X. and Xianghua, F., The impact of healthcare monitoring technologies for better pregnancy, *2021 IEEE 4th International Conference on Electronics Technology (ICET),* pp. 731-736, Chengdu, China, May 7-10, 2021.

Liu, Y. and Wang, X., Application of smart mobile medical services in maternal health care management, *Contrast Media Molecular Imaging*, vol. 2021, 2021.

Overdijkink, S., Velu, A., Rosman, A., van Beukering, M., Kok, M. and Steegers-Theunissen, R., The usability and effectiveness of mobile health technology-based lifestyle and medical intervention apps supporting healthcare during pregnancy: systematic review, *JMIR Mhealth Uhealth*, vol. 6, no. 4, 2018.

Priyanka, B., Kalaivanan, V. M., Pavish, R. A. and Kanageshwaran, M., IOT based pregnancy women health monitoring system for prenatal care, *2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS),* pp. 1264-1269, Coimbatore, India, March 19-20, 2021.

Ryu, D, Kim, D. H, Price, J., Lee, J. Y, Chung, H. U., Allen, E., Walter, J., Jeong, H., Cao, J., Kulikova, Elena, Abu-Zayed, Hajar, Lee, R., Martell, K., Zhang, M., Kampmeier, B., Hill, Marc, L., J. H., Kim, E., Park, Y. and Xu, S., Comprehensive pregnancy monitoring with a network of wireless, soft, and flexible sensors in highand low-resource health settings, *Proceedings of the National Academy of Sciences*, vol. 118, no. 20, 2021.

Sarhaddi, F., Azimi, I., Labbaf, S., Niela-Vilén, H., Dutt, N., Axelin, A., Liljeberg, P. and Rahmani, A. M., Long-term iot-based maternal monitoring system: system design and evaluation, *Sensors (Basel)*, vol. 21, no. 7, 2021.

Sherifali, D., Nerenberg K. A., Wilson, S., Semeniuk K., Ali M. U., Redman, L. M., Adamo, K. B., The effectiveness of eHealth technologies on weight management in pregnant and postpartum women: systematic review and meta-analysis, *Journal of Medical Internet Research*, vol. 19, no. 7, 2017.

Van Beukering, M., Velu, A., van den Berg, L., Kok, M., Mol, B. W., Frings-Dresen, M., de Leeuw, R., van der Post, J. and Peute, L., Usability and usefulness of mobile health app for pregnancy-related work advice: mixed methods study, *JMIR Mhealth Uhealth*, vol. 7, no. 5, 2019.

Wang, N., Deng, Z., Wen, L. M, Ding, Y. and He, G., Understanding the use of smartphone apps for health information among pregnant Chinese women: mixed methods study, *JMIR Mhealth Uhealth*, vol. 7, no. 6, 2019.

Woodworth, A., Prototyping an app for pregnancy during covid-19 prototyping a mobile app for pregnancy during covid 19 pandemic: using information design to strengthen landscapes, 2021.

Using e-health and information technology to improve health, Available: https://www.who.int/westernpacific/activities/using-e-health-and-information-technology-to-improve-health, Accessed on January 3, 2022.

Yee, L., Jackson, J., Leziak, K., Niznik, C., Saber, R. and Yeh, C., SweetMama: usability testing of a novel mobile application for diabetes education and support during pregnancy, *American Journal of Obstetrics and Gynecology*, vol. 222, no. 1, 2020.

Biographies

Mary Jane C. Samonte has a double bachelor's degree in computer education and information technology. She also has two post graduate degree; Information Technology and Computer Science. She finished her Doctor in IT with a study focusing in Deep Learning. She has a wide range of research interests that are centered around educational technologies, gamification, mobile and ubiquitous learning, digital game-based learning, artificial intelligence in education, e-health, assistive technology, natural language processing, green computing and data analytics-based studies.

Bea Shaneal Francesca F. Franco graduated from Mapúa University - Senior High School in 2019 and is currently enrolled as a third-year Information Technology Student, specializing in Enterprise Data Management. She is presently a Quality Assurance intern and is completing her thesis about the usability evaluation of TelHER: A Pregnancy Health Monitoring System Using IoT in Vital Sign Tracking. Her future prospect is to further her education by pursuing postgraduate studies.

Helisha A. Ocampo graduated from Senior High School at Mapúa University in 2019 and is currently taking up a Bachelor of Science in Information Technology specializing in Cybersecurity in the same school. One of her case studies in Cybersecurity entitled, "Awareness of Home Users' Vulnerability on Illegal Streaming that Contains Malware Disguised as Advertisement Pop-Ups," was selected for publication at the 2022 4th International Conference on Management Science and Industrial Engineering. She is currently conducting her thesis while completing her internship program at an IT and digital marketing company. Her research interests include user experience, cyber security, quality assurance, and database management.

Mauryn Angela F. Rodriguez graduated from Senior High School in Mapua University in 2019. She is currently in her 3rd year in college, taking up BS Information Technology, specializing in Enterprise Data Management in Mapua University - Makati. She is also a member of WebMasters Guild. Presently, she is doing her internship as a Quality Assurance Assistant in Libelle Creative Inc., while also accomplishing her thesis entitled TelHER: A Pregnancy Health Monitoring System Using IoT in Vital Sign Tracking.