

AN ACCEPTANCE OF ELECTRONIC PERSONALIZED HEALTH RECORDS PROTOTYPE SYSTEM: A CASE STUDY FROM MALAYSIA UNIVERSITY

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ABSTRACT: *Personal Health Records (PHRs) can be defined as one of the important roles in the management of human life and growing rapidly in the health informatics area. e-PHRs is an emerged web-based healthcare system that allows patients to access and manage their medical at any time and at anywhere and directly lead to patient-self-management. However, a few gaps have been identified in patient self-management and presented in this paper. This research work was started in 2013 and finished in 2016 under the Biomedical Computing and Engineering Technologies (BIOCORE) Applied Research Group, UTeM. Objective: This study presents the result of a user acceptance survey using the e-PHR system prototype. Method: A comprehensive literature review including data gathering from several techniques such as interviews, surveys, observation, and others has been done. The prototype system has been developed using some programming languages such as java and others. Besides that, the use case diagram, entity relationship diagram (ERD), class diagram, and sequence diagram (appendix A) for the e-PHR process was explained. A prototype system for e-PHR was developed based on the case study at Malaysia University which is Universiti Teknikal Malaysia Malacca (UTeM) health centre. The prototype system was developed to solve problems in patient self-management in e-PHR by capturing some limitations which are crucial PHR attributes and data integrity of PHR. Results: The results present in validation part in this paper show most of the users are satisfied to use e-PHR. The validation of user satisfaction is measured from a few important aspects through surveys conducted at UTeM. The target users are the UTeM staff including UTeM students in different faculties. As a result, about 87.6% of users agreed with the system's capabilities. About 83.2% of users agreed with overall performance expectancy. Approximately 86.7% of users agreed and were satisfied to use this system. Discussion: The satisfaction of users to accept e-PHR in Malaysia has shown positive. Conclusions: The findings show that the acceptance of users in UTeM from a variety of fields is agreed to accept and use the e-PHR to manage and monitor their health.*

Keywords: *Health informatics, Personalized Health Records, Information Systems*

INTRODUCTION

According to [1, 2] Personal Health Records (PHR) are a growing field of medical information because the truth can help enhance healthcare delivery and cost of care[2, 3]. PHRs used in today's development support varying functions and consequently offer varying value propositions[2, 4]. Besides that, electronic PHR [e-PHR] has been considered a set of computer-based tools [5] that enables patients or users to organize and access their personalized health records through multiple information technology devices (ICT) in their daily life including sharing their records with healthcare providers. Moreover, there is also another computer-based record which is electronic health records (EHR) which have been considered electronic health records (EHRs) [6–8] used by physicians. The EHR's purpose is to make enhancement readability including the availability and comprehensiveness related to patients' health records as well. In addition, immediate access through electronic medical records (EMR) or Lifelong health records (LHR) [9, 10] has been considered as basic which provided smooth including continuing care[3]. This is achieved through ICT convergence, and via this the health content including knowledge of the health of patient medical history could be easily shared and accessed within

healthcare professionals and healthcare facilities irrespective of their previous and final visitation locations. The paper-based and fragmented medical records have important barriers such as delay, absence, overtime, difficult transfers and integrations between providers and institutions, and the need to keep records repeatedly in varied documents [11–14]. In addition, with the increment in usage, the medical community is beginning to appreciate the promise and risk of 'going electronic'[15]. The aim of the development of e-PHR is to receive patient health records from the Clinical Support System (CSS) database. Medical records of patients collected through CSS when patients who have visited the clinic have introduced and implemented CSS. Patients could access and view details of their medical data seamlessly by registering and login in to e-PHR. e-PHR is a Web-based system used by patients to monitor their health records throughout their lives.

RELATED WORD

A new style of medical information exchange system 'personal health record (PHR)' is being developed gradually. PHR is a type of health record maintained and manage by individuals [8, 16]. Ideal personal health records can integrate personalized medical information[17] from different sources and provide complete and complete health and medical

summary through the Internet or portable media subject to security and privacy requirements [18], [19]. Many PHR-related opportunities exist for individuals and organizations mentioned related to socio-technical issues [20–22]. Currently, provider sites offer integrated PHRs offer a good starting point for determining which individuals are most likely to use PHR, for how often, for what purpose, and for what impact on health and workflow[23]. This PHR should be extended to standalone PHR users [18]. An additional EPHR system is to detail which models and individual healthcare providers hold the role of patients[24] in their own care.[25] Knowing more about how PHR can meet individual health information needs will help providers to provide better

care. Research on the weight or relative value of users and health care on individual (component) PHR functions, including decision support capabilities is required[26]. In the global, support for a better vision of how genomic information can be improve PHR is needed. Insights into how PHRs can help with the detection of eligible population health. Finally, many technical, interface, economic, vocabulary, and data issues require further investigation[27, 28].

METHOD

The prototype for e-PHR was design and developed based on the several information system diagram as shown below:

a) Use Case Diagram

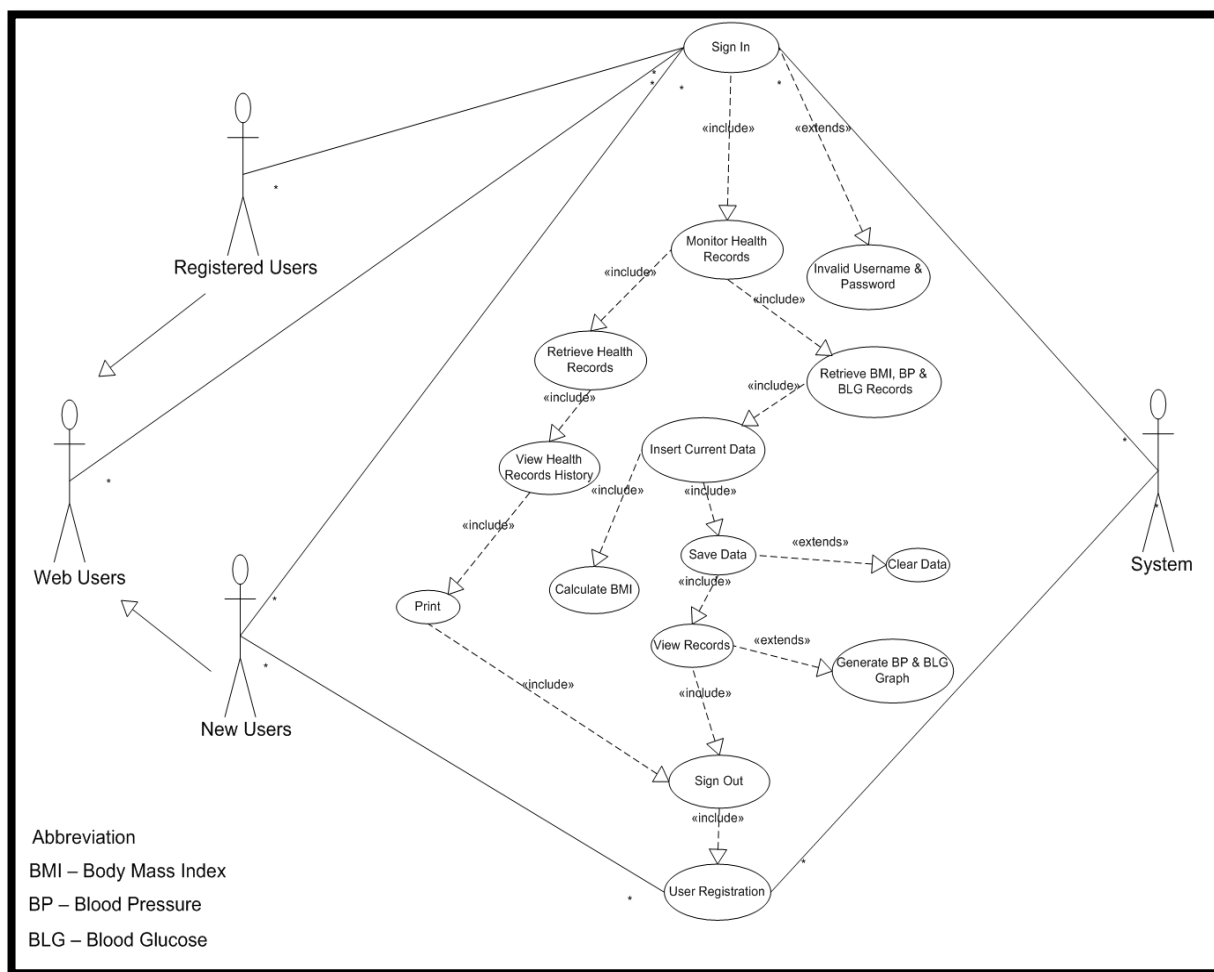


Figure 1: Use Case of e- PHR

i. Sign up and login use cases

The use case is to sign up and log in to allow users to register for first-time access to this system and after finishing the registration process they continue to log in to access this system.

ii. Retrieve health records use cases.

The purpose of using this case is to obtain the latest episode of patient health records from the system after registering and logging into the system.

iii. View health records use case.

The use case is intended to present the whole lifetime health records of the patients. In addition, Patients can browse their health records by choosing the year they want to get their records. After that, health records are sent to the computer and shown on the computer screen.

iv. Manage patient BMI use case.

This use case aims to manage and monitor Body Mass Index (BMI) by viewing, updating, and storing current BMI data

like height including weight in the system. All data will be viewed and it will automatically plot on the graph. Patients could see the whole blood pressure data on the graph of blood pressure.

v. *View monitor and maintain blood pressure use case.*

This use case aims to monitor their blood pressure by viewing, updating, and storing current blood pressure data like systolic, diastolic, and pulse into the system. All the data will be shown and plotted automatically on the graph. Patients could view their blood pressure data on the blood pressure graph. The use case is to sign up and log in to allow users to register for first-time access to this system and after finishing the registration process they continue to log in to access this system.

ii. *Retrieve health records use cases.*

The purpose of using this case is to obtain the latest episode of patient health records from the system after registering and logging into the system.

iii. *View health records use case.*

The use case is intended to present the whole lifetime health records of the patients. In addition, Patients can browse their health records by choosing the year they want to get their records. After that, health records are sent to the computer and shown on the computer screen.

iv. *Manage patient BMI use case.*

This use case aims to manage and monitor Body Mass Index (BMI) by viewing, updating, and storing current BMI data like height including weight in the system. All data will be viewed and it will automatically plot on the graph. Patients could see the whole blood pressure data on the graph of blood pressure.

v. *View monitor and maintain blood pressure use case.*

This use case aims to monitor their blood pressure by viewing, updating, and storing current blood pressure data like systolic, diastolic, and pulse into the system. All the data will be shown and plotted automatically on the graph. Patients could view their blood pressure data on the blood pressure graph.

vi. *Use case view monitor blood Glucose.*

This specific use case is to monitor including manage patients' blood glucose by viewing, updating, and storing the latest blood glucose data in the system. All data will be shown and the automatic plotted on the graph. Patients could see graphs of their blood glucose data on the blood glucose.

vii. *Save and print health record use cases.*

The purpose of this is intended to save the patient's health records into systems including cloud storage and print records as well.

b) Flow chart of e-PHR

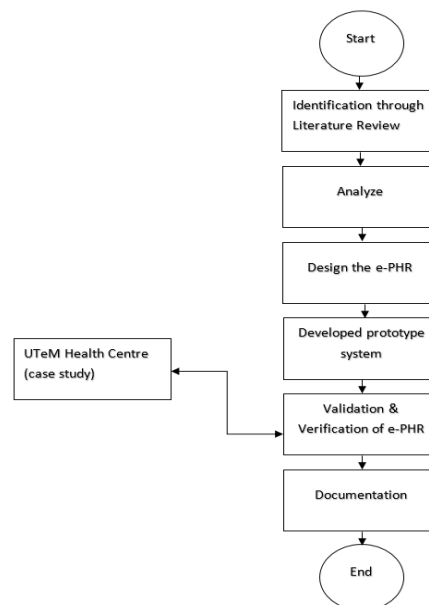


Figure 2: Flowchart of e-PHR

The processes involved in this study are illustrated in figure 2 as follows:

i. *Identification through literature review*

This study started by identification of existing studies in order to find the research gap.

ii. *Analyze*

Sample data was analyzed and validated according to the function of the model. The collected sample data has been analyzed for the identification purpose of the usefulness of space optimization in the context of the proposed model. The analysis has been carried out through the determination of space optimization cases and collecting sample set data into similar cases including comparing the results. Model function validation has been performed based on the analysis results.

iii. *Design the prototype system*

e-PHR has been designed and is defined based on the identified gaps and the data collected.

iv. *Developed e-PHR system*

The development process has been begun after the design process is finished and it was designed from the method decided through the design phase.

v. *Validate & verification of e-PHR*

The test and evaluation process was carried out with the Clinical Support System (CSS) to measure the parameters of interoperability, portability, standard, and effectiveness.

vi. *Documentation*

All findings related to processes, results, and conclusions have been documented.

The architecture of e-PHR System

This section provides a balanced discussion of the principles of architectural integration to support targeted functions. There is some process involved in several stages which are the first stage presents the request from the client side via

backend which is considered a file system containing *repositories*, *websites*, and *databases*.

C) Entity Relationship Diagram [ERD]

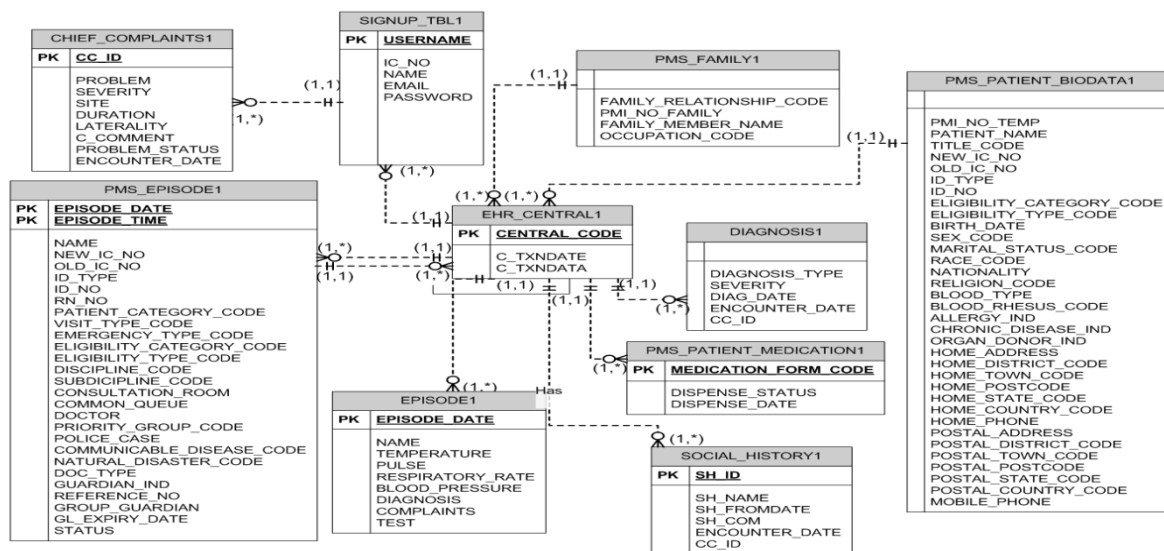


Figure 3: Entity Relationship Diagram (ERD)

determines all main entities and relationships between entities from the business

D) Class Diagram

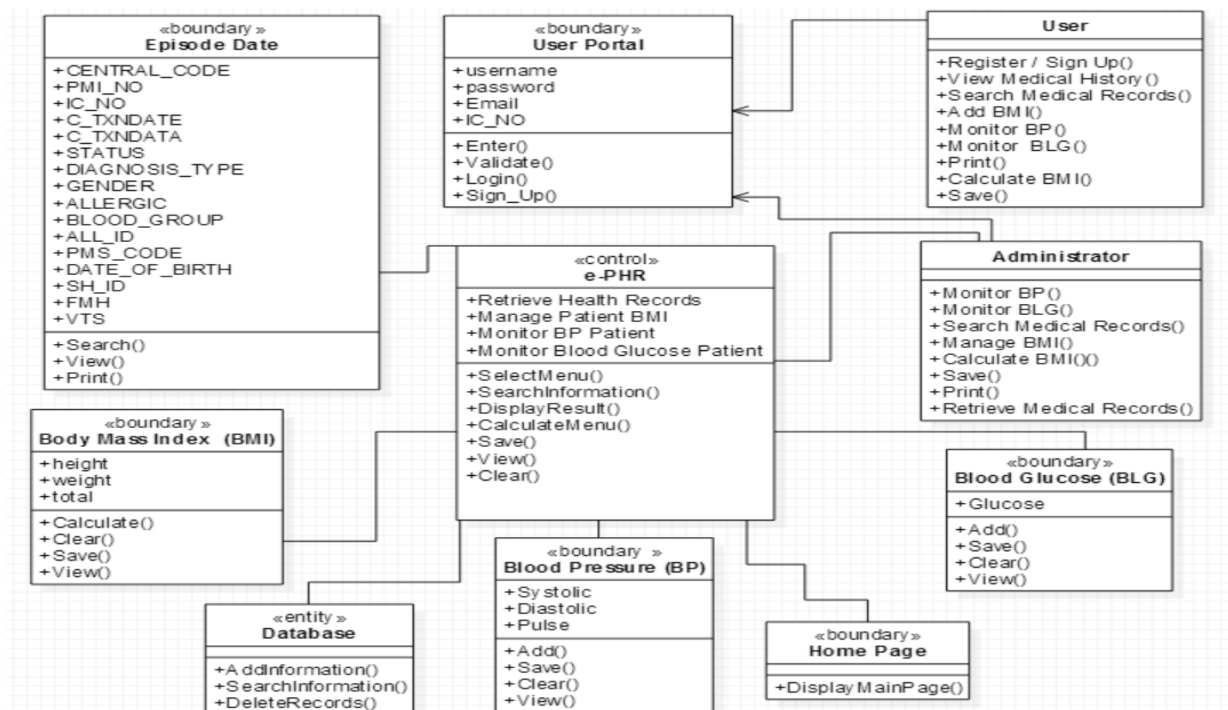


Figure 4: Class Diagram of [e-PHR]

Based on the class diagram above the authors have an e-PHR (Electronic Personalized Health Records) system as a controller. Episode Date, User Portal, Body Mass Index (BMI), Blood Pressure (BP), Blood Glucose (BLG), and Home Page as a boundary. While the database as an entity and the User and Administrator as actors.

PROTOTYPE SYSTEM INTERFACE

a) Main Menu Page



Figure 5: Main Menu Page



Figure 6: Main Menu Page (1)

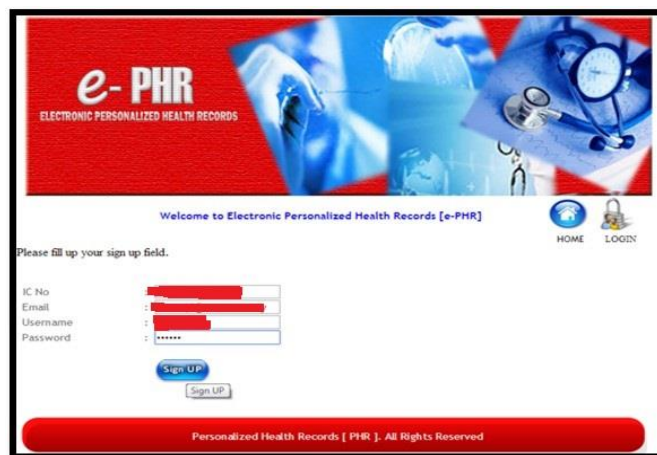


Figure 7: Sign Up Page



Figure 8: Login Page

b) Episode Date: This menu allows the user to view more details about their medical records such as patient medical history, drug treatment order, vital signs, family medical history information, and others by selecting the year. This page, also allows the user to print their medical records.



Figure 9: User Page [Main Menu]

Medical Reports

Chief Complaint Information

1. 16/05/2014 - Gout
2. 10/12/2013 - Wound of skin

Drug Treatment Order Information

1. 16/05/2014 - amoxicillin- 500mg
2. 16/05/2014 - acetamenophane- 500mg
3. 10/12/2013 - CLOTRIMAZOLE 1% W/W,BECLOMETHASONE DIPROPIONATE 0.025% W/W- 1% W/W
4. 02/12/2013 - AMLODIPINE BESYLATE- 5MG

Figure 10: User Page [Episode Date]

c) Medical Info: These menus allows user to insert and calculate their BMI data. Other than that, it also allows users to monitor their blood pressure and all inserted data will represent in the graph. On this page, the user will see this symbol (*) meant that which part has this symbol user cannot leave blank, the user must enter the data to continue saving or send their request.

Monitor Blood Pressure

e-PHR
ELECTRONIC PERSONALIZED HEALTH RECORDS

Welcome to Electronic Personalized Health Records [e-PHR]

LOGOUT

Episode Date Medical Info FAQ Contact Us Feedback

Height (cm) : 160
Weight (kg) : 78
Calculate
BMI : 30.47

Blood Pressure
*Systolic : 120
*Diastolic : 80
*Pulse : 70
Save
Clear

Figure 11: Medical Info Page

e-PHR
ELECTRONIC PERSONALIZED HEALTH RECORDS

Welcome to Electronic Personalized Health Records [e-PHR]

LOGOUT

Episode Date Medical Info FAQ Contact Us Feedback

Height (cm) : 160
Weight (kg) : 78
Calculate
BMI : 30.47

Blood Pressure
*Systolic : 120
*Diastolic : 80
*Pulse : 70
Save
Clear

Figure 12: Medical Info Page (1)

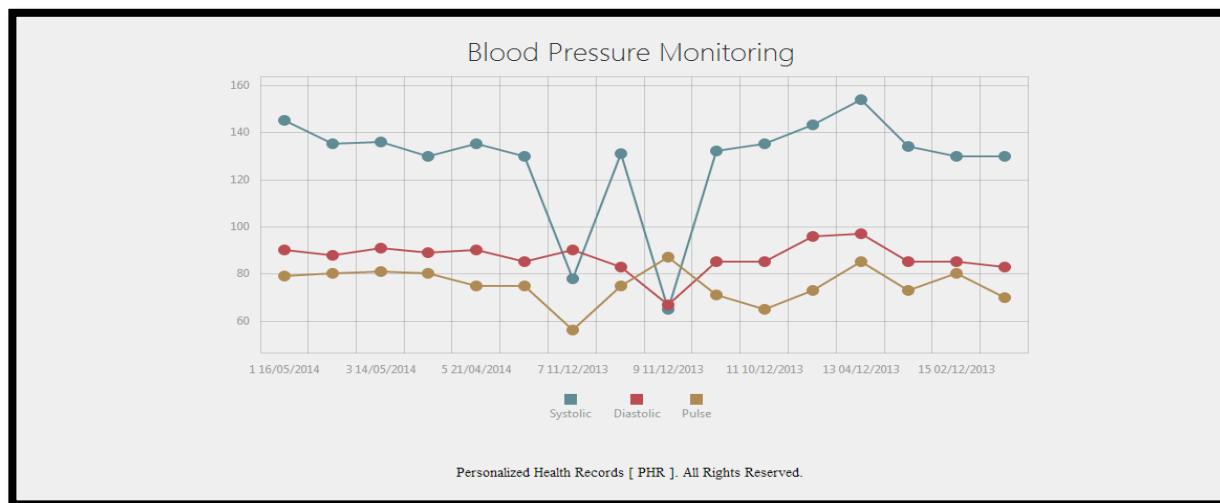


Figure 13: Medical Info Page [Graph]

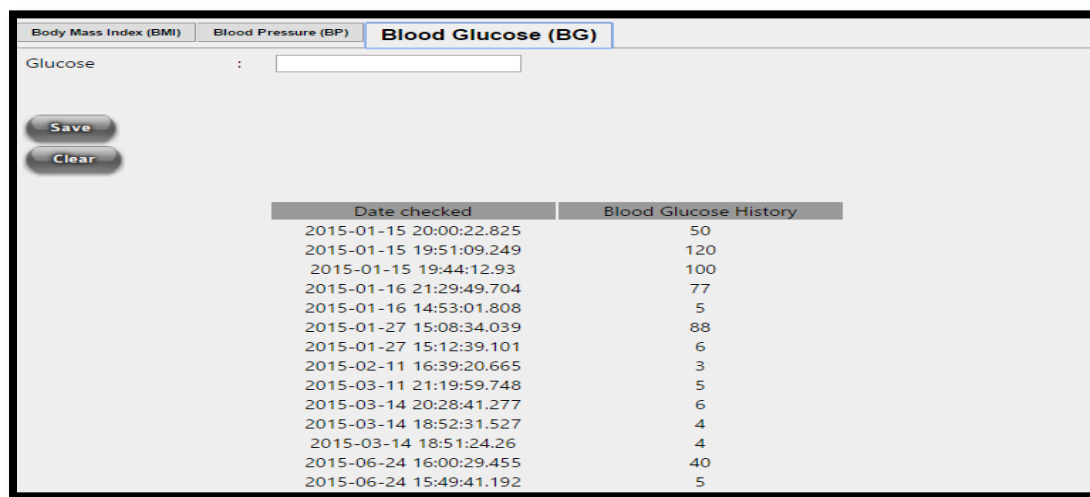


Figure 14: Medical Info Page [Graph 1]

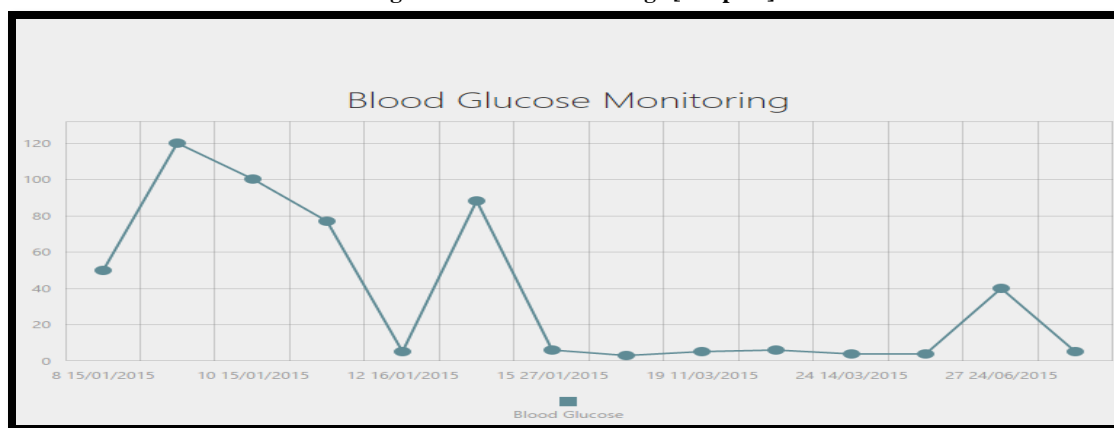


Figure 15: Medical Info Page [Graph 2]

Validation of e-PHR prototype system for user satisfaction

The validation of the e-PHR system has been done through questionnaires from users which is used this system to give

feedback regarding this system it's more on user perspective validation of the e-PHR system. The questionnaire is focused on students in UTeM. The results from the questionnaire have been analysed using SPSS tools.

Table 1: Category of age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	30 - 40	1	.9	.9	.9
	Under 30	112	99.1	99.1	100.0
	Total	113	100.0	100.0	

Table 1 shows the percentage of respondents by age involved in the questionnaire displayed around 99.1% of respondents between under 30 and the rest about 0.9% from 30 to above -

40. Therefore, this shows the age under 30 involved answered this questionnaire.

Table 2: Screen of e-PHR [reading character]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Clear	42	37.2	37.2	37.2
	Neutral	5	4.4	4.4	41.6
	Very Clear	66	58.4	58.4	100.0
	Total	113	100.0	100.0	

Table 2 show the percentage of respondent involved in the questionnaire that displayed around 58.4% of respondents is agreed the screen structure of e-PHR very clear for reading character while about 37.2% of the respondent is agreed on the screen structure of e-PHR clear for reading the character

on the screen. The 4.4% agreed on the screen structure of e-PHR neutral reading characters on the screen. Therefore, can conclude about 58.4% agreed the screen structure of e-PHR is very clear.

Table 3: Screen of e-PHR [sequence]					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Clear	45	39.8	39.8	39.8
	Very Clear	68	60.2	60.2	100.0
	Total	113	100.0	100.0	

Table 3 show the percentage of respondent involved in the questionnaire that displayed around 60.2% of respondents agreed the sequence of screen structure of e-PHR is very clear while about 39.8% of respondent agreed the sequence of screen structure of e-PHR is clear. Therefore, can conclude about 60.2% agreed the sequence of screen structure of e-PHR is very clear.

Table 4: Screen of e-PHR [structure]					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Clear	33	29.2	29.2	29.2
	Neutral	5	4.4	4.4	33.6
	Very Clear	75	66.4	66.4	100.0
	Total	113	100.0	100.0	

Table 4 show the percentage of respondent involved in the questionnaire that displayed around 66.4% of respondents agreed the screen structure of e-PHR is very clear while about 29.2% of the respondent agreed the screen structure of e-PHR is clear. Around 4.4% agreed the screen structure of e-PHR is neutral. Therefore, can conclude about 66.4% agreed the screen structure of e-PHR is very clear.

Table 5: Terminology and System Information [term]					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Consistent	46	40.7	40.7	40.7
	Very Consistent	67	59.3	59.3	100.0
	Total	113	100.0	100.0	

Table 5 show the percentage of respondent involved in the questionnaire that displayed around 59.3% of respondents agreed the term used in terminology and system information is very consistent while about 40.7% of respondents agreed the term used in terminology and system information is consistent. Therefore, can conclude about 59.3% agreed the term used in terminology and system information is very consistent.

.Table 6: Terminology and System Information [position of message]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Consistent	32	28.3	28.3	28.3
	Very Consistent	81	71.7	71.7	100.0
	Total	113	100.0	100.0	

Table 6 show the percentage of respondent involved in the questionnaire displayed around 71.7% of respondents agreed on the position message on the screen used in e-PHR under terminology and system information is very consistent while about 28.3% of respondents agreed on the position message on the screen used in e-PHR is consistent. Therefore, can conclude about 71.7% agreed on the position message on the screen used in e-PHR is very consistent.

Table 7: Terminology and System Information [prompt]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Consistent	27	23.9	23.9	23.9
	Very Consistent	86	76.1	76.1	100.0
	Total	113	100.0	100.0	

Table 7 show the percentage of respondent involved in the questionnaire displayed around 76.1% of respondents agreed on the prompt for input in e-PHR under terminology and system information is very consistent while about 23.9% of respondents agreed on the prompt for input in e-PHR under terminology and system information is consistent. Therefore, can conclude about 76.1% agreed on the prompt for input in e-PHR used in e-PHR under terminology and system information is very consistent.

Table 8: Learning [learning to operate]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Easy	36	31.9	31.9	31.9
	Helpful	77	68.1	68.1	100.0
	Total	113	100.0	100.0	

Table 8 show the percentage of respondent involved in the questionnaire around 68.1% of respondents agreed that learning to operate this system in e-PHR under the learning section is helpful while about 31.9% of respondents agreed that learning to operate this system in e-PHR under the learning section is easy. Therefore, can conclude about 68.1% agreed that learning to operate this system in e-PHR under the learning section is helpful.

.Table 9: Learning [performing task]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Easy	27	23.9	23.9	23.9
	Helpful	86	76.1	76.1	100.0
	Total	113	100.0	100.0	

Table 9 show the percentage of respondent involved in the questionnaire that displayed around 81.4% of respondents agreed on the help message on this screen is helpful in e-PHR under the learning section is helpful while about 18.6% of

respondents agreed on the help message on this screen is helpful in e-PHR under learning section is easy. Therefore, can conclude about 81.4% agreed on the help message on this screen in e-PHR under the learning section is helpful.

Table 10: Learning [help message]					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Easy	21	18.6	18.6	18.6
	Helpful	92	81.4	81.4	100.0
	Total	113	100.0	100.0	

Table 10 show the percentage of respondent involved in the questionnaire that displayed around 81.4% of respondents agreed on the help message on this screen is helpful in e-PHR under the learning section is helpful while about 18.6% of

respondents agreed on the help message on this screen is helpful in e-PHR under learning section is easy. Therefore, can conclude about 81.4% agreed on the help message on this screen in e-PHR under the learning section is helpful

Table 11: System Capabilities [system reliability]					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Easy	28	24.8	24.8	24.8
	Very helpful	85	75.2	75.2	100.0
	Total	113	100.0	100.0	

Table 11 show the percentage of respondent involved in the questionnaire that displayed around 75.2% of respondents is agreed system reliability in e-PHR under section system capabilities is very helpful while about 24.8% of respondents

are agreed on system reliability in e-PHR under section system capabilities easy. Therefore, can conclude about 75.2% agreed on system reliability in e-PHR under section system capabilities is very helpful.

Table 12: System Capabilities [system speed]					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Easy	33	29.2	29.2	29.2
	Very helpful	80	70.8	70.8	100.0
	Total	113	100.0	100.0	

Table 12 show the percentage of respondent involved in the questionnaire that displayed around 70.8% of respondents is agreed system speed in e-PHR under section system capabilities is very helpful while about 29.2% of respondents

are agreed on system speed in e-PHR under section system capabilities easy. Therefore, can conclude about 70.8% agreed on system speed in e-PHR under section system capabilities is very helpful.

Table 13: System Capabilities [system]					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Easy	19	16.8	16.8	16.8
	Very helpful	94	83.2	83.2	100.0
	Total	113	100.0	100.0	

Table 13 show the percentage of respondent involved in the questionnaire that displayed around 83.2% of respondents agreed system tend to be in e-PHR under section system capabilities is very helpful while about 16.8% of respondents

are agreed on system speed in e-PHR under section system capabilities easy. Therefore, can conclude about 83.2% agreed systems tend to be in e-PHR under section system capabilities is very helpful.

Table 14: System Capabilities [designed]					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Easy	21	18.6	18.6	18.6
	Very helpful	92	81.4	81.4	100.0
	Total	113	100.0	100.0	

Table 14 show the percentage of respondent involved in the questionnaire that displayed around 81.4% of respondents agreed designed for all users in e-PHR under the section system capabilities is very helpful while about 18.6% of

respondents agreed designed for all users in e-PHR under the section system capabilities easy. Therefore, can conclude about 81.6% agreed that designing for all users in e-PHR under section system capabilities is very helpful.

Table 15: System Capabilities [Overall satisfaction]					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Easy	14	12.4	12.4	12.4
	Very helpful	99	87.6	87.6	100.0
	Total	113	100.0	100.0	

Table 15 show the percentage of respondent involved in the questionnaire that displayed around 87.6% of respondents agreed overall satisfaction with the e-PHR system under section system capabilities is very helpful while about 12.4%

of respondents agreed on overall satisfaction with e-PHR under section system capabilities easy. Therefore, can conclude about 87.6% agreed overall satisfaction with e-PHR under section system capabilities is very helpful

Table 16: Performance expectancy of the e-PHR [quickly]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	47	41.6	41.6	41.6
	5.0	66	58.4	58.4	100.0
Total		113	100.0	100.0	

Table 16 show the percentage of respondent involved in the questionnaire around 58.4% of respondents strongly agreed of the e-PHR system can quickly view the medical records under section performance expectancy while about 41.6% of respondents agreed of the e-PHR system can quickly view the

medical records under section performance expectancy. Therefore, can conclude about 58.4% strongly agreed of the e-PHR system can quickly view the medical records under the section performance expectancy.

Table 17: Performance expectancy of the e-PHR [structured]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	24	21.2	21.2	21.2
	5.0	89	78.8	78.8	100.0
Total		113	100.0	100.0	

Table 17 show the percentage of respondent involved in the questionnaire around 78.8% of respondents strongly agreed of the e-PHR system view the medical records as more structured under section performance expectancy while about 21.2% of respondents agreed of the e-PHR system view the

medical records more structure under section performance expectancy. Therefore, can conclude about 78.8% strongly agreed of the e-PHR system views the medical records more structured under section performance expectancy.

Table 18: Performance expectancy of the e-PHR [clearly]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	33	29.2	29.2	29.2
	5.0	80	70.8	70.8	100.0
Total		113	100.0	100.0	

Table 18 show the percentage of respondent involved in the questionnaire around 70.8% of respondents strongly agreed of the e-PHR system view the medical records more clearly under section performance expectancy while about 29.2% of respondents agreed of the e-PHR system view the medical

records more clearly under section performance expectancy. Therefore, can conclude about 70.8% strongly agreed of the e-PHR system views the medical records more clearly under section performance expectancy.

Table 19: Performance expectancy of the e-PHR [easily]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	21	18.6	18.6	18.6
	5.0	92	81.4	81.4	100.0
Total		113	100.0	100.0	

Table 19 show the percentage of respondent involved in the questionnaire around 81.4% of respondents strongly agreed of the e-PHR system view the medical records more easily under section performance expectancy while about 18.6% of respondents agreed of the e-PHR system view the medical

records more easily under section performance expectancy. Therefore, can conclude about 81.4% strongly agreed of the e-PHR system views the medical records more easily under section performance expectancy.

Table 20: Performance expectancy of the e-PHR [health performance]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	35	31.0	31.0	31.0
	5.0	78	69.0	69.0	100.0
Total		113	100.0	100.0	

Table 20 show the percentage of respondent involved in the questionnaire around 69.0% of respondents strongly agreed that using the e-PHR system will improve my health performance under section performance expectancy while about 31.0% of respondents agreed that using the e-PHR

system will improve my health performance under section performance expectancy. Therefore, can conclude about 69.0% strongly agreed of the use of the e-PHR system will improve my health performance under section performance expectancy

Table 21: Performance expectancy [Overall satisfaction]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	19	16.8	16.8	16.8
	5.0	94	83.2	83.2	100.0
Total		113	100.0	100.0	

Table 21 show the percentage of respondent involved in the questionnaire around 83.2% of respondents strongly agreed with the overall satisfaction with the performance of this e-PHR system under section performance expectancy while about 16.8% of respondents agreed with the overall

satisfaction with the performance of this e-PHR system under section performance expectancy. Therefore, conclude about 83.2% strongly agreed with the overall satisfaction with the performance of this e-PHR system under section performance expectancy.

Table 22: Effort expectancy of the e-PHR [easy]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	19	16.8	16.8	16.8
	5.0	94	83.2	83.2	100.0
Total		113	100.0	100.0	

Table 22 show the percentage of respondent involved in the questionnaire around 83.2% of respondents strongly agreed that learning to operate e-PHR would be easy under section effort expectancy while about 16.8% of respondents agreed

that learning to operate e-PHR would be easy under section effort expectancy. Therefore, can conclude about 83.2% strongly agreed that learning to operate e-PHR would be easy under section effort expectancy.

Table 23: Effort expectancy of the e-PHR [understandable]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	20	17.7	17.7	17.7
	5.0	93	82.3	82.3	100.0
Total		113	100.0	100.0	

Table 23 show the percentage of respondent involved in the questionnaire around 82.3% of respondents strongly agreed of the interaction with e-PHR would be clear and understandable under section effort expectancy while about 17.7% of respondents agreed of the interaction with e-PHR

would be clear and understandable under section effort expectancy. Therefore, can conclude about 82.3% strongly agreed of the interaction with e-PHR would be clear and understandable under section effort expectancy.

Table 24: Effort expectancy of the e-PHR [easy to used]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	29	25.7	25.7	25.7
	5.0	84	74.3	74.3	100.0
Total		113	100.0	100.0	

Table 24 show the percentage of respondent involved in the questionnaire around 74.3% of respondents strongly agreed of the e-PHR would be easy to use under section effort expectancy while about 25.7% of respondents agreed of the

e-PHR would be easy to use under section effort expectancy. Therefore, can conclude about 74.3% strongly agreed of the e-PHR would be easy to use under section effort expectancy.

Table 25: Effort expectancy of the e-PHR [view]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	35	31.0	31.0	31.0
	5.0	78	69.0	69.0	100.0
Total		113	100.0	100.0	

Table 25 show the percentage of respondent involved in the questionnaire around 69.0% of respondents strongly agreed of the e-PHR would be easy to get e-PHR and view as per requested under section effort expectancy while about 31.0% of respondents agreed of the e-PHR would be easy to get e-

PHR and to view as per requested under section effort expectancy. Therefore, can conclude about 69.0% strongly agreed of the e-PHR would be easy to get e-PHR and view as per requested under the section effort expectancy

Table 26: System Flexibility of e-PHR [anytime]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	15	13.3	13.3	13.3
	5.0	98	86.7	86.7	100.0
Total		113	100.0	100.0	

Table 26 show the percentage of respondent involved in the questionnaire around 86.7% of respondents is strongly agreed of the e-PHR would flexible to use under the section system flexible while about 13.3% of respondents are agreed of the

e-PHR would flexible to use under the section system flexible. Therefore, can conclude about 86.7% strongly agreed of the e-PHR would be flexible to use under the section system flexible.

Table 27: System Flexibility of e-PHR [comfortably]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	29	25.7	25.7	25.7
	5.0	84	74.3	74.3	100.0
Total		113	100.0	100.0	

Table 27 show the percentage of respondent involved in the questionnaire around 74.3% of respondents is strongly agreed of the e-PHR would flexible to use under the section system flexible while about 25.7% of respondents are agreed of the

e-PHR would flexible to use under the section system flexible. Therefore, can conclude about 74.3% strongly agreed of the e-PHR would be flexible to use under the section system flexible.

Table 28: System Flexibility of e-PHR [system]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	15	13.3	13.3	13.3
	5.0	98	86.7	86.7	100.0
Total		113	100.0	100.0	

Table 28 show the percentage of respondent involved in the questionnaire around 86.7% of respondents is strongly agreed of the e-PHR would flexible to use in the university under the section system flexible while about 13.3% of respondents are

agreed of the e-PHR would flexible to use in university under section system flexible. Therefore, can conclude about 86.7% strongly agreed of the e-PHR would be flexible to use in universities under the section system flexible.

Table 29: Facilitating conditions of e-PHR [improve]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	8	7.1	7.1	7.1
	5.0	105	92.9	92.9	100.0
Total		113	100.0	100.0	

Table 29 show the percentage of respondent involved in the questionnaire around 92.9% of respondents strongly agreed of the e-PHR would help improve health under section system flexible while about 7.1 % of respondents agreed of

the e-PHR would help improve health under section system flexible. Therefore, can conclude about 92.9% strongly agreed of the e-PHR would help improve health under section system flexibility.

Table 30: Facilitating conditions of e-PHR [healthy life]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.0	14	12.4	12.4	12.4
	5.0	99	87.6	87.6	100.0
Total		113	100.0	100.0	

Table 30 show the percentage of respondent involved in the questionnaire around 87.6% of respondents strongly agreed of the e-PHR would help to have healthy life under the section system flexible while about 12.4 % of respondents agreed the e-PHR would help to have healthy life under

section system flexible. Therefore, can conclude about 87.6% strongly agreed of the e-PHR would help to have healthy life under a section system flexible

CONCLUSION

The results showed that this e-PHR system is suitable to be implemented especially in Malaysia. The validation shows that the respondents by age involved in the questionnaire around 99.1% of respondents between under 30 and the rest about 0.9% from 30 to above - 40. Therefore, can conclude that the age under 30 involved answered this questionnaire. The validation shows about 92.9% strongly agreed of the e-PHR would help improve their health. Also, about 83.2% strongly agreed with the overall satisfaction with the performance of this e-PHR system under section performance expectancy. For the section effort expectancy about 69.0% strongly agreed of the e-PHR would be easy to get e-PHR and view as per requested. The results show about 60.2% agreed the sequence of screen structure of e-PHR is very clear. Also, can conclude about 87.6% agreed overall satisfaction with e-PHR under section system capabilities is very helpful. About 81.4% agreed on the help message on this screen in e-PHR under the learning section is helpful. Furthermore, these research outcomes have provided improvements and benefits in the field of electronic personalized health records where patients as users are able to access and manage their own personal health records by themselves with restricted access via multi devices such as smartphones, tablets, personal computers, and laptops as well as to store data in the local, cloud and centralized storages.

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Appendix A – Presented the basic message illustration flow in the e-PHR prototype system in a sequence diagram.

a) Sequence Diagram

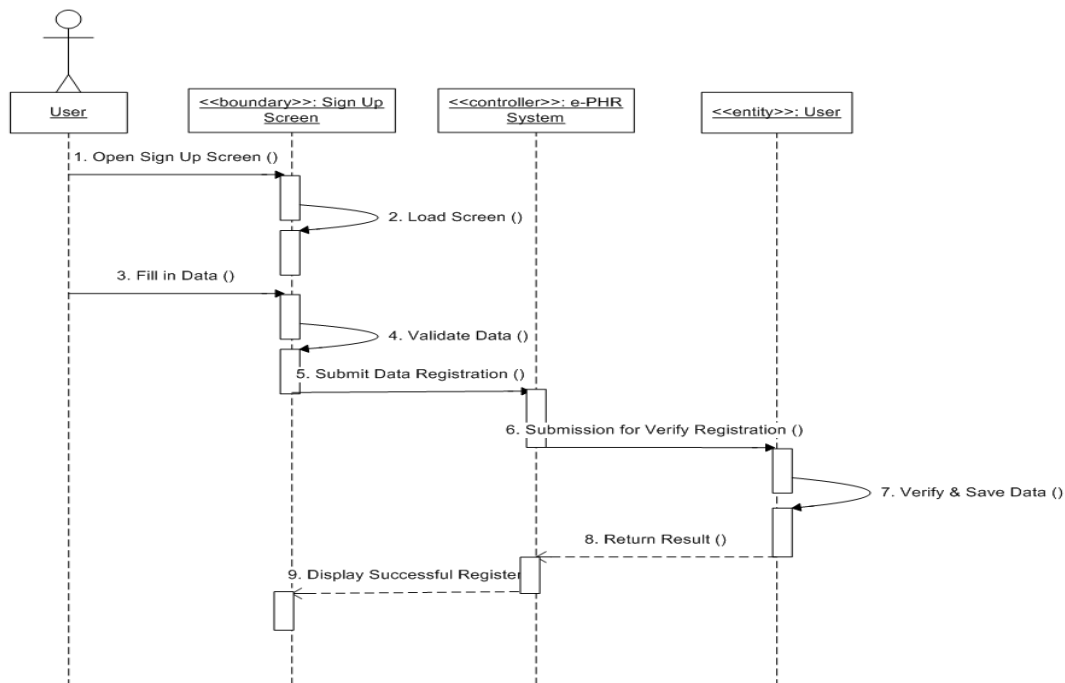


Figure 1: User Registration

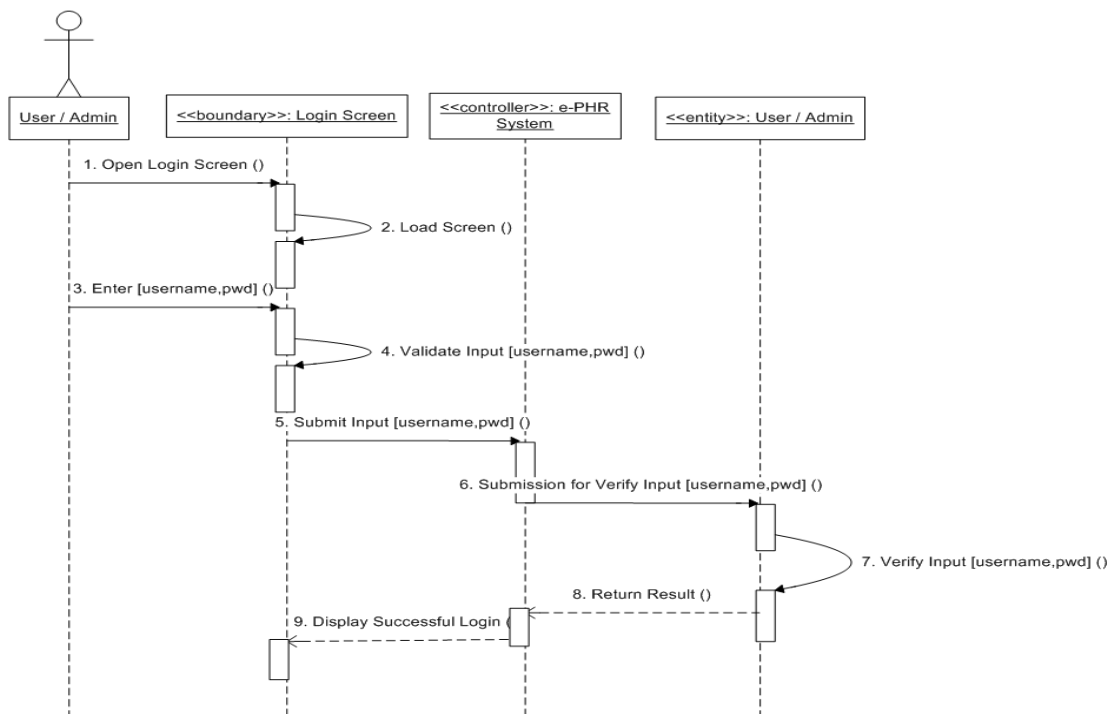


Figure 2: Login by User / Admin

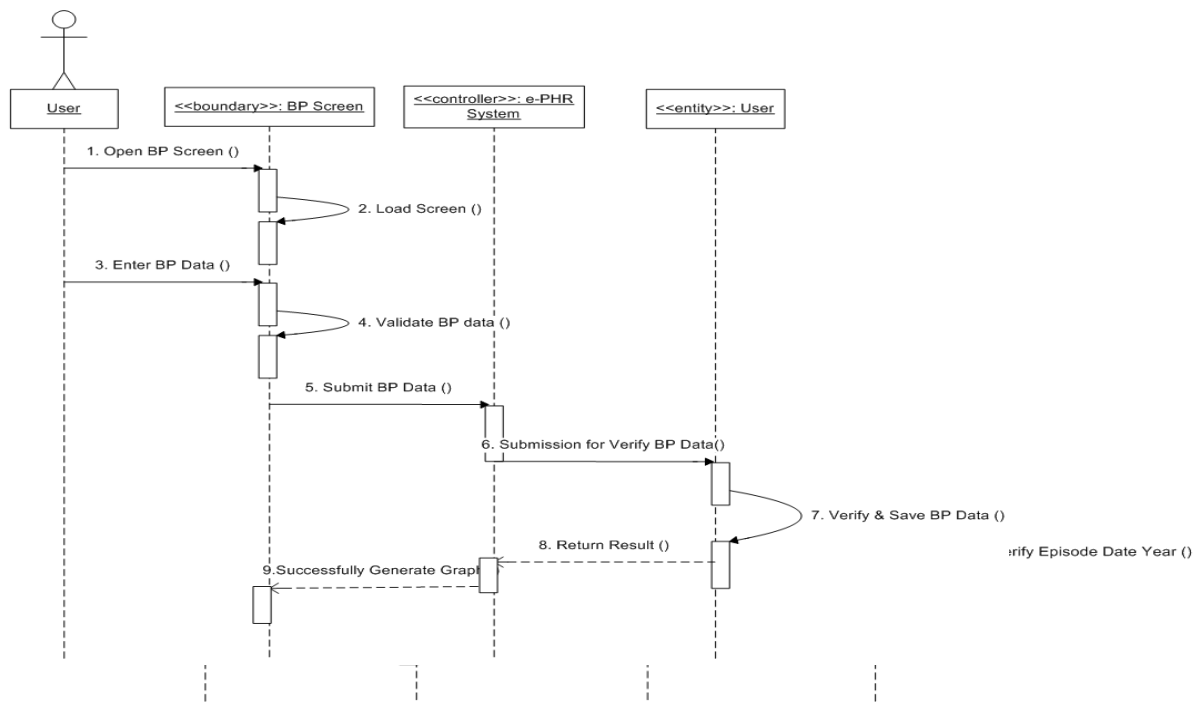


Figure 3: View Episode Date

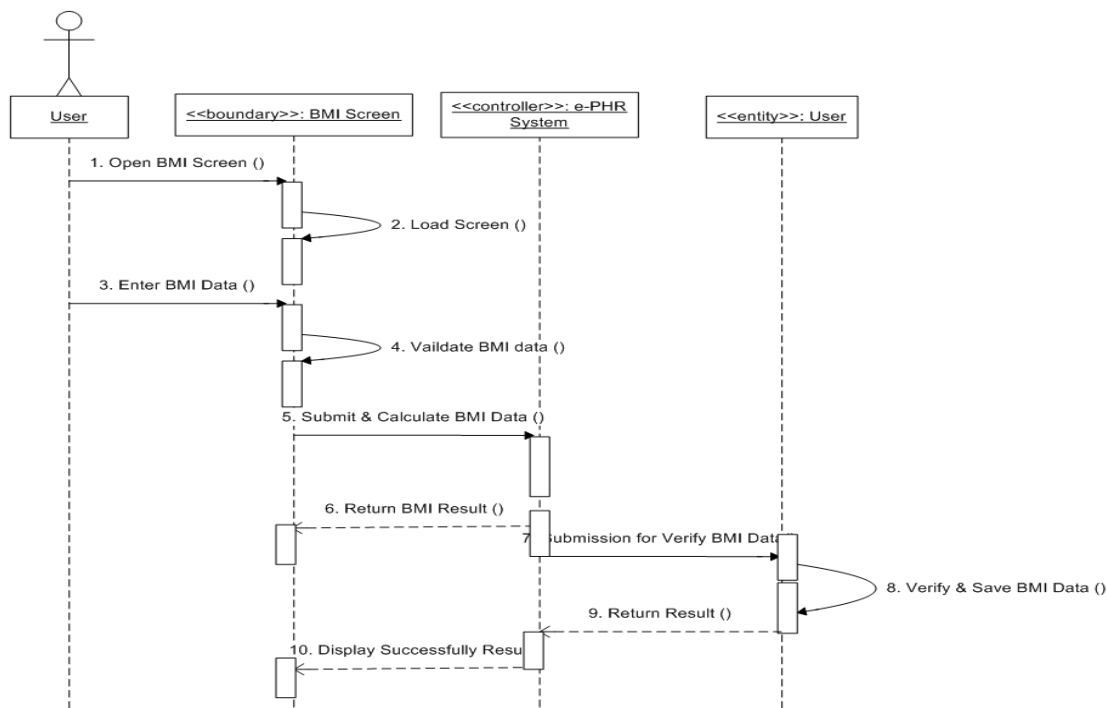


Figure 4: Add BMI data

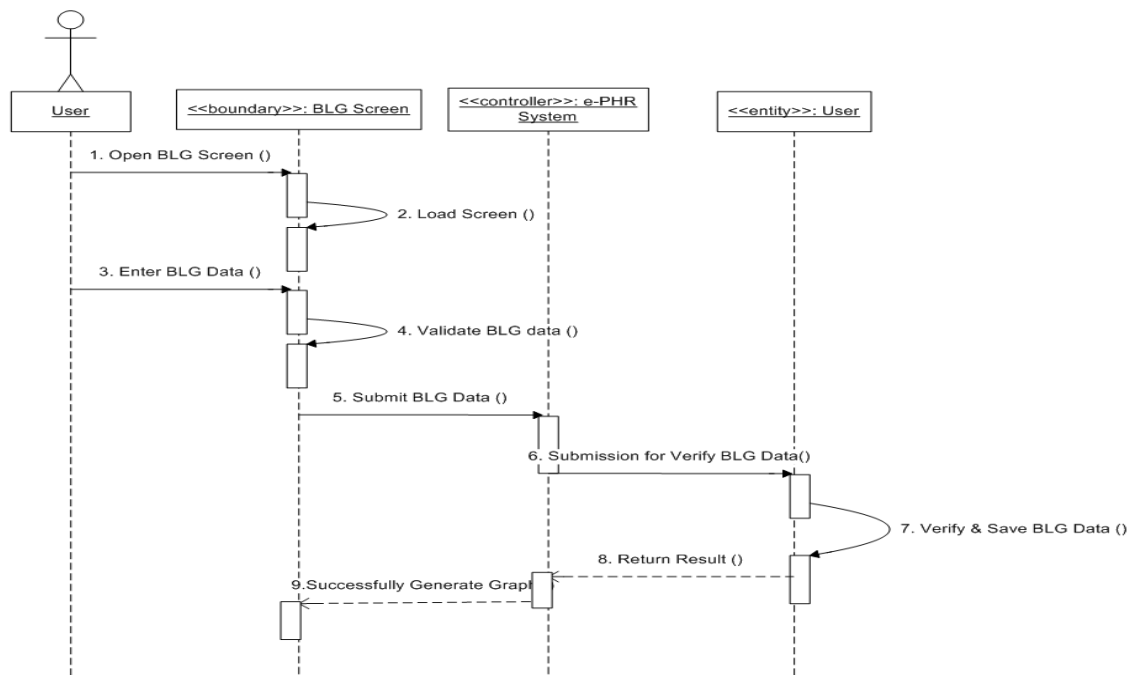


Figure 5: Add Blood Pressure (BP) Data

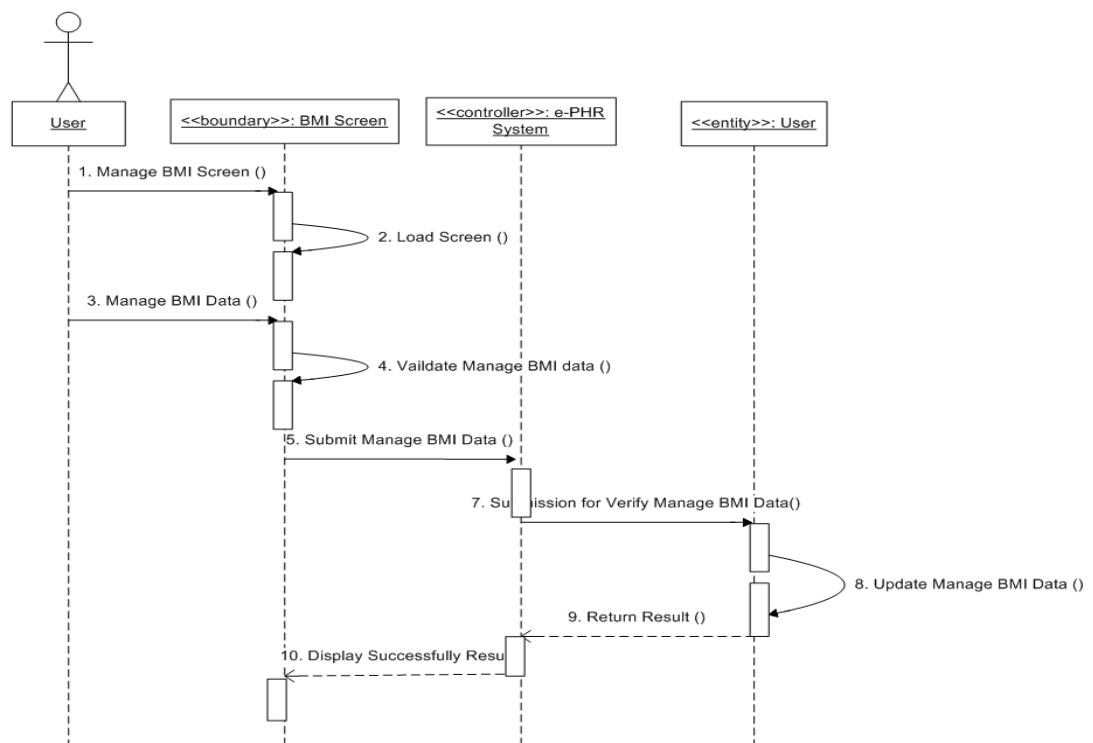


Figure 6: Add Blood Glucose (BLG) Data

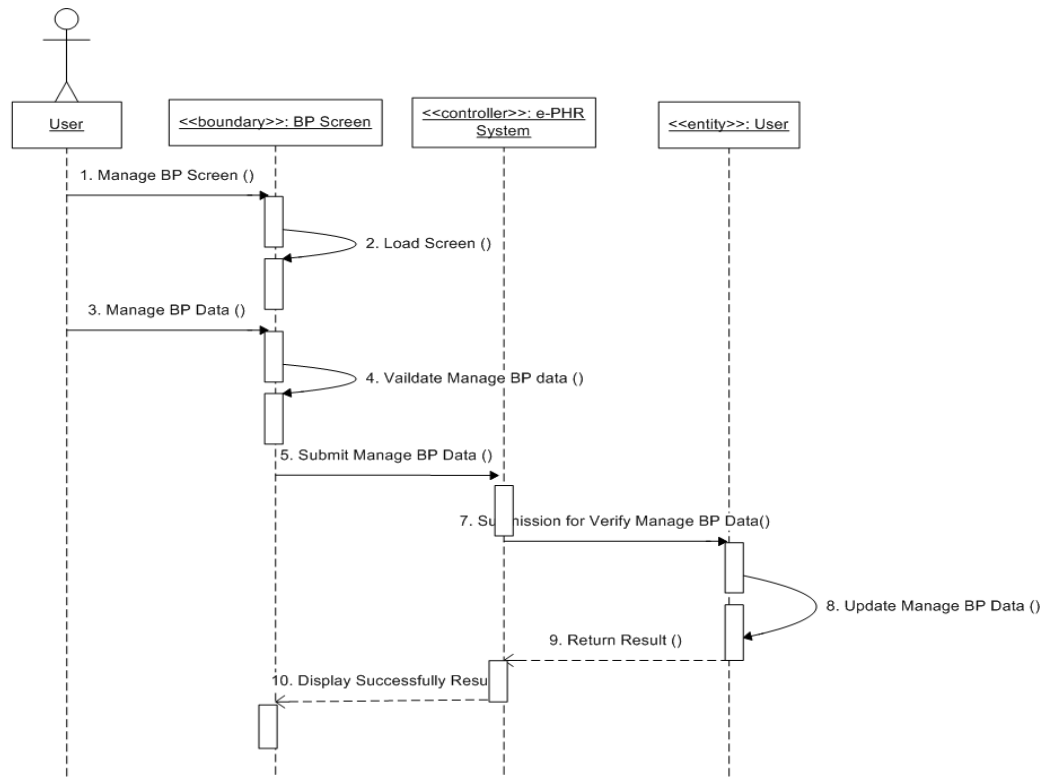


Figure 7: Manage Body Mass Index (BMI) by Admin

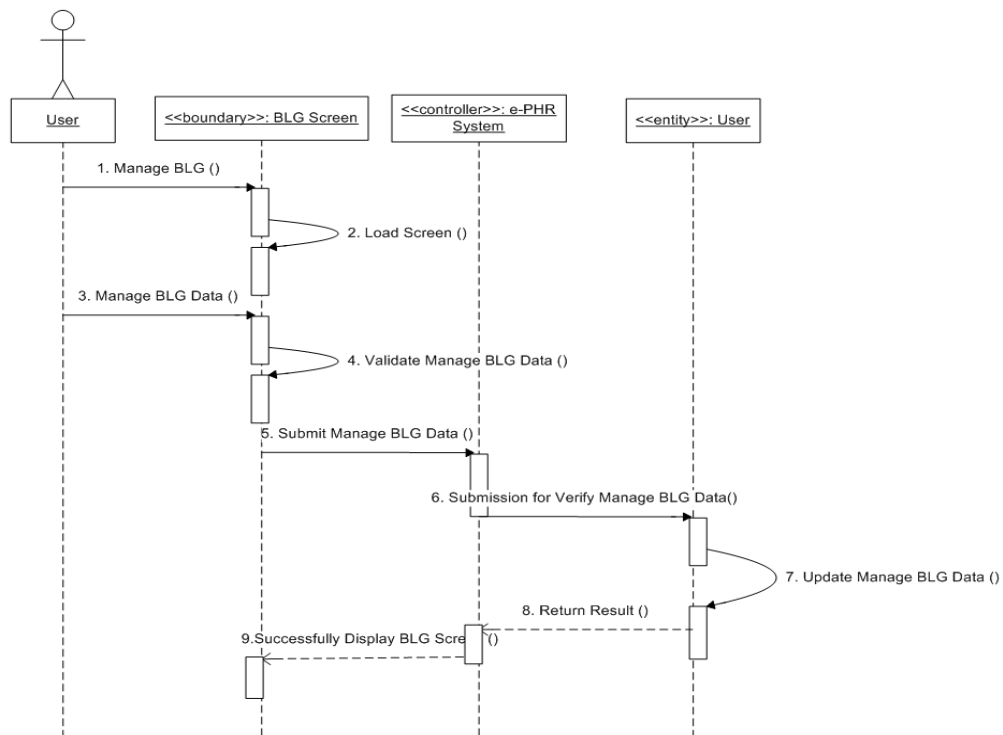


Figure 8: Manage Blood Pressure (BP)

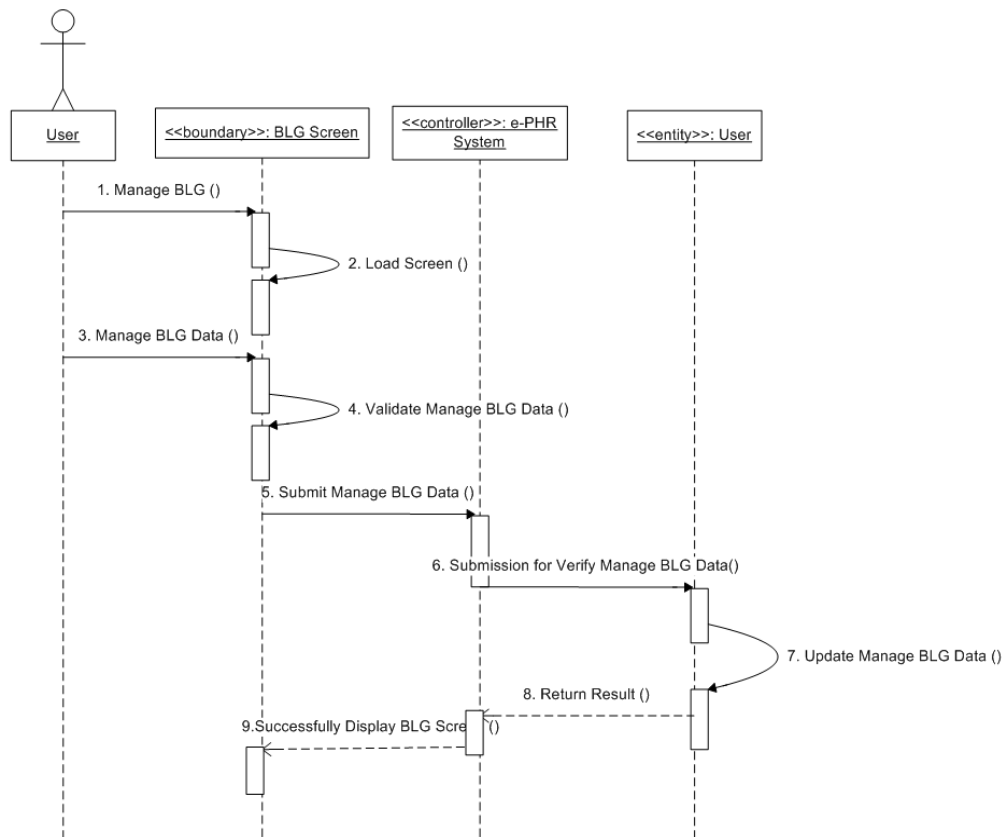


Figure 9: Manage Blood Glucose (BLG)