Software to Assist a Health Practitioner in Caring of Covid-19 Home Isolated Patients

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***Abstract*— This research uses modern communication and sensor technologies to allow health practitioners to monitor patients at home. It designed a component based software to address the problem of overcrowding in hospitals during covid-19 pandemic. It helps health practitioners in monitoring patients by measuring and testing patient's vital signs remotely with a potential for earlier guidance of treatment and transform patients to hospital in emergency cases only. This software uses wristband which placed around the patient wrist and sends vital signs data to the software using Bluetooth. Then the software analysis patient data and automatically send a notification to both health practitioners/hospital and patient family when patient symptoms get worse.**

Keywords— Healthcare Software, Coronavirus, COVID-19, Wristband, Component Modeling.

I. INTRODUCTION

Throughout the COVID-19 pandemic, the problem of overcrowding of patients in the emergency care system in the hospitals appeared to the point that the health staff was unable to distinguish critical cases from normal cases of the disease which has a negative impact on patient outcomes[1].

A lot of applications appeared recently in many countries around the world to prevent COVID-19 and stop its spread such as: (1) Contact tracing applications which use different methods of data collection such as Bluetooth technology to track the user movements [2,3,4]; (2) Information provision applications which give details information about the COVID-19 disease and guidelines to follow such as the importance of wearing face masks [5,6]; (3) Quarantine applications which track quarantined user's movement [7,8]; (4) Symptom monitoring applications which collect user's health information by showing a list of questions related to COVID-19 symptom, from which a COVID-19 diagnosis is made [7].

Some of existing applications uses smart wirstband to track patients and prevent the speration of COVID-19 such as Tetamman [7], Bader [8] and Corona Data Donation [9] applications.

Tetamman application is designed by the The Saudi Ministry of Health. It provides many features like showing COVID-19 tests results, updating data of those who were in contact with infected people, showing daily health status of patient, and allowing patient to communicat with 937 [7]. It also uses smart wirstband to track patients isolation and quarantine to prevent the speration of COVID-19 Tetamman.

Bader application is another COVID-19 application designed by Jordanian's Ministry of Health provides to track infected people communication and quarantined user's movement using a wristband [8].

Corona Data Donation application is designed by Germane Ministry of Health which automatically collects and records user's temperature, Heart rate and sleep data from volunteers wearing smartwatches or fitness trackers and represents these data in an interactive online map that would help the health authorities to assess the prevalence of infections [9].

However, all of the existing once did not used smart wristband for patients remote health monitoring which play a main role in decreasing emergency care system crowding numbers and increases system's ability to function, as well as patients outcome.

This research proposed a component healthcare software system that addresses this problem. It uses a smart wristband to help the health practitioners in monitoring patients to reduce death cases and improve the health care of COVID-19 patients by measuring and testing patient's vital signs remotely with a potential for earlier guidance of treatment and sending a notification to emergency when patient health status gets worse. A prototype of the proposed system s was implemented using java.

II. HEALTHCARE SOFTWARE COMPONENT MLDELING

The healthcare software composed four components as shown in Fig.1:

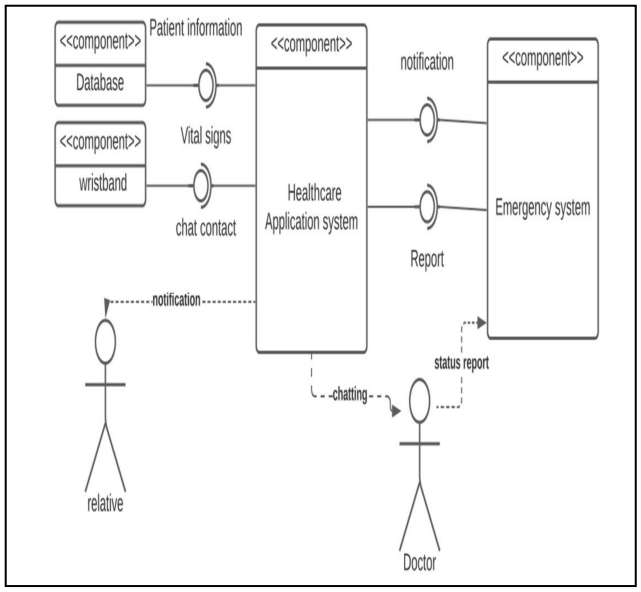

Fig.1. Healthcare Software Component Model

A. Database System Component

The database system component represents the National Information system database and is used to obtain general patient data based on his/her national ID such as name, gender, age and phone number.

B. Wristband Vital Signs Measurement System Component

A wristband which places around the patient wrist and contains a vital signs measurement system to measure Body Temperature, Heart Rate and Blood Pressure and transfer these data via Bluetooth to the mobile application installed on the patient's phone.

C. Healthcare Application System Component

A Healthcare application system is a mobile application that receives the Body Temperature, Heart Rate and Blood Pressure from the wristband vital signs measurement system component and displays these data digitally in the application interface. This application also displays the patient private data such as name, gender, age, etc., all of that of course is done after the patient is registered in the application. This Application sends a patient daily vital sign data report to the emergency system component. It also contains a chat box that allows patient to live communicate their medical concerns with health practitioners. This helps health practitioners to determining urgent and emergent status. When patient data register critically abnormal vital signs such as Temperature less than 35°C or greater than 38.9°C and Heart rate greater than 120 beats/minute, this application automatically send an emergency notification to both health practitioners/hospital and patient family.

D. Emergency System Component

The emergency system is a hospital system where the patient data are imported from the healthcare application system. Patients data with critically abnormal vital signs are shown on the application home page. This allowed health practitioners to deal with urgent and emergent status quickly and send an emergency team immediately to the patient's location. Critically abnormal vital signs which indicates an emergent statues and activates emergency team are [10]: (1)Temperature less than 35°C or greater than 38.9°C, (2)Heart rate less than 60 beats/minute or greater than 120 beats/minute, (3)Blood Pressure less than 74 mmHg or greater than 125 mmHg.

III. HEALTHCARE SOFTWARE PROTOTYPE

Using Java, Java Android studio and SQLite Healthcare software prototype was developed.

A. Database System Component

For the purpose of testing, SQLite was used to develop the Database system component.

B. Wristband Vital Signs Measurement System Component

All the existing wristband comes with build in system which reads the vital sign through difference sensor nodes and send them to other applications or devices using Bluetooth such as Caretaker Medical [11] and Bakeey T1 Thermometer [12]. Using Java Android studio a class of vital sign inside Healthcare Application System Component was developed.

C. Healthcare Application System Component

Using Java Android studio this component was developed. User can either log in or register in the application. Fig.2 shows the flow of registered new user activity from one screen to another. Register new user activity contains 6 screen and 5 pop-up windows where user can:

- Create new account by inserting his/her National ID or Residency ID and phone number using screen 2 and 3.
- Set up new password using screen 4.
- Change existing password using screen 11.
- Get permission from user to use his/her location and open his/her mobile Bluetooth using screen 5,6 and 7.
- Check wither the user have a Wristband or not using screen 8 and 9.

Fig.3 shows the flow of user log in activity from one screen to another. User log in activity contains 9 screens where user can:

- Log in by inserting his/her National ID or Residency ID and registered password using screen 1.
- Check his/her health state and vital signs using home page screen 2. There are two scenarios: (1) Emergency scenario shown in Fig.4, where patient vital signs register critically abnormal vital signs, this screen automatically send an emergency notification to both Emergency System Component (health practitioners/hospital) and patient relatives, (2) Normal scenario shown in Fig.5, it also called

non-urgent case where this screen automatically send a vital signs report to Emergency System Component (health practitioners/hospital) and user can either chat with health practitioners or call emergency using screen 3.

- Check or change his/her profile using screen 4. User can: (1) Check his/her personal information using screen 5, (2) Add, check or change his/her relative information using screen 6, 7 and 8, (3) Connect the application with the wristband using screen 9, (4) Change application language using screen 10.

D. Emergency System Component

Using Java this component was developed. Fig.6 shows the emergency main page where health practitioners can see a list of urgent and emergent status which require immediate and emergency treatment, check their vital signs and send a request to emergency team.

IV. Conclusion and Future Works

This research proposed and developed a corona virus patient monitoring component based software application which uses wristband to collect vital signs data from home isolated patients and then electronically transmit data to health practitioners. It helps health practitioners in assessment of patient state, in treatment plan and in transformation of emergency cases patients to hospital.

As future work we would like to continue our work and improve the software by connecting the four components. We would also like to add more vital signs to the applications.

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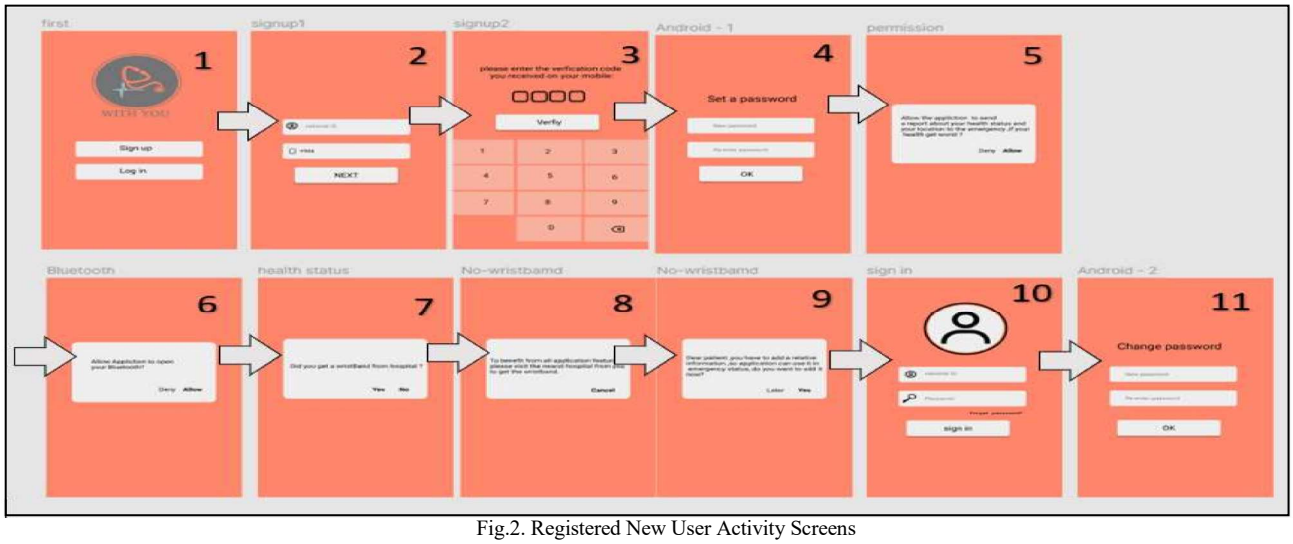

Fig.2. Registered New User Activity Screens

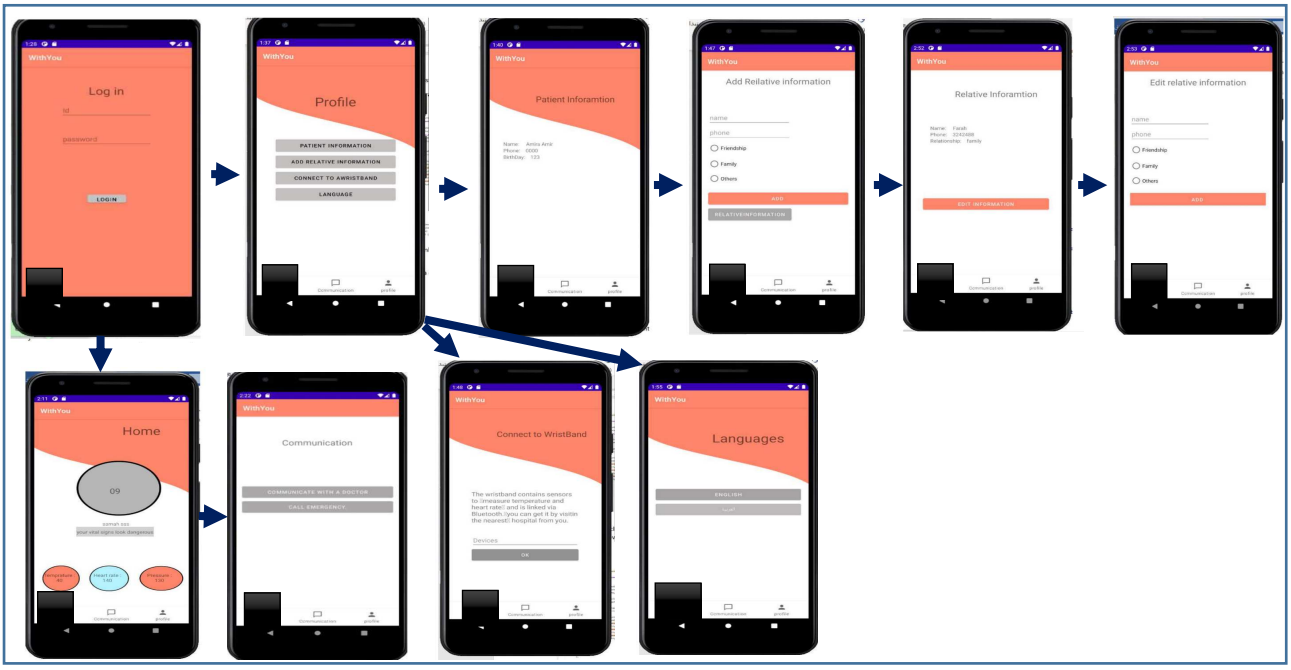

Fig.3. Log in Activity Screens

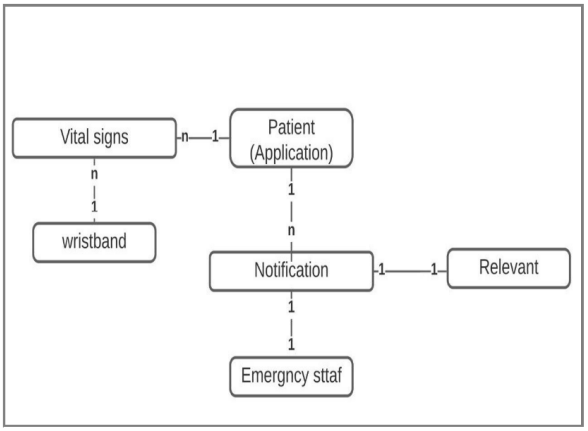

Fig.4. Emergency Scenario Diagram.

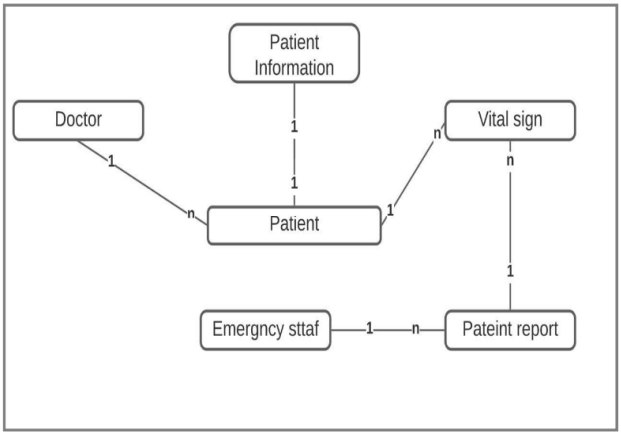

Fig.5. Normal Scenario Diagram

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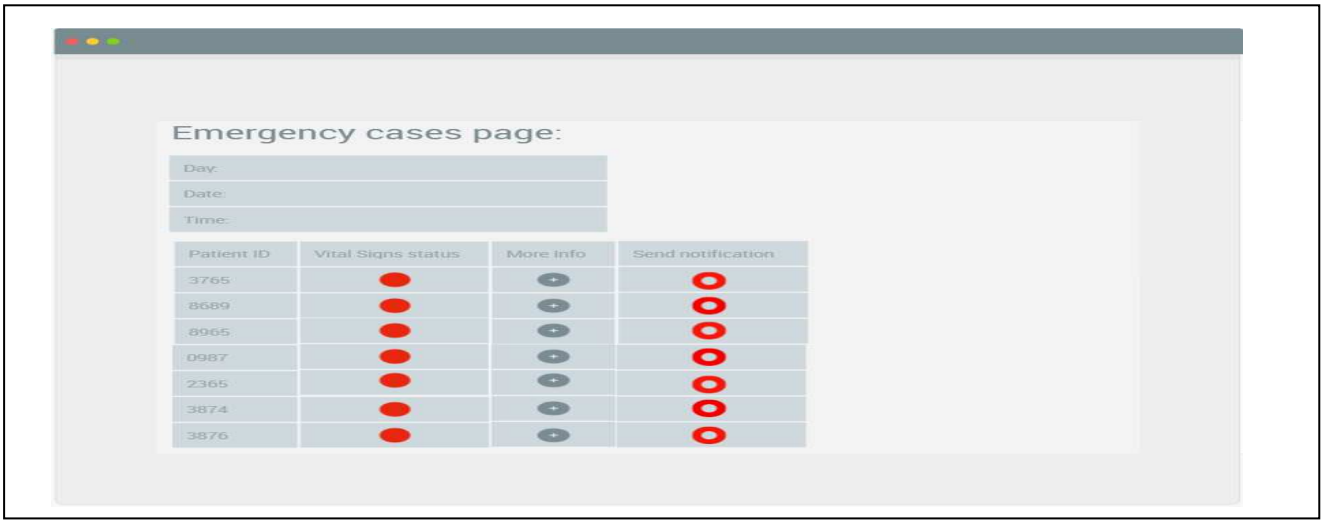

Fig.6. Emergency Main Page Screen.