How to Cite:
Jadeja, S., Bhatt, N. J., & Vaghela, R. (2022). A modern tech-driven approach to prognosis powered by realtime health care record updates from the patients. *International Journal of Health Sciences*, *6*(S9), 3836–3847. Retrieved from https://sciencescholar.us/journal/index.php/ijhs/article/view/13487

A modern tech-driven approach to prognosis powered by realtime health care record updates from thepatients

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Abstract---In this era of technological advancement, all the sectors, including primary health care, have been upgraded to their pinnacle with fascinating tools and systems that actually make the process of saving a patient's life somewhat easier than it used to be. Medical records typically consist of self-reported patient information along with doctor's notes on diagnoses, and treatments. But there's so much more to it. Up-to-date medical records generally contain self-reported detail such as contact and demographic information, lifestyle habits, medical history, vaccination information, and past test results. The primary reason why accurate and up- to-date medical records are super essential is that THEY CAN SAVE LIVES DURING EMERGENCIES. In this study, we aim to present a system that helps doctors get the necessary details of patients beforehand. So in case of an emergency, based on these essential data, the doctors can decide and start preparing the pieces of equipment and medicines before it's too late. If the health parameters cross a pre-determined threshold value, a notification will be sent through an email or an SMS.

Keywords---IoT, Remote health monitoring, vital sign monitoring.

Introduction

A combination of embedded systems, software, and sensors is referred to as the Internet of Things. The healthcare industry has seen constant evolution and gradual development in the past few years. It has exceeded the opportunities for innovation in the IoT- based development in the medical sector. However, with great opportunities come seemingly insurmountable challenges. These challenges include but aren't limited to maintaining standard security of data, adoption of the new technology, collecting all the data, and maintaining the data. Telemedicine and mobile health are some of the types of remote health monitoring [3]. This project strives to holistically gather the medical history of a patient before any medical assistance is demanded. In addition to that, the system should gauge the number of heartbeats per second, ECG, and the temperature of the patient's body. Armed with the medical history and the current measurements of that patient's physiological conditions, the doctor can observe the current situation of the patient prior to them actually reaching the hospital. This can be beneficial in innumerable ways, one of which is that the doctor can guide the staffs that are accompanying the patient in the ambulance, to administer life-saving medications which can help the patient reach the hospital safely. A real-time test reading had been done on a group of volunteers and then the resultant readings were compared with the commercial thermometer. The readings were distinctly comparable with the thermometer readings [1]. During the decade from 2050, it is expected that 20% of the total population will be 60 years or older. or older [7]. The cost of healthcare systems must increase as a result [8,6,20]. In order to maintain a healthy lifestyle, environmental conditions play a crucial role. The sensors can measure physiological signs such as electrocardiograms (ECGs), electromyograms (EMGs), and heart and blood pressure [22,21].

When critical patients arrive, a lot of time is wasted on reporting patients' illnesses and medical history. Therefore, the patient monitor is an efficient system used to carry out a quick thirty-second diagnosis using heartbeat and, temperature sensors to record vital patient parameters required initially by the doctors to start any treatment and remotely transmit these parameters over the wireless medium to the hospital even before the ambulance is deployed [2]. Telemedicine and mobile health are some of the types of remote health monitoring [11]. An early warning alarm notifies the doctors of the impending medical emergency that is detected via the cloud-native health monitoring app. This may benefit the patients' relatives who are concerned about the physical condition of the patient. In addition to that, the device may actually increase the chances of surviving an unexpected illness [4].

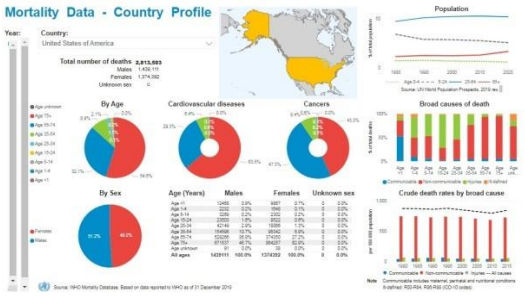

Figure 1. Who Mortality Database [41]

A patient's IoT healthcare process includes two components, a sender and a receiver. A variety of sensors, monitors, cameras, and more are used on the patient's side. Using these devices, live health details are collected, converted to digital format, and then sent to the next step [1][5]. The receiving side reviews the data. At that point, further action is taken, such as delivering the prescription, providing patient instructions, or preparing for treatment [14]. Human vital signs are measured and converted into electrical signals by sensors. This allows remote monitoring systems to use wearable sensors and communication media to monitor health [15]. Mutual understanding and trust development are essential. For data confidentiality, only authorized entities should be able to access and modify the data [10, 19].

Systolic pressure, that's the maximum strain all through a heartbeat and diastolic strain is the minimal strain among heartbeats. This pressure is measured in millimeters of mercury above the encircling atmospheric strain. A hundred and twenty mm of mercury is the systolic strain and 80mm is the diastolic strain of a completely grown human being [13]. BPM is the number of heartbeats in one minute. A normal pulse for healthy adults is between 60 and 100 BPM. If the heartbeat of a person plummets to 60 BPM, the patient suffers from Bradycardia, on the other hand, if the BPM exceeds 100, the anomaly is

Materials and Method

In this project, we have used Arduino IDE for data extraction and sensors for measuring heartbeat, body temperature, and ECG. Three health sensors have been used in this system, namely: galvanic skin response sensor, body temperature sensor, and heart pulse sensor. These are clubbed together into a single circuit along with Arduino Raspberry Pi and UNO. The Raspberry Pi sends the captured data to the cloud bucket. Using the ESP8266 WI-FI module we send all the data to the server and that will be reflected in the android application. The device is automatically connected to Wi-Fi and sends the data to a server which will appear in the android application. We have used a crocodile clip that is attached to Patience's finger. It continuously takes all the measurements of the patient and then it is reflected in the application. The resultant data is stored in the cloud using Raspberry Pi. The data in the cloud will be updated in a real-time. The proposed system also generates an ECG

Diagram and can show the health parameters graphically. The ambulance number is also a part of the information transmitted to the application. The application shows the ambulance numbers of the ambulances that are currently on their way to the hospital. Using the ambulance number, the doctors can access the record of a particular patient. For data confidentiality, only authorized entities should be able to access and modify the data [10, 19].

Table I Sensors and Their Usage

Sensor Name	Use of Sensor
Dallas18820	To measure body temperature level
Heart rate sensor	To measure Heartbeat of patient
ECG	To measure Electrocardiogram Of patient

called tachycardia [3]. Heart-associated diseases have been considered the biggest cause of impermanence in the world [12]. The heat can be calculated by subtracting the total heat produced by the human body from the heat lost by the body. The importance of consequently monitoring the body temperature is that it justifies the patient's condition because the temperature of the body is a function of the heart's performance. The heart starts pumping blood faster as the temperature of the body gets high. The normal body temperature stays between the range of 36.5°C and 37.5°C. The patient might suffer from hypothermia if the temperature level goes below 36°C. On the other hand, if the temperature level goes above 37.5°C, hyperthermia attacks the [8, 6]. In this project, the Dallas18820 sensor is used for measuring the body temperature of the patient. The installation is not fixed which is why a change in the number of sensors will immediately reconfigure your network. Physicians can readjust the network's mission as medical needs change. Sensors self- routing paths, work together in data processing, and establish hierarchies [18].
organize to form

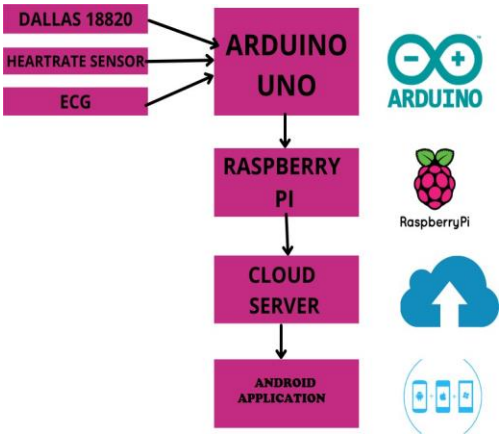

Figure 2. Sensors attached for remote health monitoringx

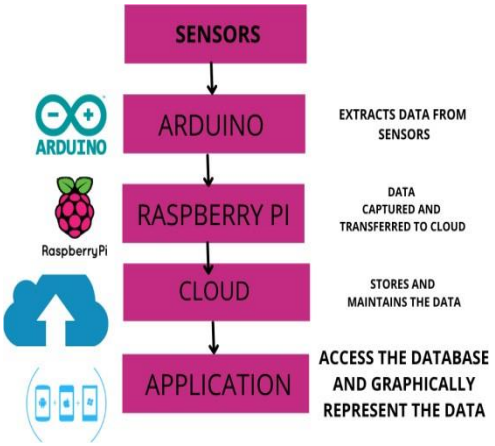

Figure 3. Architechture of the remote health monitoring system

The android app, persistently connected to the server, is the primary user interface is connected with the server. The alarm notification will be sent directly to the hospital staff in cases of emergency by the application. The emergency alarm notification will prompt the staff to send urgent ambulance help to the place where the patient is currently situated. This location is tracked and sent through the android application. A gyroscope is used to identify the position of the patient. A gyroscope comprises a rapidly spinning disc or wheel fixed on an axis which can freely change its direction at any time. Even if the wheel/disc is titled the orientation of the axis remains unaffected.

The medical information and history that will be collected through the application will be:

1. Blood group
2. History of the patient's family's medicalhistory
3. Medications taken by the patient
4. Allergies
5. Info about past diagnoses, the uncovereddiseases, and their suggested remedies
6. Info about previous medical history
7. Preventative measures like vaccines
8. Preliminary info about the family doctor andhis/her health care provider

Results and Discussions

The test results obtained by calculating the body temperature and heart rate of 5 people, with three different test cases, are presented in the table below. The table shows that after the patient performs these activities, there are various changes in the measurements, the number of heartbeats, and body temperature.

Android Application (Remote Health Monitoring System) Of The Project:

Name	Major disorder (if any)	Activity	Average heart rate reserve	Average body temperature (in celsius)
Ketan	Minor Diabetes	Standing	100	37
		Walking	120	37.5
		Exercising	135	37.5
Riya	NA	Standing	88	36.4
		Walking	95	36.88
		Exercising	140	37.1
Ramesh	NA	Standing	100	37
		Walking	96	37.23

The android application which constantly receives data from the server and can be accessed by the hospital staff is shown in the figure below.

Figure 4. Interface of the application (RHMS)

As reflected in Fig.1, the android application will be having two buttons in the home page, where the user needs to authenticate and select one of the options and move forward with the next step.

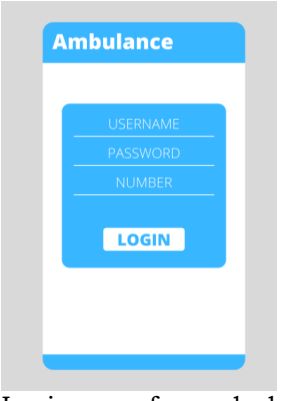

Figure 5. Login page for ambulance staff

Fig. 2 displays how to enter the details about the emergency situation of a patient who is in the ambulance. The person entering the details about the patient needs to enter the username, password, and ambulance number to access

the patient's previous data and to send currently measured data to the hospital staff.

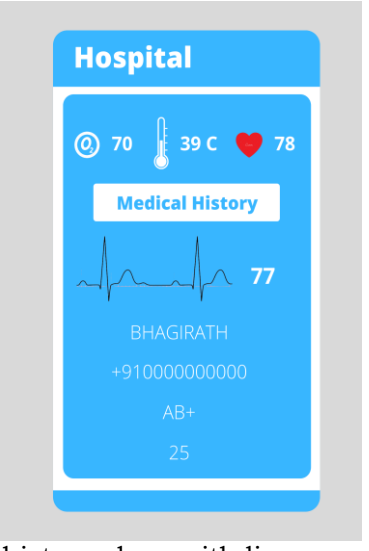

Figure 6. Sending medical history along with live sensor measured health report

The next figure, Fig. 3 shows the data to be sent to the hospital staff. This would reflect the current measurements of patient's heart rate, oxygen level, temperature along with the patient's medical history details.

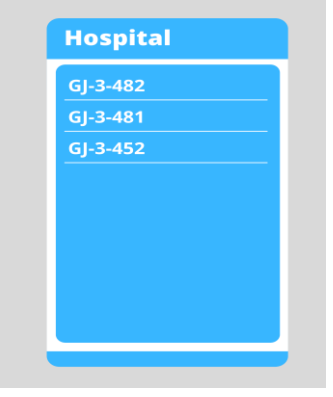

Figure 7. List of ambulances on the way

The pre-medical history of the patient appears in the fig. 4. There are two buttons on the home screen. Both buttons lead to the ambulance module and the hospital module, respectively. After clicking the former button, the next screen will display the list of ambulances on their way to the hospital.

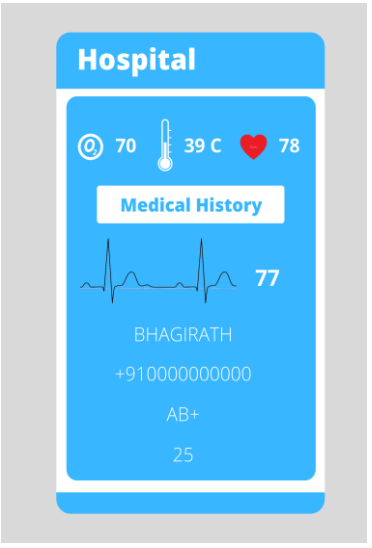

Figure 8. Medical history along with live sensor measured health report

Clicking the ambulance number will allow the doctor to view the patient's information. Upon entering the following screen, the current health status of the patient and his medical history will be displayed.

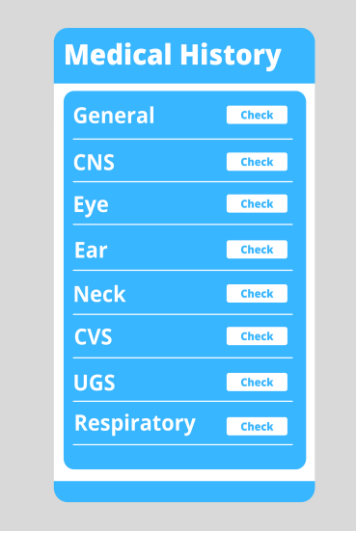

Figure 9. Medical history reports of patient

Web Portal:

The website disseminates all the information related to the patients and the hospitals. The website has been made 100% confidential and is secure to use. The following screenshot in the Fig. 5 shows the test case data of a hypothetical patient named, Bhagirath.

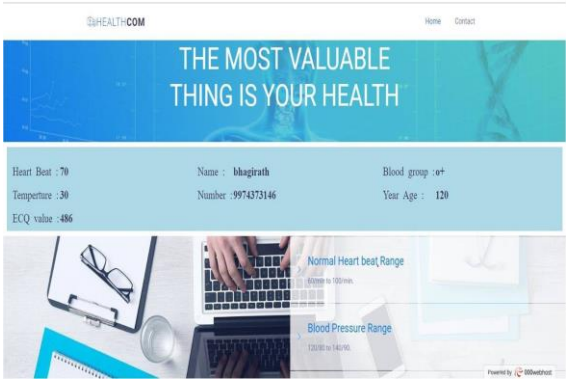

Figure 10. Online website of remote health monitoring system

Conclusion and Future Scope

This paper has addressed the current demands and necessity of providing a contactless health-based sensor technology that gives an early warning to the doctors about a medical emergency detected through the cloud-based health monitoring system. The sensors integrated with Arduino UNO measure the patient's essential physiological parameters and transmit them to the medical staff during emergency.

Using an android application, the patient's physiological parameters can be viewed graphically. The final results are uploaded to the cloud by Raspberry Pi. Users then receive their desired output. It can be concluded from critical reviews, surveys, and design reviews that the project has met its primary objectives. Even though invasive or contact- based interventions are needed in many circumstances, there are new methods of collecting physiological data as non-invasively as possible. In order to achieve this, contactless methods have been extensively researched in recent years. For future development, the patients should be identified in a database, so that the risk of getting the wrong drug, dose, or procedure is decreased by reducing the chance of mistakes. In addition to that, multitenancy could cause security problems such as data leaks. Confidentiality (privacy of patients' data) and integrity (a safety valve against unauthorized modification of patients' data) in IOT systems are of paramount importance.

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