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A Real Time, Automated, Medical Emergency Service for Informing the Closest Rescuer

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Abstract - *In an age where mobile phones and social media have become more influential than ever, the society of medical emergency responders need use of it now more than ever. Nowadays, hospitals, care centers, and other institutions currently provide care for many physically disabled and elderly patients. For these patients to receive the care they deserve, they must leave their areas of comfort and go to the nearest hospital. This takes a toll on the patients' body and induces mental stress. Also, these patients may have medical conditions that might not enable them to go outside on their own, and in worst situations, these patients may have critical emergencies that may require medical attention. For instance, if a patient has a cardiac arrest inside or outside the premises of a hospital, there may not be anyone to quickly arrive and assist. As of this day, fatal accidents like these have had a spike in occurrence. The main problem being faced in these situations is the delayed arrival of medical response. So, to combat this situation, we propose a medical emergency application that allows us to monitor the vitals of the patients to provide them medical services in dire situations. This application also provides storage of information of the patients in the community cloud, establishes the means of communicating with the doctor and receive medications if necessary.*

Key Words: Mobile, Medical, Emergency, etc.

1. INTRODUCTION

The usage of smartphones has seen a major increase due to its ease of use. If this technological marvel was made available to every employee and patient inside or outside a hospital, then there is a huge possibility that these patients will be offered help in the quickest way possible. Therefore, with the use of Cloud Computing implemented in a smartphone application, patients will be able to accept aid from doctors whenever and wherever necessary.

One of the most interesting things in Cloud is the emphasis on Cloud Storage. Cloud Storage is a service that lets you store data by saving it in the Internet or another network to an offline storage medium maintained by a third party. This way, the information about the hospital employees and the patients are safe and secure, known only to the service provider.

During the early 2000s, smartphones were being patented and developed by the world's leading companies. But at the time of invention, they were too expensive for the commoners to buy. Therefore, many were still using pagers for exchanging information with one another. This means of communication was widely practiced by most hospitals, and is still being considered the norm. This allowed the employees to rapidly give medical response and save lives within a short distance (Hospital infrastructure).

By extending this idea and implementing it using the smartphones we could cover wider region which may also include outside the hospital infrastructure. This way the patients who are in need of medical attention can receive help quicker than usual. According to 2013 civil registration data that was released by the CENSUS directorate nearly 23% of total deaths in India had occurred because of no medical attention during the time of death. Our project aims to reduce this rate as well as possible.

To achieve this, we propose a smartphone application that monitors the vitals of the patients and detect emergencies as quickly as possible. If such emergencies are detected, the application sends an alert message along with the patient details to the closest medical rescuer which allows the responders to try to save the patient as quickly as possible. This application also allows the patients to receive prescription for medicines from the doctors.

2. RELEATED WORKS

Shin Yan Chiou et al., proposed that the use of community cloud is briefly mentioned. A Community Cloud is a cloud-based database which continually collects sensor data from a Smart Building, making this data easily available in the event of an emergency. Access restrictions are applied to provide different information granularity for scenarios. In the event of an emergency, the Community Cloud can release detailed information to authorized medical staff, allowing for more efficient rescue operations. [1]

S. Zeadally et al., mentioned several anonymous authentication protocols for Wireless Body Area Networks (WBAN) that were proposed to enhance security by protecting the identities of patients and by safely encrypting their information. However, these protocols are not secure enough. So, this project tells the user to review the most

recent technique for WBANs and point out that it isn't secure for medical applications by conducting an impersonation attack. After that, the user proposes a new AA scheme for WBANs and proves that it is secure. The results show us that the proposed scheme not only overcomes the security weaknesses in previous schemes but also has the same computation costs at the client side. [2]

L. Chen et al., proposed an efficient and privacy-preserving location-based services query scheme. In this scheme, the location-based service provider's data are first stored in the cloud server in an encrypted manner, and then, a registered user can get accurate location-based service query results without divulging his/her location information to the location-based service provider and the cloud server. [3]

C. Adams et al., proposed that acquiring information during emergency situations encounters substantial challenges, such as large volume of data processing, unstructured data, privacy, authorized data access, and so forth. Among these issues, access authorization has received little attention. To jointly address the aforementioned issues, a location-aware authorization scheme that enables first responders to access information is theorized, provided that they are within a predefined distance from data owners at the time of an emergency. [4]

L.-J. Kau et al., proposed an architecture for the fall accident detection and corresponding wide area rescue system based on a smart phone and the third generation (3G) networks. To realize the fall detection, the angles acquired by the electronic compass (e-compass) and the waveform sequence of the tri-axial accelerometer on the smart phone are used as the system inputs. The acquired signals are then used to generate an ordered feature sequence and then examined in a sequential manner by the proposed cascade classifier for recognition purpose. Once the corresponding feature is verified by the classifier at the current state, it enters the next state. Otherwise, the system will reset, going back to the initial state and wait for another feature sequence to appear. Once an accident is detected, the user's position can be acquired by the global positioning system (GPS) or the assisted GPS, and sent to the rescue center via a 3G communication network so that the user can get medical help as soon as possible. Computational burden and power consumption issue on a smart phone system is proven to have reduced. Moreover, the superiority of the proposed algorithm is justified by the test results, which showed that a distinguished accident detection accuracy up to 92% on the sensitivity and 99.75% on the specificity can be easily achieved of activities that are estimated by using the proposed cascaded classifier. [5]

F. Hoflinger et al., proposed a novel indoor localization and monitoring system based on inertial sensors for emergency responders. The system makes use of acceleration, angular rate and magnetic field sensors and consists of three main components. The first component is a modified Kalman filtering which implements the sensor data fusion and at the same time, detects and minimizes the magnetic field disturbances, in order to provide a long term stable solution. The second component is zero velocity updating. This resets the velocity within still phase to deliver accurate position information. The last component of the system is motion monitoring, which is achieved by calculating the relative position of each body segment based on the transformation of coordinate frame of each body segment. This experimental result shows that the system is able to track person indoors in both walking and running cases, and also helps monitor the body movement during the whole period of experiment. [6]

F. Pascucci et al., proposed the REFIRE project that explains that GPS-denied areas lack the necessary resources to provide location and proper communication to the first responders such as fire responders in indoor environments. To overcome this, the REFIRE project the REFIRE project proposes a system composed of deployable solutions exploiting low-cost, simple, highly standardized pre-installed landmarks. The REFIRE project has ambitious targets: to validate such solutions in realistic scenarios and to anticipate the large number of location information that systems are unable to operate. [7]

J. Rantakokko et al., provided a survey on technologies and theoretical concepts that could be used for rescue positioning systems, with an emphasis on indoor positioning. An easy and efficient positioning system with seamless coverage is a highly needed for increasing safety in emergency situations, medical and otherwise. It must be lightweight, portable, inexpensive, and must consume lower power, and still provide accuracy during time consuming operations. [8]

3. PROPOSED SYSTEM

According to 2013 civil registration data that was released by the CENSUS directorate nearly 23% of total deaths in India had occurred because of no medical attention during the time of death. Our project aims to reduce this rate as well as possible. To achieve this, we propose a smartphone application that monitors the vitals of the patients and detect emergencies as quickly as possible. If such emergencies are detected, the application sends an alert message along with the patient details to the closest medical rescuer which allows the responders to try to save the patient as quickly as possible. This application also allows the patients to receive prescription for medicines from the doctors.

3. METHODS

- Information Storage
- Patient Appointment Request
- Patient Medication
- Emergency Monitor and Rescue Aid

3.1 Information Storage

In this module, the information of all the patients and employees (doctors, nurses, ward boys and ambulances) in the hospital or the organization are obtained and stored in a common cloud server database. The employees can send a registration request along with their information through the cloud using their smart phone. These information are verified by a common administrator in the admin dashboard and if the information are valid, the registration request will be accepted and an employee ID will be generated for the respective employee. Only after receiving an employee ID will the employee be able to perform further actions. After the registration process is completed, the user (employee and patient) can login in into the application using the username and password given while registering.

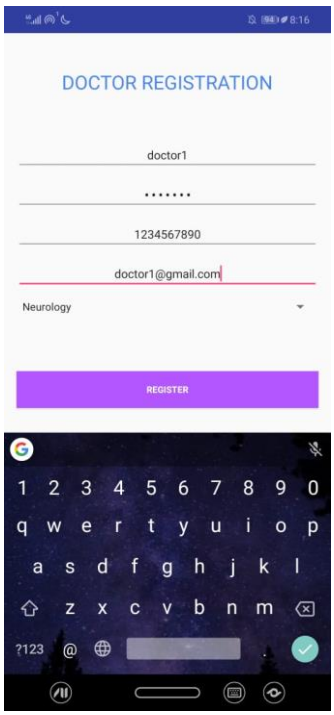

Figure 1. .Registration Of User

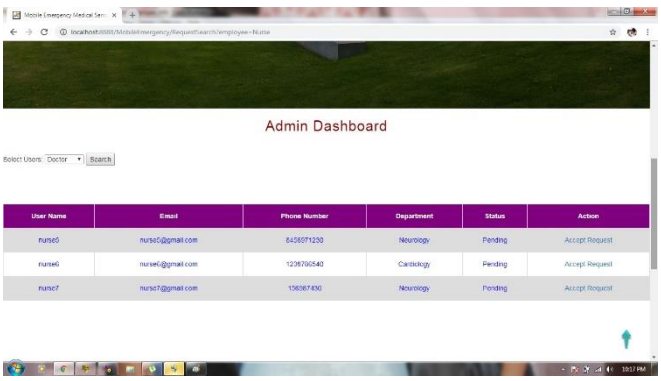

Figure 2. Admin Dashboard

3.1.2 Patient Appointment Request

After the employees and patients are registered, they can login into the application. If the patients are logged in and they can send an appointment request to the preferred doctor. The request sent by the patient will be received be the server and it will be forwarded to the respective doctor. The doctor can log in into the application and check for the appointment requests given by the patients.

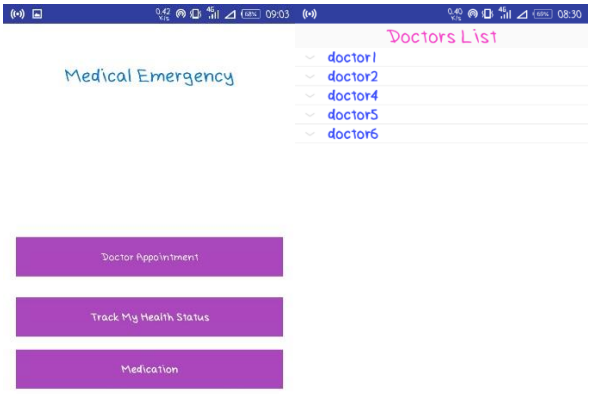

Figure 3. Appointment Request and doctors list

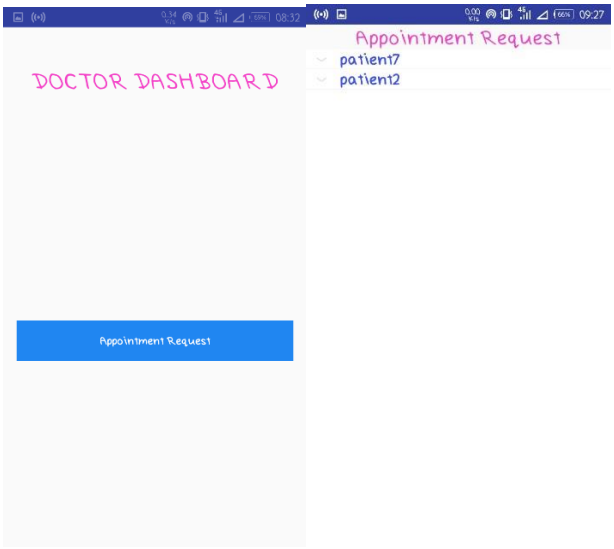

Fig 4. Doctor Dashboard and Appointments

3.1.3 Patient Medication:

Once the doctor accepts the patient request, he/she will determine whether the patient should be admitted in the hospital or not. If the doctor decides that the patient can be an outpatient, then the medication suggested will be send directly to the patient's smartphone. If the doctor decides

that the patient should be an admitted patient then the suggested medication will be sent to the head nurse from the respective department in which the patient is admitted. To summarize this, either the patient or the head nurse will be able to see the medication depending on the type of the patients.

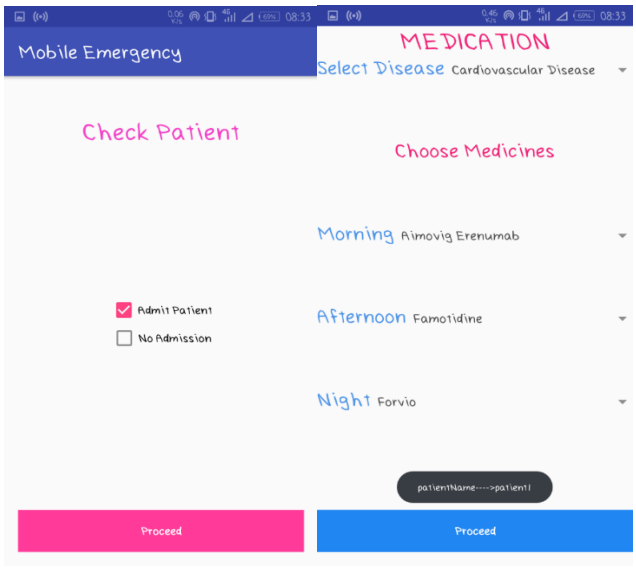

Figure 5. Check Patient and Medication Prescription.

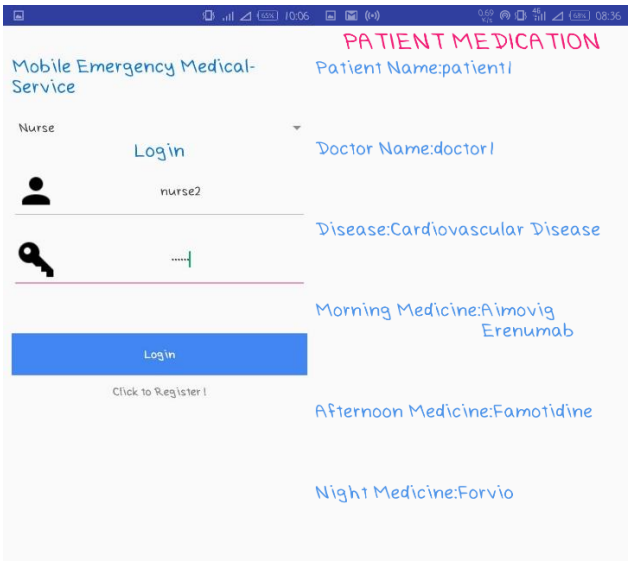

Figure 6. Head Nurse Login and Medication Details.

3.1.4 Emergency Monitor and Rescue Aid:

In this module the vitals are continuously monitored and are simultaneously updated to the cloud server. These vitals which include pulse rate and temperature are monitored using a Pic 16 Micro Controller. These details can also be tracked by the patients through their smart phones. These vitals may increase or decrease way past the threshold values. If this happens, an emergency is triggered and an emergency alert is sent to the server. The server in turn forwards this alert message to the concerned doctor and the ambulance of the hospital. The coordinates of the patient where the emergency has occurred will also be relayed to the ambulance. This way, the patient can be saved as soon as possible without further delay.

4. SYSTEM ARCHITECTURE

Our system architecture includes two main entities:

- Patients, who are in need of medical attention.
- Hospital Employees, who provide medical service to the patient in case of emergencies.

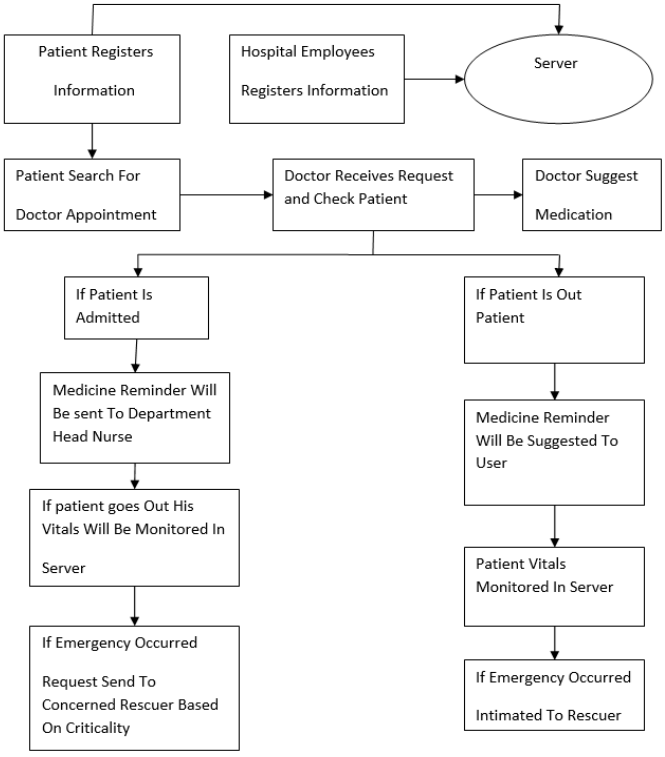

Figure 7. Medical Emergency System

In order for the doctors to provide the necessary services to the patients, we consider the following precautions:

- The patients should be registered in the application.
- Each employee of the hospital should be registered and be available whenever possible.
- The vitals of the patient should be monitored cautiously if he/she is to be saved.
- Misdiagnosis and wrongful prescription of medicine should not be done, since this will cause more harm than good.

5. CONCLUSION

We implement a medical service emergency to save the lives of patients who are admitted or recently discharged. It uses a smartphone to get the vitals and the location of a patient via BP sensor, heart rate sensor, and the GPS sensor. All the necessary medical staff are notified of the patient's status prior to bringing the patient, in order to be well prepared. This idea is applicable in hospitals and old age homes. This can be applied in individual houses also. Future enhancements may include migrating this service to smartphones of different operating systems. It may also include implementing payment of service charges for the consulted medical staff.

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