IoT Based Ambulance Alert System for Geriatric people

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Abstract: Geriatric people are more prone to physiological imbalances due to the effect of aging. They face many problems in their day to day life which are needed to be solved before any serious complication arises. Most of the geriatric people are not getting adequate healthcare especially in case of old age homes the manager has to visit them in person to check their condition. Thus, providing them with remote and quick access to healthcare has become crucial. Our work focuses on, design of Internet of Things based vital parameter monitor for geriatric people along with Ambulance alert system. This device helps the old age home managers to monitor the condition of the patients with the help of an application. Based on Internet of Things technology, the application gets the temperature and SpO2 data of a patient and in case of emergency, nearby ambulances are tracked and alerted to save the lives. In addition, it will also be useful for contactless monitoring of patients who are affected by COVID-19 virus.

Keywords: Geriatric People, Vital Parameter Monitor, Internet of Things, Ambulance Alert System, Contactless Monitoring.

I. INTRODUCTION

In many of the old age homes, geriatric people are in rooms which are away from the control room and the manager has to visit the room and help the needy, this can consume time and cause more discomfort to the geriatric people. Patient monitors can monitor the vital parameters but are too costly and only used in hospitals. So, there is a need of a device which can monitor them continuously and send data to the care taker [4]. An effective way to monitor them is designing a vital parameter monitor which is always in contact with them without disturbing their daily activities, simultaneously tracking them. The proposed system can monitor the vital parameters and transmit the information along with the location via Internet of Things technology [7]. In case of emergency which is possible when the patient is outdoors the device can track the location and send the data to nearby ambulance. The device will surely be a boon to geriatric people who are in need of adequate healthcare.

II. WHY TEMPERATURE AND OXYGEN SATURATION ARE VITAL PARAMETERS?

According to a research conducted by National Institute of Aging, for an older person, a body temperature of 95°F or low can cause many health problems, such as a heart attack, kidney problems, liver damage, or worse[12]. Patients older than 65 years or those with chronic disease who have fever represent a group at high risk for serious disease. Morbidity and mortality rates in this group are significant. From 70%-90% are hospitalized and 7-9% die within 1 month of admission.[10]. The risks of hypothermia are shown in Fig 1.

Fig 1-Risks of Hypothermia

A study conducted by Keith S Kaye, Malini Stalam, Wendy E Shershen, Donald Kaye, suggests that in acutely infected nursing home patients, a decrease in oxygen saturation of >3% from baseline, as well as a single oxygen saturation of <94%, should suggest pneumonia.

If the oxygen saturation level falls below 90% and left unmonitored in particular for older people who are in sleep[11]it can lead to Hypoxemia which can even cause brain and liver damage. The effects of hypoxemia are shown in the below infographics (Fig-2).
I. IoT Based Ambulance Alert System for Geriatric people

II. COMPARISON WITH EXISTING PRODUCTS

| PRODUCT         | PARAMETERS MONITORED     | ADVANTAGE                                      | NEED OF PROPOSED PRODUCT                                      |
|-----------------|--------------------------|------------------------------------------------|----------------------------------------------------------------|
| Proposed Product| Temperature, SpO₂        | IOT based Alert Mobile application for easy User interface | Real time monitoring Sends location of patient to ambulance driver and vice versa |
| Snap ECG B10    | ECG and EKG              | Continuous monitoring for 12 hours              | No any type of alert system found in case of emergencies        |
| Health Watch    | ECG, temperature, respiratory rate, body posture | Remote health monitoring                      | No mobile application for easy user interface                   |

Table 1-Comparison with existing products

IV. MATERIALS

This section includes selection of sensors and controllers for the development of IoT based ambulance alert system for geriatric people. The sensors and controllers were selected based on those meeting the specific requirements for the proposed system.

TEMPERATURE SENSOR (LM35)

Fig 3- LM35 (Temperature Sensor)

Courtesy: mikroe.com/lm35-sensor

Fig 2- Hypoxemia-Symptoms and causes

Courtesy: vivehealth.com/blogs/resources/what-is-normal-oxygen-saturation

[14]
### Table 2: Specifications of LM35

| PARAMETERS   | VALUES                  |
|--------------|-------------------------|
| Scale Factor | Linear + 10.0 mV/°C     |
| Accuracy     | 0.5°C                   |
| Temperature  | −55°C to 150°C          |
| Operating Voltage | 4 V to 30 V  |

### Table 3: Specifications of SpO2 Sensor (MAX30100)

| PARAMETERS         | VALUES                  |
|--------------------|-------------------------|
| Operating Voltage  | 1.8V and 3.3V           |
| ADC Resolution     | 14 bits                 |
| Digital band reject filter | 50Hz/60Hz   |
| LED pulse width    | 200μs to 1.6ms          |

### Table 4: Specifications of Neo-6m GPS Module

| PARAMETERS                  | VALUES                  |
|-----------------------------|-------------------------|
| Receiver type               | 50 channels             |
| Horizontal position accuracy| 2.5 m                   |
| Velocity accuracy           | 0.1 m/s                 |
| Operating Voltage           | 3.3V                    |

### Table 5: Specifications of Node MCU ESP8266

| PARAMETERS                  | VALUES                  |
|-----------------------------|-------------------------|
| Input voltage               | 7-12V                   |
| Clock speed                 | 80 MHz                  |
| Digital Input/Output Pins   | 16                      |
| Operating Voltage           | 3.3V                    |

**Fig 4- MAX30100 (SpO2 Sensor)**

**Fig 4- NEO-6M (GPS MODULE)**

**Fig 5- ESP8266 ( NODE MCU)**
V. METHODOLOGY

When homeostatic imbalance occurs, especially for geriatric people there are changes in temperature, oxygen saturation and heart rate. Temperature sensor has been used to measure temperature differences and for monitoring and measuring oxygen saturation, the SpO₂ sensor has been incorporated along. These sensors are integrated using Internet of Things development board Node MCU ESP8266 and the software used is Arduino IDE (Version 1.8.8). To locate the nearby ambulances the GPS Module and a microcontroller Node MCU ESP8266 is used. The data is uploaded in a real-time database, Firebase and consequently it is transmitted to the designed application. The application tracks patient’s health condition and it has smooth User interface with option to switch off the alert system if not required.

VI. RESULTS AND DISCUSSION

Temperature and oxygen saturation were measured and recorded. Location of the ambulance was tracked and uploaded to firebase along with the data of vital parameters. These data will be sent to an application which monitors parameters and tracks the ambulance simultaneously. The application alerts the ambulance if the SpO₂ range falls below or above the threshold value. The location of the ambulance will be received by the application and it also has the option to turn down the alert when the user does not require any emergency help of the ambulance

VII. CONCLUSION AND FUTUREWORKS

Based on few trials with patients’ consent we conclude that, the application monitors the vital parameters such as temperature and oxygen saturation using LM35 and MAX30100 accurately and it also obtains the ambulance location data successfully. On the whole, the monitoring system is very useful for the elderly in old age homes. In addition we believe that this device will also be useful for COVID-19 patients who are in need of emergency health service with contactless monitoring. Further, we are currently in research to make the device wearable such that it would help to monitor existing parameters along with additional parameters such as ECG and respiratory rate of the elderly with better accuracy.

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