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A Real-Time Monitoring System for the Elderly based on the GSM Network

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Abstract

Infectious illnesses are more prevalent and harmful in older adults because to functional, demographic, and immunological changes brought on by aging. Treatment for these disorders is complicated by aging organ systems. Given that many seniors have multiple illnesses and take multiple medications, antimicrobial therapy for them should be carefully chosen to prevent drug interactions and other issues. Thus, it is important to keep an eye on the health of elderly people. In this research, we tracked elderly patients using a clever technique. The device includes a microprocessor, temperature sensor, pulse sensor, LCD display, and GSM module. The temperature and pulse of the elderly are shown on an LCD monitor. The system may notify emergency services if the pulse and temperature data go over the permitted limitations. The method was successfully tested on a large number of elderly persons.

Introduction

According to Meyer (2001), people aged 65 and older have an extremely high prevalence of respiratory idiopathic disorders such as airway hyperreactivity, lung neoplasms, chronic obstructive pulmonary disease, and pneumonia.

Adult human immune systems perform less effectively than those of children and adolescents. It is possible for people who are suffering respiratory distress to have reactions to treatment interventions that are either delayed or abnormal. In addition, the adult population is at risk for infections of the skin and subcutaneous tissue, infections of the urinary system, infections of the respiratory tract, and infections of the digestive tract.

The introduction of innovative initiatives has the potential to reduce the number of infectious illnesses that affect the senior population. In addition, the treatment of time-sensitive infections in a timely manner and in an effective manner, such as sepsis, bacteremia, and pneumonia, has been proven to reduce death rates (Htwe et al., 2007; Cooper et al., 2002). This may improve the quality of care provided to patients (Htwe et al., 2007; Cooper et al., 2002).

In the study referred to as (Pines et al., 2006), the researchers utilized the database of the National Hospital Ambulatory Care Survey to investigate the usefulness of temperature and pulse irregularities as predictors of hospital admission and antibiotic administration in elderly patients who presented themselves at an emergency department.

The exclusive reliance on triage temperature and pulse in a community comprised of old residents, where the chance of infections is high, may not be adequate in appropriately determining the requirement for hospitalization and antibiotic medication. This is because the likelihood of infections is higher in communities with more senior individuals.

The current research suggests the construction of an intelligent monitoring system that may be adapted specifically for the senior population. This system would be able to measure the elderly person's temperature and pulse, and it would show the results it acquired on an LCD screen.

In the event that the previously established limits are breached, the system is equipped to send an alert message to the relevant authorities in the event that the thresholds have been exceeded.

The following parts are to be included in the text after the introduction section, in the order shown below: The following outline is the current draft of the manuscript: The relevant literature will be elaborated upon in Section 2, the suggested system will be outlined in Section 3, the results will be analyzed in Section 4, and Section 5 will provide a thorough conclusion.

Related work

In the year 2023, a consolidation of an oximeter and a body temperature module was implemented into a singular apparatus with the intention of streamlining the procedure of conducting exigent health assessments. The data obtained from the MAX30102 and GY-906-BCC sensors were transmitted to an Arduino microcontroller. The facilitation of COVID-19 monitoring is observed as a consequence, as per the findings of Pathania et al. (2023).

In the year 2022, a novel patient health monitoring device was created utilizing the Internet of Things and four distinct sensors that quantified temperature, heartbeat, pulse, and UV radiation. The study conducted by Odusami et al. (2022) revealed that the ESP8266-01 Wi-Fi module data was stored in the cloud via Thing Speak. This approach led to an enhancement of the measured parameters, deployment environment, and response time.

In the year 2021, a monitoring system was procurable that had the capability to activate an alert in the event of any aberration in the user's heart rate, body temperature, or usage of an infusion, as compared to the norm. The findings of Devis et al. (2021) suggest that there was a notable enhancement in the health of patients as indicated by each of the three measures employed in the tests.

In the year 2020, a technological device was developed utilizing an Arduino microcontroller, temperature sensors, and an ESP-WiFi shield module. The aforementioned apparatus was employed for the purpose of remotely measuring an individual's bodily temperature. The device has the capability to establish a connection to an internet-based temperature portal through its wireless fidelity (WiFi) connectivity. Rahimoon et al. (2020) reported that the temperature difference between S1 and S2 was found to be 15 degrees Celsius on average.

Methods

The system is bifurcated into two distinct components: the former is responsible for monitoring the health status of the elderly, while the latter is designed to receive and process alerts or notifications generated by the former. The second component is denoted by the mobile device of the emergency center or any responsible individual implicated in the case of the elderly individual. The block layout of the system is illustrated in Figure 1.

The initial segment comprises the Arduino microcontroller, the temperature sensor, the pulse sensor, the GSM module, and the LCD. The temperature monitor is utilized to quantify an individual's body temperature, while the pulse sensor is employed to assess the individual's heart rate. In the event that the measured values exceed the permissible threshold, a notification will be transmitted to the emergency center and any pertinent stakeholders.

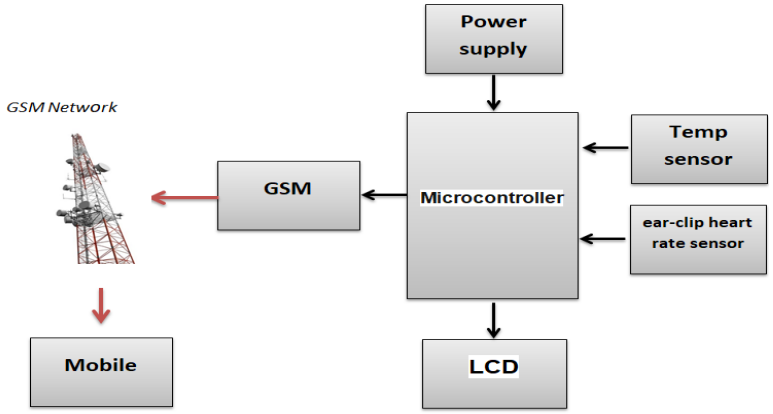

Figure 1 the block diagram of the system

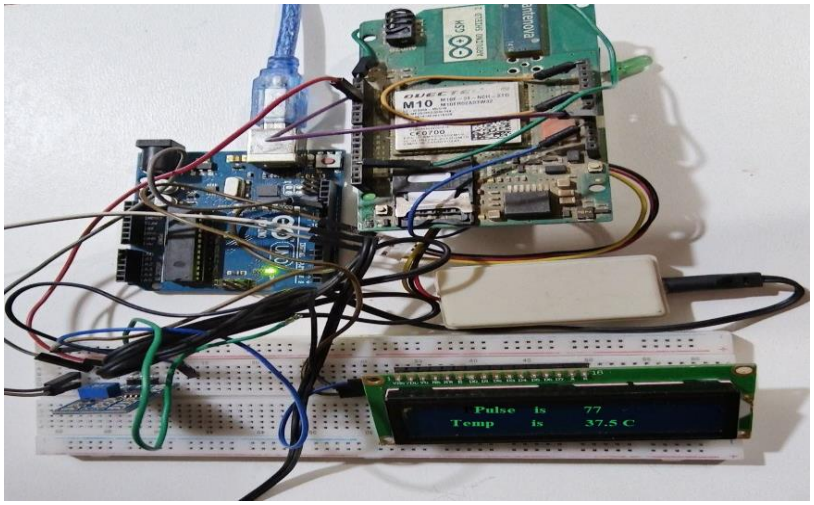

Figure2. Proposed System

The proposed system design, as depicted in Figure 2, illustrates the interconnection of the monitoring system's components. -

Hardware design

The Arduino Uno, a widely utilized microcontroller, is designed with a configuration that situates the digital pins on the right-hand side of the board and the analog pins on the left-hand side of the board. Soni et al. (2020) posit that digital signals, commonly known as pulse width modulation (PWM), have the capacity to modulate signal brightness by timely provision of supply voltage. Romendhon et al. (2020) have suggested that the integration of a GSM module with either an Arduino or an AVR can facilitate the transmission or reception of data, which can subsequently be processed by an Android smartphone or a microcontroller. Thomas et al. (2016) posit that the measurement of body temperature is a facile method for the monitoring and diagnosis of diverse health conditions. Temperature sensors are utilized for this objective.

A wearable device, specifically an ear band, equipped with a heart rate monitor, has been developed for the purpose of monitoring an individual's heart rate during physical activity. The Liquid Crystal Display (LCD) is a device with the capability of receiving analog heartbeat output. Farin et al. (2016) have reported the capability of monitoring the cardiac rhythm of the human body. The Liquid Crystal Display (LCD) Panel is a type of flat panel display that utilizes liquid crystals to produce images. It is commonly used in electronic devices such as televisions, computer monitors, and mobile phones. The LCD panel consists of several layers, including a backlight, polarizers, and electrodes, which work together to control the flow of light and produce the desired image. The LCD panel has become a popular choice due to its

low power consumption, high resolution, and slim design. Arduin et al. (2017) explicate that the present panel employs a conventional overhead projector to project data from a microcomputer onto a larger display. The Arduino microcontroller, which receives input signals from various devices and subsequently transmits output signals to control said devices, serves as the central control unit for all system components.

Software design

The Arduino UNO is amenable to programming and uploading of code through the utilization of the open-source Arduino Software (IDE) version 2.0.4. The current iteration exhibits enhanced efficiency and heightened potency in comparison to its predecessor. The software program exhibits compatibility with multiple operating systems, including Windows, Mac OS X, and Linux. The Java-based system employs a variety of open-source technologies, including Processing.

Activity diagram

An activity diagram is a kind of UML behavior diagram that was designed to demonstrate how a system develops over the course of time. It is considered to be one of the most important UML behavior diagrams. Basically, it is an upgraded and more complex version of the flowchart that depicts the development from one activity to the next. Flowcharts are used to show how one task leads to the next. It exemplifies, at multiple levels of abstraction, how numerous activities need to be coordinated in order to provide a service, as stated by Geambaşu (2012). The system's action diagram is shown here in Figure 3, which gives a visual depiction of the diagram.

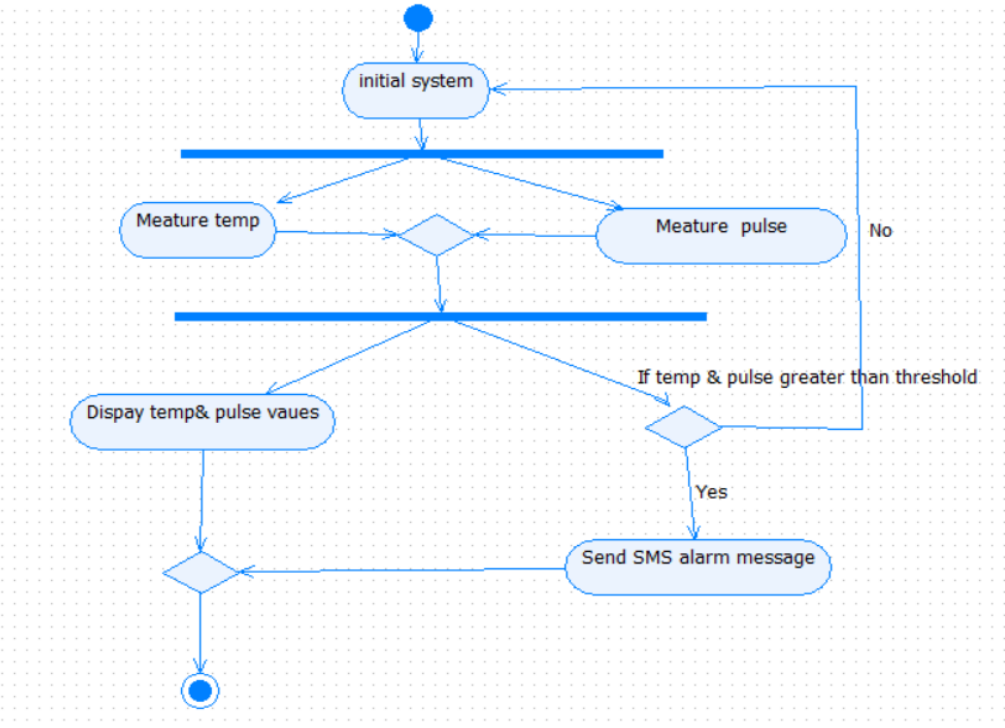

Figure 3. The activity diagram of the system.

Results and Discussion

The necessity of timely medical intervention for the management of various medical conditions in order to sustain or uphold life is widely acknowledged. In the present study, a surveillance mechanism was implemented on a substantial cohort of

subjects aged 60 years and above, exhibiting a commendable performance. The fourth figure in the series depicts the notification of an alarm via a text message, which was transmitted through the Global System for Mobile Communications (GSM) network. In the event that both the temperature and pulse rate surpass the predetermined threshold, the system shall transmit an alert message to the emergency center.

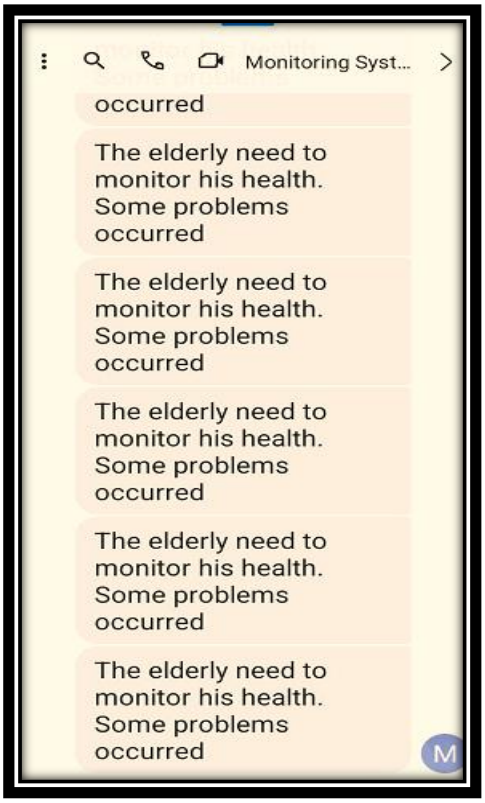

Figure 4. *SMS alarm message.*

Table 1 presents a comparative analysis of the previous research conducted in the relevant field and the proposed system, highlighting their distinctive features. The preservation of precise temporal synchronization is a fundamental requirement for the system's optimal functioning. In this regard, the Global System for Mobile Communications (GSM) represents a highly suitable alternative for guaranteeing the reception of signals.

Table 1. Difference between the previous works and the proposes system.

System	Methodology	Transmitted media
Previous systems	Previous systems used a traditional, Procedural model	Previous system used a group of sensors that transmit information based on the presence of the Internet.
Proposed system	The proposed system used the object-oriented model. Where it takes into account the synchronization of operations simultaneously, when sending more than one signal at a time to the control device.	GSM network is used to ensure the arrival and transmission of data and alarm message. Especially as we deal with critical systems

Conclusion

The aging process is associated with a multitude of alterations, several of which elevate susceptibility to contracting infectious diseases and impede their management. The present study introduces a real-time monitoring system designed to measure the pulse and temperature of elderly individuals. The system is equipped with an LCD screen that displays the results of the measurements. In the event that the measured values fall outside of the acceptable range, the system is programmed to send an alert message to the appropriate emergency services. The objective of this investigation is to ensure the provision of uninterrupted surveillance for geriatric patients. Early detection of the condition of the elderly and timely intervention are crucial factors that positively impact outcomes and enhance the quality of life for the aging population. The Global System for Mobile Communications (GSM) network was employed to ensure reliable transmission of the alert message. The deployment of this technology underscores the imperative of discovering inventive approaches to augment the management and treatment of geriatric patients and patients residing in long-term care facilities. In order to enhance the emergency response component, we propose the integration of an additional biosensor and a GPS device to facilitate the determination of the location of elderly individuals.

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