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ABSTRACT

In a pandemic, the availability of health indicators among at-risk populations, such as the elderly, is crucial due to the disease's rapid transmission and the need to act quickly to contain its evolution. Traditional clinical methods for monitoring vital signs typically involve contact-based sensors that must be precisely attached by a skilled healthcare professional. However, these methods are less practical for repeatable measurements and are unsuitable for long-term monitoring. On the other hand, contactless vital signs monitoring, employing radar-based techniques or IR-thermal imaging, eliminates the need for physical electrodes and proves beneficial for remote health monitoring. This not only reduces physical contact between subjects and healthcare professionals, ensuring social distancing, especially in nursing homes,but also shields the elderly population from external factors that may increase the likelihood of infection.This article presents three key contributions: ***(i)*** *vital signs characterization in the elderly population;* ***(ii)*** *astate-of-the-art review of the most prominent techniques and methods for Contactless Health Monitoring (CHM);* ***(iii)*** *the design, specification, and evaluation of a low-cost proof-of-concept CHM system for nursing homes, incorporating an IoT Edge Device. This facilitates real-time monitoring of vital signs (cardiorespiratory rates and elevated body temperature) using a multimodal approach based on Doppler radar and IR thermal imaging sensors, generating health indicators without any form of contact or invasiveness. Direct comparisons with reference instruments have revealed an error rate below 10%, in 74%, 52%, and 96% of cases for Heart Rate, Respiratory Rate, and Body Temperature measurements, respectively.*

1-INTRODUCTION

Global urban congestion is a result of the unprecedentedly high increase in vehicle traffic that urbanization has brought about. In addition to frustrating commuters, this congestion presents serious difficulties for emergency services, especially when it comes to guaranteeing prompt responses to life-threatening circumstances. Due to their predetermined time schemes, traditional traffic signal systems find it difficult to effectively prioritise emergency vehicles and adjust to changing traffic patterns. On the other hand, technological developments provide encouraging answers to these urgent problems. In an effort to completely transform emergency response procedures and urban traffic management, this paper presents the idea of IoT-Enabled Traffic Optimization.

By utilizing real-time data and adaptive algorithms to dynamically modify signal timings based on traffic density, IoT-Enabled Traffic Optimization marks a paradigm leap in traffic signal regulation. Through the use of sensors and cameras to continually monitor traffic flow at junctions, the system is able to precisely forecast levels of congestion and adjust signal cycles accordingly. With the help of this adaptive strategy, green hours are distributed more effectively, reducing delays and enhancing traffic flow in general. The system's efficacy is further increased by the use of machine learning algorithms, which allow it to learn from past data and predict future traffic patterns.

The system prioritizes emergency vehicle traffic at junctions in addition to streamlining traffic flow using a Density-Based Ambulance Clearance mechanism. The technology automatically modifies signal timings to create a lane when it detects an ambulance approaching a junction, allowing for quick and unhindered transit. By reducing delays in life-threatening medical circumstances, this ground-breaking function not only improves emergency response times but also helps save lives. The goal of IoT-Enabled Traffic Optimization is to enhance public safety and lessen the negative impacts of traffic congestion on metropolitan areas by facilitating smooth coordination between emergency services and traffic management.

The ability of IoT-Enabled Traffic Optimization to lessen traffic, shorten travel times, and improve emergency response capabilities highlights how effective it is. When compared to conventional signal systems, simulation studies and real-world experiments have shown notable improvements in traffic flow and emergency vehicle clearance. However, issues like interoperability, scalability, and connection with current infrastructure continue to be crucial factors to take into account when implementing the system on a bigger scale. In order to fully utilise this creative traffic management solution and create smarter, more resilient cities for the future, it will be imperative to address these issues.

Existing System

The existing systems for traffic management in urban areas struggle to prioritize emergency vehicles effectively due to their reliance on traditional traffic signal mechanisms. These mechanisms typically operate on pre-programmed timing schedules, which are unable to adapt dynamically to real-time traffic conditions. As a result, emergency vehicles, such as ambulances, often face delays at intersections, jeopardizing timely medical assistance and public safety.

Conventional traffic signal systems lack the ability to dynamically adjust to real-time traffic congestion. These systems operate based on fixed cycles that fail to account for the presence of emergency vehicles or sudden changes in traffic density. Consequently, traffic congestion continues to pose significant challenges for emergency response times, especially in densely populated urban areas.

Recent studies have proposed various IoT-based traffic management solutions aimed at addressing the shortcomings of traditional systems. These solutions leverage modern technologies such as IoT, real-time data analytics, and wireless communication to enhance traffic flow and prioritize emergency vehicle passage. Below are key examples of IoT-based systems:

Proposed System

The system integrates Wi-Fi modules, Arduino Uno microcontroller, and IR LEDs to create an efficient, flexible, and scalable solution for data transmission and interaction with sensors and actuators.

Adjusts traffic signals based on current traffic conditions. Automatically clears the way for ambulances by changing traffic lights.

Uses infrared sensors to detect vehicle presence and measure traffic density at intersections.

2-LITERATURE SURVEY

1**. Author: Divij N, Divya K, Anuradha Badage**

Title: IoT-based Automated Traffic Light Control System for Emergency Vehicles using LoRa

Description: The study utilizes IoT and LoRa technologies, including sensor networks, LoRaWAN communication protocol, real-time data processing algorithms, and smart traffic signal control mechanisms. Sensor networks are deployed to detect approaching emergency vehicles, while LoRaWAN enables long-range wireless communication between traffic signals, emergency vehicles, and the central control system. Real-time data processing algorithms analyze traffic conditions and dynamically adjust signal timings to prioritize emergency vehicle passage.

2. Author: Rishabh Madani

Title: Smart Traffic Light Control System for Ambulance using IoT

Description: The study utilizes IoT technologies including sensor networks, real-time data processing algorithms, wireless communication protocols, and smart traffic signal control mechanisms. Sensor networks are deployed to detect approaching emergency vehicles, while real-time data processing algorithms analyze traffic conditions and dynamically adjust signal timings. Wireless 7 communication protocols enable seamless communication between traffic signals, emergency vehicles, and the central control system.

3. Authors: J. Jijin Godwin, B. V. Santhosh Krishna, R. Rajeshwari, P. Sushmitha, and M. Yamini

Title: IoT Based Intelligent Ambulance Monitoring and Traffic Control System

Description: The study utilizes a combination of IoT technologies including GPS tracking devices, sensors, wireless communication protocols, cloud computing, and data analytics algorithms. GPS tracking devices are employed to monitor the location and movement of ambulances in real-time, while sensors gather environmental data such as traffic density and road conditions. Wireless communication protocols facilitate data transmission between ambulances, traffic signals, and the central control system. Cloud computing platforms are utilized for data storage and processing, while data analytics algorithms analyze incoming data to optimize ambulance routes and prioritize clearance at intersections.

3. METHODOLOGY

Hardware:

- Arduino Uno microcontroller.
- IR sensors to detect vehicle presence and measure traffic density.
- Traffic poles and power supply.
- Miscellaneous components for system integration.

Software:

- IDE: Arduino IDE.
- Programming Language: Python (version 3.12).
- Operating System: Windows 10.

System Design

- Utilize infrared sensors to monitor real-time traffic density.
- Integrate RFID technology to prioritize ambulance movements by adjusting traffic signals automatically.
- Design the system to operate with 24/7 availability and high reliability.

Implementation

- Prepare and assemble the hardware components.
- Write and upload the microcontroller program using Arduino IDE.
- Test the system for correct detection and response to emergency vehicles.

4-SYSTEM ARCHITECTURE

Based on the conceptual framework introduced in Section a system architecture was put forward, keeping in mind the core challenges previously identified. The proposed architecture, presented in, was specified to be installed in bedrooms of nursing homes and positioned above the bed so that the measurement process could be undertaken in Lineof-Sight (LoS), with as little interference as possible. The goal is to automatically generate health indicators that can be used for contactless screening. These health indicators do not intend to substitute a clinical diagnosis but instead to assist caregivers and healthcare professionals in their work, operating as an adjunctive screening tool. Complementary, as identified in Section, to assess the bedroom IAQ, several indoor environmental parameters can be acquired by the IoT Edge device, of which we highlight air temperature and relative humidity, CO2, VOCs, and PM2.5/PM10. illustrates the proposed architecture, which includes:

1) CHM IoT Edge devices deployed above the bed in a nursing home bedroom;

2) Cloud AI engine with context broker and a context provider to handle data storage;

3) Client App (Web or Mobile) for the user interface;

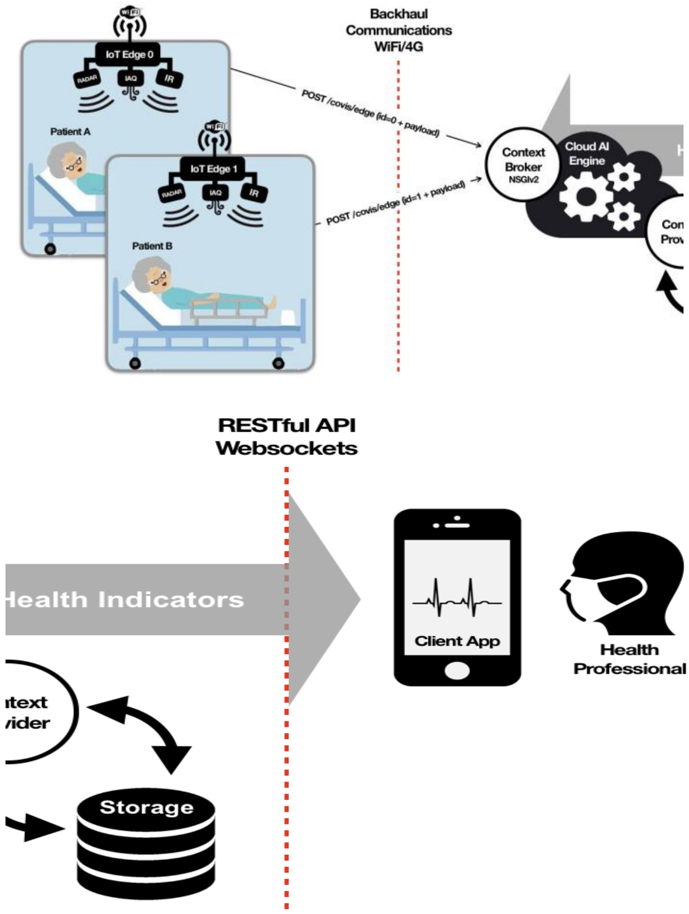

FIGURE 1. System Architecture: 1) IoT Edges deployed in nursing homes bedrooms; 2) CloudAI Engine with Context Broker and Storage; 3) Client

Apps. Image from

5-RESULTS

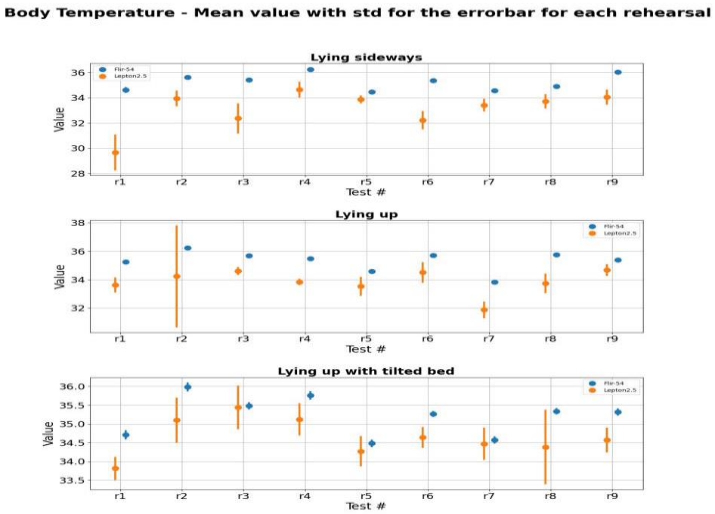

FIGURE 1. Body Temperature results presented in Error bar format for the 27 rehearsals with subjects.

6-CONCLUSION

The traffic clearance system for ambulances helps ambulances to reach their destination faster by managing traffic signals and finding the best routes. This system saves time and helps save lives during emergencies.

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