

Article Smart IoMT Framework for Supporting UAV Systems with AI

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Abstract: The health monitoring system is one of the most innovative technologies that has gained traction in the Internet of Medical Things (IoMT). It allows the connection of multiple sensors and actuators that can capture and monitor the data through the web page or mobile application. IoMT technology not only provides communications but also will provide monitoring, recording, storage, and display. IoMT in healthcare is used for measuring the vital signs of the human body, which allows medical professionals to assess the well-being of a patient. The doctor may recommend lifestyle modifications, prescribe more tests, or diagnose a disorder according to the results. This paper illustrates the remote-control health monitoring system (HMS) with the integration of a UAV, which allows the doctor to access the data and analyze the patient data remotely. Thus, the proposed HMS-UAV system aims to measure the temperature, humidity, blood pressure, heart rate, and SpO2 and stores the data on the UAV. Several sensors were thus used namely DHT11, MAX30102, Myoware and K24C16, and the Raspberry Pi camera. Reduced hospital stays and avoidance of readmissions are benefits of remote patient monitoring with IoMT-based UAVs. Contrary to its advantages, IoMT has flaws in information processing since a huge volume of data are needed to be handled in a single environment. One major novel inclusion in this work is to measure multiple parameters and provide a comparative analysis for all of them. Furthermore, the functionality of video recorded and stored is included where the doctor can surveil the patient.

Keywords: healthcare; IoMT; machine learning; service oriented architecture; UAV (unmanned aerial vehicle)

1. Introduction

Health is of major concern to the human body since it determines a person's well-being and ensures a prolonged lifespan. Over the years, the world has been facing the inability to cope with the spread of chronic diseases due to their more advanced and mutated versions constantly evolving. This makes it essential to combat major health issues all over the world. IoT has been majorly used in improving the technology of treating patients [1]. The growth of IoT over the past few years has been exponential. In 2012, there were 8.7 billion devices connected, but it grew exponentially and, in 2020, there are 50.1 billion devices connected [2].

In [3], it is further illustrated that the market share is anticipated to be held by the most prevalent IoT applications by the year 2025. It can be noticed that 41% of the market share is for healthcare applications while 33% is for manufacturing, 7% is for electricity and other applications such as security, infrastructure, agriculture, and resource extraction, and vehicles account for the other 19%. The range of the use of IoT in the healthcare sector is enormous. It has many different applications which include telemedicine, inpatient monitoring, clinical operations, workflow management, telemedicine, connected imaging, medication management, and other applications. In [4], it is established that inpatient monitoring has the largest market share among all different applications. Considering the



Citation: Shankar, N.; Nallakaruppan, M.K.; Ravindranath, V.; Senthilkumar, M.; Bhagavath, B.P. Smart IoMT Framework for Supporting UAV Systems with AI. *Electronics* **2023**, *12*, 86. https://doi.org/10.3390/ electronics12010086

Academic Editor: Nurul I. Sarkar

Received: 21 October 2022 Revised: 17 December 2022 Accepted: 21 December 2022 Published: 26 December 2022



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https:// creativecommons.org/licenses/by/ 4.0/). merits of IoT and its huge market in healthcare, this research work primarily focuses on the implementation of an IoMT framework for health monitoring systems onto UAVs to facilitate monitoring and diagnosis of patients in remote areas. This research brings out the concept of a mobile system that can be utilized by anyone and can be accessed anywhere. Surveillance UAVs have shown promise and their implementation in medicine still shows promise to improve the existing infrastructure.

Remote health monitoring is currently being implemented for various purposes that range from protecting the elderly and sending regular updates to their kin and even reducing the costs of visiting a doctor in-house. Individuals who are subjected to remote monitoring are not only shielded from a mishap, but it also contributes to the prevention of premature mortality by constantly monitoring and diagnosing the patient. There are countless other benefits such as improving data-driven decision-making and helping patients improve selfmanagement while also reducing the cost for them. It also improves access to care, builds patient engagement, and combats clinical staff shortages. The Unnamed Aerial Vehicles (UAV) provide complete support to these kinds of people by providing medical assistance to these elderly people if they get ill. They are capable of supplying medicine to the patients if their body vitals fluctuate. The IoMT assisted UAV introduced additional aspects to the healthcare system. There are several approaches to incorporating IoMT into the health monitoring system. Clinics, hospitals, and other healthcare facilities are now utilizing IoT to increase patient comfort, improve medical decision-making, and make facilities safer for both patients and staff. IoT integration in the healthcare system makes it simpler than the traditional healthcare system which does not use IoMT. Additionally, it is used in e-health applications for early symptom detection, medical identification, emergency alerting, and computer-assisted therapy.

1.1. Contributions of the Paper

- Provides solution architecture for integrating UAV with IoMT;
- Discusses various possibilities, opportunities, and challenges on implementing the IoMT based UAV for medical assistance;
- To integrate multiple sensors for measuring various parameters, sending the obtained data to the healthcare provider through a UAV, and providing a detailed analysis for the same;
- To make the data of the patient accessible through a secure log-in page to prevent data breach, and access is provided to the kin and the healthcare provider.

1.2. Organization of the Paper

This paper is organized into four sections. First, this paper illustrates the previous research work and identifies some useful contributions made in these articles. Section 2 deals with the material and methods of this work, which describes the techniques of the suggested system and proposes a UAV model-assisted IoMT architecture. The Section 3 explores the system's results and offers further analysis. In Section 4, we perform the accuracy analysis of the system with a machine learning algorithm, and we also discuss the challenges, opportunities, and the future scope of the UAV-assisted IoMT architecture. The Section 5 gives the conclusions of this work.

2. Literature Review

The outdoor healthcare system for older adults in emergencies was implemented by Cao et al. [5]. A healthcare system based on UAVs and IoT is created to speed up reaction times in emergencies. With the use of the UAV, the suggested system may offer older persons real-time assistance in outside emergency scenarios. Additionally, it can aid specialists or medical personnel and send emergency information utilizing communication networks Computer-assisted treatment refers to psychotherapy or behavioral treatment that may be offered to patients through a computer program or the internet as per a publication by Chola et al. [6]. Based on the Edge Computing by mobile-based UAV last-mile delivery