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# Remote Intensive Care Unit Monitoring And Communication

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**ABSTRACT:** As we all undergone the COVID-19 pandemic, we have to be well prepared and ready for any such future pandemic. As we all know patients were isolated and it would also affect the doctors and health care workers the more because of being close to the patient as to monitor or help them. The key idea of this project is implementing a remote ICU monitoring and communication System. As the patient would be attached with inhalers, they would not be able to communicate, by using this system with a press of a button a message alert will be notified to doctors or the relatives of the patients.

**KEYWORDS:** COVID,MAX30100,ESP8266,HVAC

## I. INTRODUCTION

WHO (World Health Organization) estimates that between 80,000 and 180,000 health and care workers could have died from COVID-19 in the period between January 2020 to May 2021, converging to a medium scenario of 115 500 deaths. These deaths are a tragic loss. They represent a gap in the global response to the pandemic that cannot be filled. The IOT Monitoring and communication device will help us to monitor a patient remotely, this can be useful for any future pandemic or also in isolation patients. As we all undergone the COVID-19 pandemic, we have to be well prepared and ready for any such future pandemic. As we all know patients were isolated and it would also affect the doctors and health care workers the more because of being close to the patient as to monitor or help them. The key idea of this project is implementing a remote ICU monitoring and communication System. As the patient would be attached with inhalers, they would not be able to communicate, by using this system with a press of a button a message alert will be notified to doctors or the relatives of the patients.

Continuous monitoring of vital signs is critical for ensuring patient safety in intensive care units (ICUs) and is becoming increasingly relevant in general wards. Usability is a key factor in the efficiency of health information technologies, such as patient monitoring systems, and its absence can eventually impact patient safety. Users (i.e., clinicians) can help identify and prevent usability issues. In this paper, we adopt a human-centered design method to conceptualise and assess design improvements as well as assess the usability of a remote patient monitoring system user interface (UI). The primary goal is to enhance communication during ambiguous periods, which are defined as the first 24 hours after ICU admission. A further goal is to use informatics to improve communication and patient safety by encouraging better and more frequent family communication.

A remote ICU system is a type of telemedicine that enables remote monitoring and management of critical care patients in disaster situations like earthquakes. The system consists of various medical devices, sensors, and communication technologies that enable healthcare professionals to remotely monitor, diagnose and treat patients in real-time. During a disaster, hospitals may become inaccessible or overwhelmed, and critical care patients may require immediate medical attention. A remote ICU system can provide remote medical assistance to critically ill patients, reducing the need for physical transportation and decreasing the burden on local healthcare facilities.



The system is designed to be user-friendly and efficient, with real-time data transmission, automated alerts and notifications, and remote monitoring of patient vital signs such as heart rate, blood pressure, and oxygen saturation. The data can be accessed by healthcare professionals from any location, allowing them to provide timely and effective medical care to patients. On October 30, 2020, a powerful earthquake struck Turkey's western coast and the nearby Greek islands. The earthquake had a magnitude of 7.0 on the Richter scale, and its epicenter was in the Aegean Sea, near the city of Izmir. The earthquake caused significant damage to buildings and infrastructure in the affected areas, and over 100 people were reported to have died, while many more were injured.

## II. PROBLEM STATEMENT

WHO (World Health Organization) estimates that between 80,000 and 180,000 health and care workers could have died from COVID-19 in the period between January 2020 to May 2021, converging to a medium scenario of 115 500 deaths. These deaths are a tragic loss. They represent a gap in the global response to the pandemic that cannot be filled. The IOT Monitoring and communication device will help us to monitor a patient remotely, this can be useful for any future pandemic or also in isolation patients. There are uncertainties surrounding diagnosis, treatment, and prognosis in ICU. In order to keep them informed, bring disclosure, and reflect the excellent level of care they received, patients and family typically seek out additional information. Frequently, informing patients and their families about predictive uncertainty in the ICU can be misleading or confusing. Less than half of the 90 family members of patients who passed away who participated in an interview about "communicating prognostic uncertainty" expressed dissatisfaction with conveying the patient's expected course of action.

The goal of the project is to enhance the communication of uncertainty between the ICU team and patients and family members, assess reaction, create an action plan, and offer support for patients who are admitted to the ICU within the first 24 hours. When the clinical situation changes or fresh data becomes available, follow up and provide an update. The project will not address uncertainty measurement, risk assessment, and evaluating how physicians respond and deal with uncertainty.

Additionally, it has been demonstrated that good communication enhances patient and family experiences with end-of-life care and is linked to high-quality care. The project will help improve the quality of care delivered in ICU to patients and their families by improving communication and support through decision-making under uncertainty and building trust.

## III. METHODOLOGY

Espressif created the ESP32 line of low-cost, low-power System on a Chip (SoC) microcontrollers, which have a dual-core processor, Wi-Fi, and Bluetooth wireless connectivity. The ESP32 is the ESP8266's successor and is jam-packed with an immense amount of brand-new functionality.

Heart Rate click includes a heart rate sensor and Maxim's MAX30100 integrated pulse oximetry. It is an optical sensor that obtains its readings by first emitting two wavelengths of light—a red and an infrared one—from two LEDs. Then, it uses a photodetector to measure the absorbance of pulsing blood. The data reading performance of this specific LED colour combination through the tip of the finger is optimised. The MAX30100 sensor is a highly integrated pulse oximetry and heart rate monitor sensor that utilizes photoplethysmography (PPG) principles to measure oxygen saturation level and heart rate. This sensor utilizes both green and red LEDs to emit light onto the skin, with different wavelengths, allowing it to measure the absorption of light by hemoglobin in the blood. Additionally, the MAX30100 sensor includes a photodetector that detects the amount of light that is transmitted through or reflected from the skin. The sensor also features a built-in analog front-end that filters and amplifies the signal from the photodetector, as well as a digital signal processor (DSP) that processes the signal and calculates the oxygen saturation level and heart rate. With these features, the MAX30100 sensor is an accurate and non-invasive way to monitor oxygen saturation level and heart rate, making it highly useful for various medical and fitness applications.

An electronic device known as a humidity sensor monitors the humidity in its surroundings and then transforms the data into an appropriate electrical signal. Humidity sensors come in a wide range of shapes and capacities; some are built into small handheld devices (like smartphones), while others are part of larger embedded systems (like air quality monitoring systems). In the fields of meteorology, medicine, automobiles, HVAC, and industry, humidity sensors are frequently utilised.

#### IV. BLOCK DIAGRAM

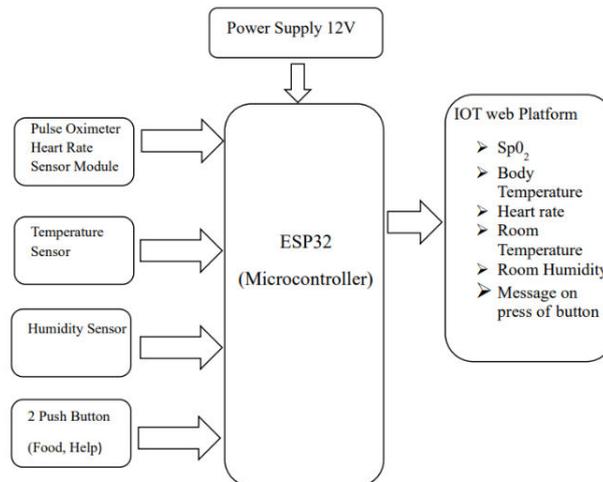


Fig 2 : Block diagram of Remote Intensive Care Unit Monitoring and Communication

#### V. MATERIALS

##### A. ESP32:

ESP32 is a powerful and versatile microcontroller developed by Espressif Systems. It is based on the Xtensa LX6 processor and features Wi-Fi and Bluetooth connectivity, making it a popular choice for Internet of Things (IoT) projects and applications.

##### B. Max30100/Max30102 Module Pulse Oximeter and Heart rate Sensor:

The MAX30100 and MAX30102 modules are pulse oximeter and heart rate sensor modules developed by Maxim Integrated. They are compact and low-power modules that can be used to measure heart rate and blood oxygen saturation levels in a non-invasive way.

The MAX30100 and MAX30102 modules use a combination of red and infrared light to measure the absorption of light by the blood in the fingertip or other body part. The module consists of an LED that emits light, a photodetector that detects the light that passes through the blood vessels, and a signal conditioning circuit that processes the detected signal.

##### C. Humidity Sensor:

A humidity sensor is a device that is used to measure the moisture content or relative humidity in the air. These sensors are commonly used in a variety of applications such as HVAC systems, weather stations, industrial processes, and indoor environmental monitoring. Humidity sensors can be used to control various systems based on the measured humidity levels. For example, in HVAC systems, the humidity sensor can be used to regulate the amount of moisture in the air to maintain a comfortable environment. In ICU, humidity sensors can be used to ensure that the humidity levels are maintained at optimal levels for the ICU room as per patient's needs.

##### D. Temperature Sensor:

A temperature sensor is a device used to measure temperature, or the degree of heat present in a substance or environment. There are various types of temperature sensors available, including thermocouples, RTDs (Resistance Temperature Detectors), thermistors, and infrared sensors. Here it is used to measure the temperature of the patient.

#### VI. CONCLUSION

ICU monitoring and communication devices have become crucial during the COVID-19 pandemic, and it is likely that they will continue to play an important role in future pandemics. These devices enable healthcare providers to remotely



monitor patients' vital signs, communicate with patients and their families, and manage critical care resources more efficiently.

Remote ICU monitoring and communication have several benefits. For one, it enables healthcare providers to remotely monitor a patient's vital signs, such as heart rate, blood pressure, and oxygen levels. This information can be transmitted in real-time to healthcare providers who can then intervene if necessary, leading to more timely and effective care.

Remote ICU monitoring and communication can also help to reduce the workload on healthcare providers by enabling them to remotely manage and monitor multiple patients simultaneously. This can be particularly beneficial during times of high patient volume or during a pandemic when resources may be limited.

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### BIOGRAPHY



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