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Design of IoT based Patient Health Monitoring System .

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# Simplified Title

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# Abstract

Internet of Things allows health care providers to break out of traditional clinical settings. Home monitoring systems allow patients and physicians to monitor a person's health when they are not in the doctor's office to prevent unnecessary and expensive visits to the doctor. Many years of research have shown that remote monitoring of patients is one of the most effective treatments for chronic diseases such as diabetes, heart failure and chronic obstructive pulmonary disease (COPD), but also increases patient participation and reduces emergency admissions. Assisted and individually adapted environments will be possible through the introduction of technologies that provide individual medical care to anyone living in an environment of their choice. In this article, we consider several requirements for the development of such systems, in particular sensors for automatic detection of physiological parameters of the patient's health data which will be send to the cloud where in real time artificial intelligence will process the data and present it to the doctor in the form of infographics that can be easily analyzed, the mobile app where a patient can see own health parameters and contact with a doctor and the website where the doctor, based on real-time data, can examine the patient and, in an emergency, contact with a patient and warn against future diseases.

# Introduction

The Internet of Things provides a continuous platform for facilitating interaction between people and various physical and virtual entities, including individual healthcare domains. The lack of access to medical resources, the growing number of older people with chronic diseases and their need for remote monitoring, rising medical costs and the desire for telemedicine in developing countries make IoT an interesting topic in healthcare [1]. This work aims to consider the components required to create a system that collects physiological data from patients without the involvement of the healthcare system. This study aims to discuss the solutions for remote patient monitoring presented in the literature describing vital sign monitoring systems and identifying the most important physiological parameters that need to be considered to ensure a viable diagnosis of health status, and create a prototype of a long- acting system and the methods for detecting early changes in patients' health parameters, which could help to provide measures for disease prevention. The novel diagnostic system will help to implement a relatively simple and inexpensive health control of a patient over a long period.

# State of the Art

Up to now, several researchers have considered several ways and methods of remote monitoring of patients. With all the prospects for the development of synchronous home monitoring using Mobile Health and the Internet of Things technologies, it is necessary to note the not fully resolved issues, both of a functional nature and at the level of the sensors themselves. The main unresolved problem is the integration of sensors into a single complex, convenient for use by the patient.

# Original Contribution

In this work we designed and developed the mobile APP because of its ability of connecting to the microcontrollers and to the cloud services with Bluetooth and wi-fi where a patient can see own health parameters, send his/her data in real-time to the doctor and contact with a doctor.

# Methodology

The IoT diagnostic system is described by a combination of a three-tier architecture with reception, network and application applications, as well as a cloud architecture. In the architecture of the IoT diagnostic system, cloud computing seems convenient, as it provides flexibility and scalability for users and developers [2]. Users can access services such as servers, databases, data processing and storage tools. Developers can work and use the necessary data generation, artificial intelligence and visualization tools through the cloud.

# Results

To create this device, we decided to use the ESP8266 NodeMCU v3 microcontroller, since ESP8266 is already installed in this board, which will allow us to send information via the Internet. In addition, one of the advantages of this board is the presence of an I2C bus, which allows us to connect useful and accurate sensors, such as the MAX30102 sensor, which can accurately determine the heartbeat and blood saturation. Another sensor that also uses the I2C bus for connecting to NodeMCU v3 is the MAX30205. It can measure a person's temperature and does it with an accuracy of 0.1C. In order to record data using these sensors, the patient simply needs to fix all the sensors on his arm, and then press the button, which will be located on the body of the utility model. After that, all the necessary data will be collected within a minute and sent to the database. We decided to use FireBase for the database, since its API is very convenient to use for all the tasks that we need, which include sending and reading data from a mobile application, a website and a microcontroller [3].

# Evaluation

A utility model has been created for this project, with the help of which the patient will collect analyzes, after that all the results will be sent to a database, from where, using a website or a mobile application, the doctor will be able to monitor Patient physiological parameters.

# Conclusions

In the first stage of our research, we created architecture of the Monitoring system based on the IoT method and includes a three-tier architecture with perception, network, application layers, and cloud-based architecture. This work examines and analyzes the requirements for remote patient monitoring. The devices needed to collect physiological data from patients were identified. At the next stage, in coordination with health care organizations, the system will be tested and experimented with remote monitoring of the health of volunteer patients. Data will be collected and analyzed to see how effective the developed patient monitoring system is.

# References

[1] Kashani M. H. et al. A systematic review of IoT in healthcare: Applications, techniques, and trends //Journal of Network anComputer Applications. – 2021. – С. 103164.

[2] Jacob Rodrigues M., Postolache O., Cercas F. Physiological and behavior monitoring systems for smart healthcare environments: Areview //Sensors. – 2020. – Т. 20. – No. 8. – С. 2186.

[3] Zhang H. et al. SafeCity: Toward safe and secured data management design for IoT-enabled smart city planning //IEEEAccess. – 2020. – Т. 8. – С. 145256-145267.

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