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Full Length Article

Heart Disease Detection Using Feature Extraction And Artificial Neural Networks

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Abstract
Heart disease is one of the major causes of death worldwide, and early diagnosis is essential for reducing mortality rates. This paper presents an efficient heart disease detection system using feature extraction techniques and Artificial Neural Networks (ANN). The proposed system collects physiological parameters such as heart rate and body temperature through sensors and processes the data using embedded systems. The extracted features from the medical data are analyzed using ANN algorithms to identify patterns associated with heart disease. Feature extraction improves the performance and accuracy of the system by selecting the most relevant information from the collected data. The integration of IoT technology enables real-time monitoring and remote access to patient health information. Experimental results demonstrate that the proposed system achieves an accuracy greater than 85%, which is higher than many traditional machine learning approaches. Therefore, the system can be effectively used for early heart disease diagnosis and continuous health monitoring.

Keywords: *Heart Disease Detection, Artificial Neural Network, Feature Extraction, IoT, Embedded System*

INTRODUCTION

Heart disease remains one of the leading health problems across the globe and is responsible for a large number of deaths every year. Early detection and continuous monitoring are important for reducing risks and improving patient care. Traditional diagnosis methods mainly depend on medical experts and manual analysis, which may sometimes lead to delayed diagnosis or misinterpretation of symptoms. To overcome these limitations, Artificial Neural Networks (ANN) have emerged as an efficient technique for analyzing medical data and identifying hidden patterns related to heart disease.

The proposed system combines ANN with feature extraction techniques to improve the accuracy of disease prediction. The system uses sensors such as pulse and temperature sensors to collect real-time physiological data from patients. This data is processed using embedded systems and then analyzed using ANN algorithms to determine the presence of heart disease at an early stage. The integration of IoT technology further enables remote monitoring and real-time access to patient health information, making the system more efficient and reliable.

EXISTING SYSTEM

Existing heart disease detection systems mainly rely on machine learning techniques such as Decision Trees, Support Vector Machines (SVM), and statistical analysis methods. These approaches are widely used for disease prediction and classification; however, they have certain limitations. Many existing systems suffer from lower prediction accuracy due to poor feature selection and an inability to effectively detect complex patterns in medical datasets. In some cases, the models fail to process real-time patient data efficiently, which reduces their reliability in practical healthcare applications.

PROPOSED SYSTEM

The proposed system improves heart disease detection by integrating feature extraction techniques, Artificial Neural Networks, and IoT-based monitoring. Feature extraction helps in selecting the most relevant medical parameters, thereby improving the efficiency and accuracy of the ANN model. The ANN algorithm is capable of identifying complex relationships within the medical data and provides more accurate predictions compared to traditional methods. The incorporation of IoT technology enables continuous real-time monitoring of patient health conditions and allows remote access to medical data.

The proposed system offers several advantages, including higher prediction accuracy of more than 85%, reduced chances of misdiagnosis, real-time monitoring, and remote healthcare support. These features make the system highly suitable for early diagnosis and continuous monitoring of heart disease patients.

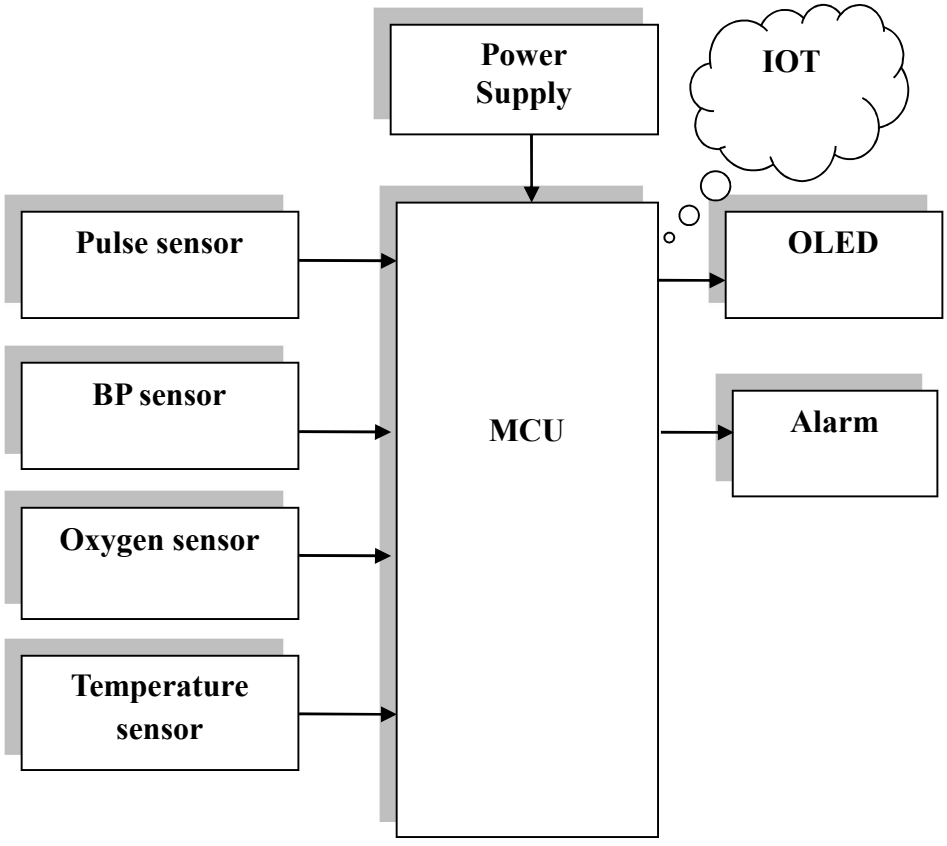
PROJECT DESCRIPTION

A. Embedded System

An embedded system is a specialized computing system designed to perform dedicated functions within a larger system. In the proposed project, the embedded system is responsible for collecting, processing, and transmitting physiological data obtained from sensors. The system mainly consists of a microcontroller, sensors, display units, and communication modules. The microcontroller processes the sensor data, while the communication modules enable IoT-based data transmission and remote monitoring.

B. Block Diagram Components

The proposed system consists of several important hardware components. The power supply unit provides the required electrical power to the entire system. The Raspberry Pi Pico W acts as the main microcontroller that controls data processing and communication. A pulse sensor is used to measure the patient's heart rate, while a temperature sensor monitors body temperature. An OLED display is included to show the measured parameters and system status in real time. The IoT module enables wireless communication and remote access to patient health information for continuous monitoring and analysis.



A. Microcontroller (Raspberry Pi Pico W)
Dual-core ARM processor
Built-in Wi-Fi
Low power consumption
Supports Arduino & MicroPython

B. Sensors Used

Pulse Sensor – Measures heart rate

The Pulse Sensor is a well-designed low-power plug-and-play heart-rate sensor for the Arduino. Anyone who wants to incorporate real-time heart-rate data into their work—students, artists, athletes, makers, and game and mobile developers—can benefit from it.

The best part is that this sensor plugs right into Arduino and easily clips onto a fingertip or earlobe. It is also super small (button-shaped) and has holes for sewing into fabric.

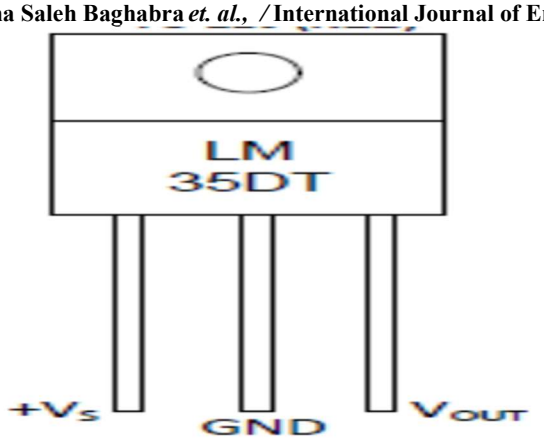
The front of the sensor, with the heart logo, is where you put your finger. You'll also notice a tiny circular opening through which the Kingbright's reverse mounted green LED shines

Just beneath the circular opening is a small ambient light photo sensor – APDS-9008 from Avago. This sensor is similar to the ones used in cell phones, tablets, and laptops to adjust the screen's brightness based on the ambient lighting conditions.

On the back of the module are an MCP6001 Op-Amp from Microchip and a few resistors and capacitors that make up the R/C filter network. Additionally, there is a reverse protection diode to prevent damage in the event that the power leads are accidentally reversed

Temperature Sensor – Measures body temperature

Temperature is the most-measured process variable in industrial automation. Most commonly, a temperature sensor is used to convert temperature value to an electrical value. Temperature Sensors are the key to read temperatures correctly and to control temperature in industrials applications.A large distinction can be made between temperature sensor types. Sensors differ a lot in properties such as contact-way, temperature range, calibrating method and sensing element. The temperature sensors contain a sensing element enclosed in housings of plastic or metal. With the help of conditioning circuits, the sensor will reflect the change of environmental temperature.



BP Sensor – Monitors blood pressure

Blood pressure (BP) is the pressure exerted by circulating blood on the walls of blood vessels, and is one of the principal vital signs. During each heartbeat, BP varies between a maximum (systolic) and a minimum (diastolic) pressure. The mean BP decreases as the circulating blood moves away from the heart through arteries, has its greatest decrease in the small arteries and arterioles, and continues to decrease as the blood moves through the capillaries and back to the heart through veins.

The term *blood pressure* usually refers to the pressure measured at a person's upper arm. It is measured on the inside of an elbow at the brachial artery, which is the upper arm's major blood vessel that carries blood away from the heart. A person's BP is usually expressed in terms of the systolic pressure and diastolic pressure,

BP is sometimes measured at other places, for instance at an ankle. The ratio of the BP measured at the main artery of an ankle, to the BP measured at the brachial artery of an upper arm, gives the Ankle Brachial Pressure Index (ABPI).

Arterial pressure is most commonly measured via a sphygmomanometer, which historically used the height of a column of mercury to reflect the circulating pressure.Today BP values are still reported in millimeters of mercury(mmHg), though aneroid and electronic devices do not use mercury.

For each heartbeat, BP varies between systolic and diastolic pressures. Systolic pressure is peak pressure in the arteries, which occurs near the end of the cardiac cycle when the ventricles are contracting. Diastolic pressure is minimum pressure in the arteries, which occurs near the beginning of the cardiac cycle when the ventricles are filled with blood. An example of normal measured values for a resting, healthy adult human is 115 mmHg systolic and 75 mmHg diastolic (written as 115/75 mmHg, and spoken [in the US] as "one-fifteen over seventy-five"). Pulse pressure is the difference between systolic and diastolic pressures.

SOFTWARE IMPLEMENTATION

The software implementation of the proposed system is carried out using the Arduino IDE, which is used for writing, compiling, and uploading the program code to the microcontroller. The collected sensor data, including heart rate and temperature values, is processed by the embedded system and uploaded to the IoT platform for monitoring and analysis. The Serial Monitor available in the Arduino IDE is used to display and verify the output during system testing and debugging. Various software libraries are integrated into the program to support communication with sensors, OLED displays, and IoT modules, ensuring smooth and accurate operation of the system.

IMPLEMENTATION

The implementation of the proposed heart disease detection system involves hardware setup, sensor integration, and microcontroller programming. The hardware components such as the pulse sensor, temperature sensor, OLED display, and communication modules are connected to the microcontroller. The sensors continuously collect physiological data from the patient, which is processed by the embedded system. The programmed microcontroller analyzes the data and displays the results on the OLED screen. In addition, the processed data is transmitted to the IoT platform, enabling real-time monitoring and remote access to patient health information.

RESULTS AND DISCUSSION

The experimental results demonstrate that the proposed system achieves an accuracy greater than 85% in detecting heart disease. The integration of feature extraction techniques and Artificial Neural Networks improves the overall detection rate and enhances the reliability of the prediction process. The

system also provides real-time monitoring through IoT technology, allowing healthcare professionals to continuously observe patient conditions remotely. Furthermore, automation of the analysis process reduces human error and improves the efficiency of heart disease diagnosis.

CONCLUSION

The proposed heart disease detection system successfully identifies heart-related abnormalities using Artificial Neural Networks and feature extraction techniques. The system improves prediction accuracy while enabling real-time health monitoring through IoT integration. By combining embedded systems, sensor technology, and intelligent data analysis, the proposed model provides an effective solution for early diagnosis and continuous patient monitoring. Due to its reliability, accuracy, and remote monitoring capabilities, the system can be widely applied in hospitals, clinics, and remote healthcare environments.

REFERENCES

[1] T. A. McDonagh, M. Metra, M. Adamo, et al., "2021 ESC Guidelines for the Diagnosis and Treatment of Acute and Chronic Heart Failure," *European Heart Journal*, vol. 42, no. 36, pp. 3599–3726, 2021.

[2] G. Savarese and L. H. Lund, "Global Public Health Burden of Heart Failure," *Cardiac Failure Review*, vol. 3, no. 1, pp. 7–11, 2017.

[3] A. Rajkomar, J. Dean, and I. Kohane, "Machine Learning in Medicine," *New England Journal of Medicine*, vol. 380, no. 14, pp. 1347–1358, 2019.

[4] S. Haykin, *Neural Networks and Learning Machines*, 3rd ed., Pearson Education, New York, USA, 2009.

[5] R. D. Labati, V. Piuri, and F. Scotti, "Neural-Based Quality Measurement of ECG Signals for Biometric Authentication," *IEEE Transactions on Instrumentation and Measurement*, vol. 60, no. 10, pp. 3460–3470, 2011.

[6] D. Singh and V. Kumar, "Heart Disease Prediction System Using IoT and Machine Learning," *International Journal of Innovative Technology and Exploring Engineering (IJITEE)*, vol. 8, no. 9, pp. 1532–1536, 2019.

[7] M. Chen, S. Gonzalez, A. Vasilakos, H. Cao, and V. C. M. Leung, "Body Area Networks: A Survey," *Mobile Networks and Applications*, vol. 16, no. 2, pp. 171–193, 2011.

[8] J. Pan and W. J. Tompkins, "A Real-Time QRS Detection Algorithm," *IEEE Transactions on Biomedical Engineering*, vol. BME-32, no. 3, pp. 230–236, 1985.

[9] A. K. Dewangan and P. Agrawal, "IoT-Based Smart Healthcare Monitoring System for Heart Disease Prediction," *International Journal of Advanced Research in Computer Science*, vol. 10, no. 3, pp. 45–50, 2019.

[10] K. Srinivasan, G. S. A. Kumar, and N. Shankar, "Artificial Neural Network Based Heart Disease Prediction System," *International Journal of Engineering and Advanced Technology (IJEAT)*, vol. 8, no. 6, pp. 2249–2254, 2019.