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Smart Diagnosis And Prescription System For Onboard Patient In Hospital

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Abstract: The Smart Diagnosis and Prescription System is a remarkable innovation in the healthcare industry, providing an efficient and effective way to diagnose and treat patients in hospitals. By utilizing advanced technology such as artificial intelligence and machine learning algorithms, the system is able to analyse patient data in real-time and provide healthcare professionals with accurate diagnostic information and treatment recommendations. This not only improves patient outcomes but also reduces the workload of healthcare professionals, allowing them to focus on providing direct care to their patients. With its ability to automate many of the tasks associated with patient monitoring and diagnosis, the system has the potential to revolutionize the way healthcare is delivered in hospitals, improving the quality of care and reducing healthcare costs. Overall, the Smart Diagnosis and Prescription System is a game-changing technology that has the potential to transform the healthcare industry.

Index Terms **- Aurdino Esp 32, BP sensor, ECG sensor, Pulse rate Sensor, Health Care Diagnosis**

I. INTRODUCTION

The field of healthcare technology is rapidly advancing, and it is playing a critical role in extending human lifespan. However, with the increasing prevalence of health problems such as coronary heart diseases, obesity, and lung failures, it is clear that more needs to be done in order to overcome these issues. One of the challenges facing healthcare professionals today is the constant monitoring of patients' health parameters, which can be difficult in our busy lives. This is where remote patient monitoring using IoT and embedded technology comes in. By allowing doctors to observe patients' health conditions remotely in real-time, this technology can facilitate early detection of diseases and enable preventative measures to be taken. Moreover, with the rise of digitized data acquisition, machine learning and AI solutions are becoming increasingly relevant in healthcare. In this research paper, we propose a prototype that uses an autonomous system to detect and analyze patients' symptoms in real-time, enabling early diagnosis and treatment prioritization. The system can also alert doctors when a patient's condition becomes critical, allowing for prompt intervention. By predicting the recovery rate of patients using machine learning algorithms, this system has the potential to revolutionize the way healthcare is delivered. Healthcare problems such as coronary heart diseases, obesity, and lung failures are still on the rise, leading to the death of millions of people every year. The need of the hour is to overcome these problems through a constant monitoring of the patient's body parameters such as temperature and heart rate. This can be achieved through the use of IoT and embedded technology, which allows doctors to observe a patient's health condition remotely at any time and any place. Early diagnosis of diseases through symptom analysis is also in high demand, especially in rural areas with limited resources. This is where machine learning and AI solutions come in, providing clinicians with the necessary data for early detection and prevention of disorders.

II. Objective

The main aim of a smart diagnosis and prescription system for on board patients in a hospital is to improve the quality of patient care by providing accurate diagnoses and personalized treatment plans while increasing efficiency in the healthcare system. By leveraging advanced technologies like artificial intelligence, machine learning, and big data analytics, the system aims to enhance communication and collaboration among healthcare providers, optimize treatment plans, and improve patient outcomes. The ultimate goal of the system is to improve the overall health and well-being of patients while reducing the cost of care and increasing the efficiency of the healthcare system.

III. Background Work

Health monitoring systems have been a popular area of research in recent years, with many researchers investigating various technologies to develop intelligent patient monitoring systems. One such system, as described in a paper, utilizes sensors to automatically screen a patient's health condition. The data is processed using a Raspberry Pi and saved to an IoT cloud. The system primarily extracts the bio signal, ECG using an ECG sensor, and through continuous monitoring and graphical representation of patient's information, doctors/nurses/relatives can remotely check the patient's condition. If the condition becomes critical, a notification is sent to inform medical professionals and a video call can be initiated if necessary.

The authors of the paper note that IoT-based smart health monitoring systems play a vital role in the telemedicine concept for mankind. With the help of advanced communication and information technology, it has led to the Internet of Things (IoT) for various real-world applications. The basic functionalities of IoT are for storage, display, and communication of information. The e-Health monitoring system with IoT is adapted for distant patient monitoring on a continual basis and aggregated analyzed data. It can bring about a massive positive transformation in the field of e-Smart-health management for rural or urban patients. This may help people who want or have a good opinion on technology diagnosis.

In another paper, the authors develop an IoT-based patient monitoring system which provides data on a patient's respiration. This project makes medical equipment more efficient by allowing real-time monitoring of patient health, in which sensors acquire data of the patient's and reduce human error. In the Internet of Things, patients' parameters get transmitted through medical devices via a gateway, where it is stored and analyzed. IoT in the medical field brings out the solution for effective patient monitoring at a reduced cost and also reduces the trade-off between patient outcome and disease management. In this paper, the authors discuss monitoring a patient's body temperature, respiration rate, heart rate, and body movement using a Raspberry Pi board. Respiration measurement is done using two thermistors that are connected in the resistor bridge network. The differential amplifier provides the error voltage at its input, which is converted to +12v to -12v square wave pulse, which is again converted to 5v to 0v. Transistor-Transistor Logic (TTL) pulse goes through the transistor (BC547) and then it is given to Raspberry Pi.

Another paper proposes a real-time remote patient monitoring and analysis using Raspberry Pi. Raspberry Pi is a credit card-sized single-board computer with an ARM11 microprocessor with the LINUX based operating system. Python is used as the programming language in Raspberry Pi, which is an open-source programming language. The presented system involves sensors to acquire the biological parameters from the patient's body and transmit it wirelessly to the website that can be accessed by any medical expert across the world for diagnosis. These parameters are stored in the MySql database, and the acquired parameters are processed in Pi and trigger a message if there is any abnormality in the parameters. In the previous methods, Zigbee, Bluetooth modules are used for transmission. But they are restricted by the short range of communication. The presented system reduces man-power and cost.

In conclusion, health monitoring systems have come a long way in recent years with the help of advanced communication and information technology. These systems have the potential to revolutionize the field of eSmart-health management, making it possible for medical professionals to remotely monitor patients' health conditions in real-time. With the development of IoT-based smart health monitoring systems, the tradeoff between patient outcome and disease management can be reduced, making it possible to provide effective patient monitoring at a reduced cost.

IV. Proposed System

The proposed system uses machine learning techniques to assist doctors in diagnosing medical conditions and prescribing treatments for their patients. The system is designed to enhance the accuracy and efficiency of medical diagnosis and treatment by providing doctors with the latest medical knowledge and insights from vast amounts of patient data. The system works by analysing the symptoms of the patient and matching them with a vast database of medical knowledge and patient data. Based on the results of the diagnostic tests, the system generates a list of potential treatments and prescriptions, taking into account the patient's medical history, allergies, and other relevant factors.

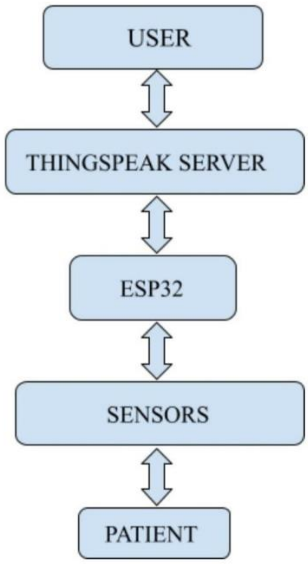

Fig 1. Diagram

V. REQUIREMENTS SPECIFICATION

*H*ardware Requirements

- Esp32
- LM35 temperature sensor
- Heartbeat sensor
- JHD162A- LCD Module
- SpO2 Sensor
- ECG Sensor
- ThingSpeak

ESP32:-

ESP32 is a microcontroller board. ESP32 devkit has 36 pins and 18 on each side of the board as shown in the picture above. It has 34 GPIO pins and each pin has multiple functionalities which can be configured using specific registers. There are many types of GPIOs available like digital input, digital output, analog input, and analog output, capacitive touch, UART communication and USB cable.

ESP32 is 32-bit microcontroller, provides low power & connectivity, wifi & bluetooth for low energy consumption and Low power system on chip(SOC),clock speed of ESP32 can be controlled independently. ESP32 has dual core processor,one is application cpu which handles code and another is protocol cpu which handles wifi and indicative peripheral for A2D controller and D2A controller

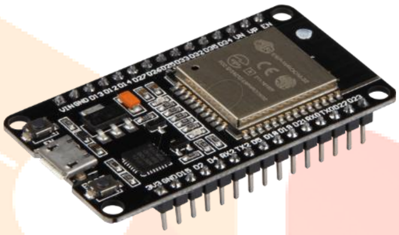

Fig 2. ESP32

SEN 11574 Pulse rate Sensor:-

This sensor has two faces. On one face it has a light sensor and on the other face it has some circuits. It operation voltage is +5 Volts or +3.3Volts and Current Consumption rate is 4 milliAmpere. The SEN 11574 sensor is used for determining the pulse rate. This sensor has two faces. On one face it has a light sensor and on the other face it has some circuits. This circuit-System oversees the amplification and noise termination tasks. The LED is placed on the fingertip or ear tip. The LED present on the sensor will emit light. When the heart pumps, the blood flows in the veins. If we keep track of the flow of blood, we can observe the heartbeat also. The blood will reflect the light, as a result the light sensor will absorb more lights. These changes will be analysed over time to determine the pulse rate.

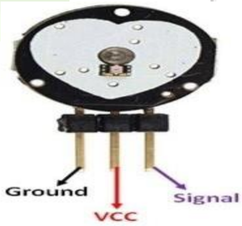

Fig 3. Pulse Rate Sensor

Temperature Sensor:-

Temperature sensor used in our project is LM35.It is a precision IC temperature sensor with its output proportional to the temperature (in °C). With LM35,the temperature can be measured more accurately than with a thermistor. The operating temperature range is from -55°C to 150°C.

LM35 Temperature sensor we are using, in which we get the analog output and we are setting the operating voltage to 5Volts.The formula to calculate the temperature=analog read*5(operatingVolts)/2^10.

Advantage:

Thermistor requires an external calibration. Accurate value Operates from 4v to 30v. Low self -Heating, 0.08degree Celsius in still Air. This sensor measures from -55 degree to 150 degree.It consumes 60 micro Ampere of current.Library :SHT31, SHTC3.

Fig 4. Temperature Sensor

Max 30100 Oxygen Sensor:-

This sensor's breakout voltage is from 1.8Volts and 5.5Volts. This sensor has 2 LEDs in which one emits the red light and the another emits the infrared light. It operates at Ultra-Low-Power. The MAX30100 sensor is used for finding the oxygen level in the blood of a patient's body. This sensor has 2 LEDs, 1 photodetector and 1 analog low-noise signal processor.

This sensor's breakout voltage is from 1.8 Volts and 5.5Volts. This sensor has 2 LEDs in which one emits the red light and the another emits the infrared light. When the blood is pumped by the heart, the volume of oxygen in the blood will be more and when the heart relaxes, the volume of oxygen in the blood decreases. When the oxygen level is more, the blood absorbs more infrared light and the passed red light will be more.

Similarly, when the oxygen level is less, red light will be absorbed and infrared light will be passed more. By measuring these changes of the red-light absorption in the oxygenated blood and deoxygenated blood, the volume of oxygen in the blood of the person is determined. Features are that it operates at Ultra-Low-Power and it has less Shutdown Current which is 0.7 micro amperes

Fig 5. SP02 Sensor

JHD162A-LCD Module:-

JHD162A is a commonly used 16x2 character LCD module. It can display 16 characters in each of its two rows, hence the name 16x2. The JHD162A LCD module is compatible with the popular Hitachi HD44780 controller chip, which allows easy interfacing with microcontrollers such as the Arduino or Raspberry Pi. The JHD162A LCD module has a built-in character generator, which can display a wide range of characters including alphanumeric characters, symbols, and Japanese Kana characters. The module also has a backlight, which can be controlled using a separate pin. To use the JHD162A LCD module, you need to connect it to your microcontroller using a 16-pin connector. The module has two rows of pins, with the top row being for data connections and the bottom row for power and control signals. You also need to write code to send data and commands to the module to display the desired characters and control the backlight.

Fig 6. JHD162A-LCD Module

ECG:-

Electrocardiogram sensor is used to measure the heart rate of a person. Electrocardiography (ECG) is used to get information of cardiovascular system of the person. The device consists of MAX86150 Integrated ECG and PPG Bio-Sensor. It operates at 1.8 volts. It monitors heart rate and also acts as pulse oximeter. Generally, if a person is in trouble, his/her hands shake. The device consists of SW-420 Module of vibration sensor. It operates at 3.3 volts to 5 volts DC voltage. This sensor has two faces. On one face it has a light sensor and on the other face it has some circuits. It operation voltage is +5 Volts or +3.3Volts and Current Consumption rate is 4 milli Ampere. The SEN 11574 sensor is used for determining the pulse rate.

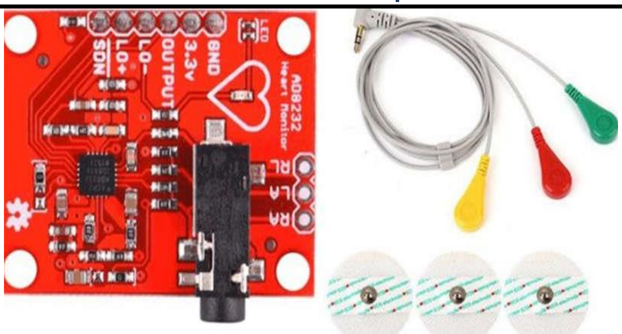

Fig 7. ECG Sensor

Thing Speak:-

Thingspeak interacts with the devices, web services and social media is possible with ThingSpeak. It is a platform for Internet of Things that lets the user collect the data and store it in cloud and develop applications in any IoT platform. Thus the ThingSpeak acts like a data collector. The sensed value sending nodes is called the edge devices. The edge devices send value to the data collector. It uses API key to read and write the data. The ThingSpeak can study the historical data and comprehend the data. Thingspeak works over the Internet. This means that the hardware you choose should be able to connect to the internet. Some of the boards, like ESP32 bit microcontroller will need an Ethernet or Wi-Fi Shield to communicate. Thingspeak interacts with the devices, web services and social media is possible with ThingSpeak.

Software Requirements

- Arduino IDE
- Jupyter Notebook
- Embedded C

Arduino IDE:

The Arduino Integrated Development Environment (IDE) is a cross-platform application that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. The Arduino IDE supplies a software library from the wiring project, which provides many common input and output procedures.

Embedded C:

Embedded C is most popular programming language in software field for developing electronic gadgets. It plays a key role in performing specific function by the processor.

Anaconda Jupyter Notebook:

The Jupyter Notebook application allows to create and edit documents that display the input and output of a Python or R language script.

VI. METHODOLOGY

The system is a game-changer in the healthcare industry, as it provides doctors with a comprehensive understanding of their patient's health status, allowing them to make informed decisions about treatment options. By incorporating all sensors into a single device, this system eliminates the need for multiple devices, making the process more efficient and cost-effective. The real-time and accurate data collected by the device is stored in the cloud, allowing doctors to access the patient's health data remotely. The use of Machine-Learning Algorithms is a significant advantage of this system, as it enables accurate predictions of a patient's recovery rate in real-time. The data collected is analyzed and processed to identify critical patient health status, and the results are presented in an easy-to-understand graphical format. This helps doctors to understand the patient's responsiveness to medication and make necessary adjustments to the treatment plan. The user-friendly mobile application allows patients to access their estimated data and predicted recovery rate, and the medications required to be taken. The login credentials ensure secure access to the patient's data, and the THINGSPEAK platform provides efficient communication between web applications

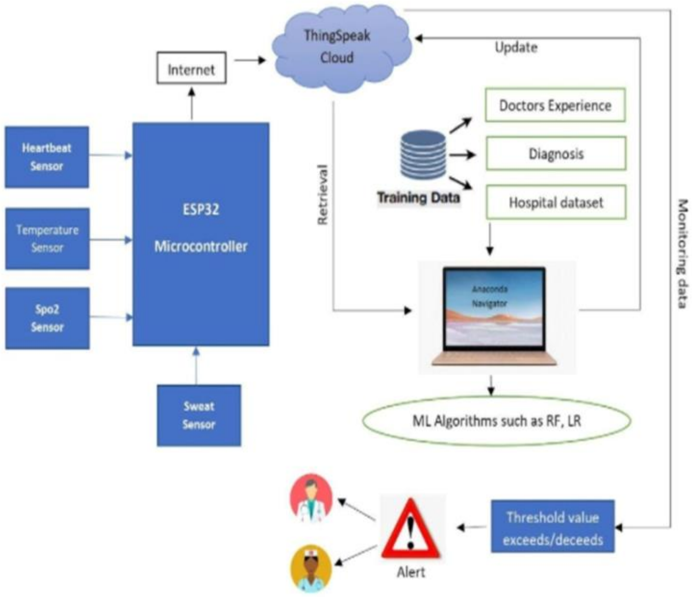

Fig 8. Smart Contract Execution on Etherscan.

This diagnosis and prescription system have three modules. They are collection of health data, analysing the data and prediction of recovery rate. For collection of health data, We are using sensor devices such as temperature sensor, heartbeat sensor, spo2 sensor and are used to sense the body parameters. ESP32 is the powerful tool for IoT applications having inbuilt Bluetooth and Wi-Fi which is programmed using the Arduino IDE. Data is collected from different sensor networks and processed by the Esp32 microcontroller for analysis. ThingSpeak cloud is a free web service for displaying the data online and one can access and monitor the data from ThingSpeak from anywhere. The analysed data is sent over the internet and stored in the cloud for access by the doctors. By using ThingSpeak server, we can monitor our data over the internet using the API and channels provided by ThingSpeak. The patient's medical history is stored in the cloud. From the cloud the processed data can be retrieved for treatment. The Machine learning algorithms along with the trained data and the sensor parameters are used to analyse the patient's health condition and is continuously updated to the cloud. A Threshold range of the parameters is fixed to monitor the current status of patient. If any parameters like heartbeat, temperature and oxygen level deviates from the standard range, then patient must be alerted and notification is sent to the family and doctor. The analysed data and the treatment given by doctors are again stored in the cloud which can be retrieved by the doctors to know the history of the patient and for further treatment. The values obtained and the state of the person is made available.

VII. DATA FLOW DIAGRAM

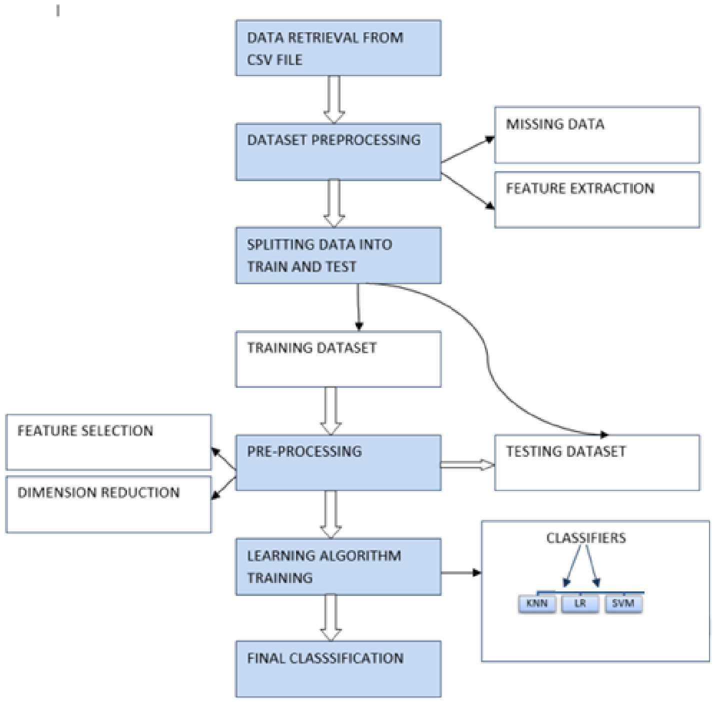

Fig 9. Dataflow Diagram

VIII. RESULTS AND DISCUSSION

ThingSpeak is a great tool for anyone who wants to collect data from their IoT devices and store it in the cloud. Its ability to interact with devices, web services, and social media makes it a powerful platform for IoT applications. With ThingSpeak, users can easily control hardware remotely, display sensor data, store and visualize data, and create amazing interfaces for their projects using various widgets. One of the key features of ThingSpeak is its ability to act as a data collector. The edge devices, or sensed value sending nodes, send data to the data collector using an API key to read and write the data. ThingSpeak can also study historical data and comprehend it, allowing users to gain insights from their data over time. To use ThingSpeak, users need hardware that can connect to the internet. While some boards like ESP8266 and Particle Photon are already internet-enabled, others may require an Ethernet or Wi-Fi Shield to communicate. Even if a shield is not available, users can still connect their devices to their laptop or desktop using a USB connection.

Fig 10. Think Speak Database

User Registration and Profile Creation:-
Users can create individual accounts and set up their profiles with personal information, medical history, and preferences. Secure login functionality ensures confidentiality of patient data.

Symptom Checker:-
Users can input their symptoms into the system through an intuitive interface. The system utilizes a sophisticated algorithm to analyze symptoms and generate potential diagnoses.

Medical Knowledge Base:-
The application incorporates a comprehensive database of medical information, including symptoms, diseases, treatments, and drug interactions. The knowledge base is regularly updated to reflect the latest medical research and guidelines.

Diagnosis Generation:-
Based on the symptoms provided by the user, the system generates a list of possible diagnoses, ranked by likelihood. The diagnoses are accompanied by detailed explanations and information to educate the user about their condition.

Prescription Generation:-
After a diagnosis is made, the system generates personalized treatment plans and prescriptions based on the user's medical history, allergies, and other relevant factors. The prescriptions include recommended medications, dosages, frequencies.

Drug Interaction and Allergy Checking:-
The system cross-references prescribed medications with the user's known allergies and checks for potential drug interactions. Alerts are provided to the user and healthcare professionals in case of any potential risks or conflicts.

Integration with Healthcare Providers:-
The web application can be integrated with electronic health record systems used by healthcare providers, allowing seamless data sharing and collaboration. Healthcare professionals can access the system to review diagnoses, prescriptions, and make necessary adjustments.

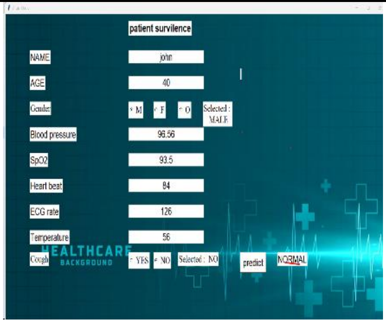

Fig 11. Normal Condidtion

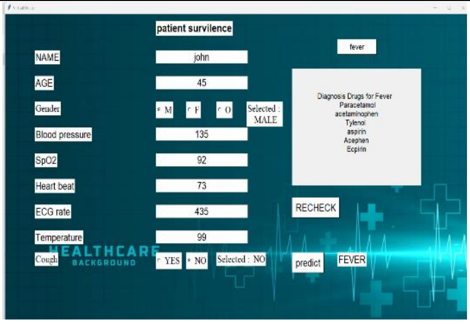

Fig 12. Fever Condition

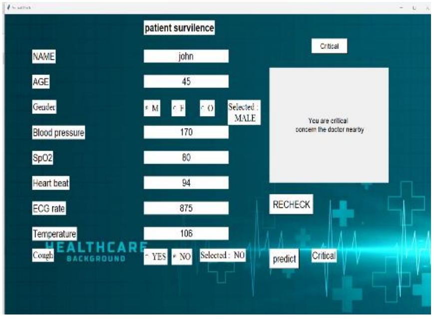

Fig 13. Critical Condition

VI. CONCLUSION

In conclusion, the implementation of a smart diagnosis and prescription system for onboard patients in hospitals offers numerous benefits and holds great potential for improving healthcare outcomes. By combining advanced technologies such as artificial intelligence, machine learning, and data analytics, this system can streamline the diagnostic process, enhance accuracy, and facilitate efficient treatment decisions. Firstly, the smart diagnosis system can leverage patient data, including medical history, symptoms, and test results, to provide rapid accurate diagnosis diagnoses. The use of machine algorithms can assist healthcare professionals in making informed decisions by analyzing large datasets and identifying patterns that may not be immediately evident to human practitioners. This can lead to faster diagnosis, reduce the waiting times for patients and enabling early intervention when necessary. Moreover, the prescription aspect of the system can optimize treatment plans by considering individual patient characteristics, including allergies, drug interactions, and medical history. The smart system can suggest appropriate medications, dosages, and treatment regimens based on evidence-based guidelines and personalized patient data. This can minimize the risk of adverse reactions and improve patient safety. The smart diagnosis and prescription system also has the potential to improve healthcare resource allocation. By automating certain aspects of the diagnostic process, it can help alleviate the burden on healthcare staff, allowing them to focus on more complex caases and provide better care. Additionally, the system can enhance the accuracy of diagnoses, minimizing misdiagnoses and unnecessary procedures, which can result in cost savings for both patients and healthcare institutions.

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