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Virtual Doctor Robot

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Abstract: The convergence of robotics, Internet of Things (IoT), cloud computing, and machine learning is revolutionizing the concept of virtual doctors. This paper explores the integration of robots as nurses, IoT devices, and cloud-based systems to create an advanced virtual doctor platform.Robotic nurses are designed to assist with routine tasks, patient monitoring, and interaction, while IoT devices collect real-time health data from patients. This data is transmitted to cloud-based systems where machine learning algorithms analyze it to provide accurate diagnostics and personalized treatment recommendations.

The study examines the benefits of this integrated approach, such as enhanced patient monitoring, increased accessibility to healthcare, and improved efficiency in medical services. Additionally, the paper addresses the technical challenges, including data security, interoperability of devices, and the accuracy of machine learning models. The findings suggest that this multi-faceted approach has the potential to transform healthcare delivery, particularly in remote and resource-limited settings, by offering comprehensive and continuous medical care.

INTRODUCTION

The healthcare industry is undergoing a transformative shift with the advent of advanced technologies such as robotics, the Internet of Things (IoT), cloud computing, and machine learning. These innovations are converging to create sophisticated virtual doctor systems that enhance patient care, streamline medical processes, and improve healthcare accessibility. Central to this transformation is the integration of robots as nurses and IoT devices, which work in tandem to collect, transmit, and analyze patient data through cloud-based platforms powered by machine learning algorithms.Robots as nurses represent a significant advancement in healthcare, providing support for routine tasks, continuous patient monitoring, and seamless interaction with patients. These robotic systems are equipped with sensors and AI-driven capabilities that enable them to perform various functions, from administering medication to assisting with mobility and daily activities. By alleviating the burden on human healthcare professionals, robotic nurses can improve the efficiency and quality of patient care.IoT devices play a crucial role in this integrated approach by enabling real-time health monitoring and data collection. Wearable devices, smart sensors, and connected medical equipment continuously gather vital signs and other health metrics from patients. This data is transmitted to cloud-based systems, where it is stored and processed. Cloud computing provides the necessary infrastructure to handle the vast amounts of data generated by IoT devices, ensuring scalability, reliability, and accessibility.Machine learning algorithms are then applied to the collected data to derive meaningful insights, detect anomalies, and generate personalized treatment recommendations. These algorithms can analyze patterns and trends in patient data, enabling early detection of diseases, prediction of health outcomes, and customization of healthcare interventions. The integration of machine learning enhances the diagnostic accuracy and efficiency of virtual doctor systems, making them a powerful tool in modern healthcare.This paper aims to explore the comprehensive integration of robots as nurses, IoT devices, and cloud-based machine learning systems in the development of virtual doctor platforms. It will examine the benefits, challenges, and potential of this integrated approach in transforming healthcare delivery. By leveraging these advanced technologies, virtual doctor systems can provide continuous, comprehensive**,** and personalized care to patients, particularly in remote and underserved areas.

LITERATURE SURVEY

1. Alvee Rahman, Tahsinur Rahman, proposed an “IoT Based Patient Monitoring System Using ECG Sensor”, The ECG signals by using a single lead heart monitor(AD8232) ,temperature sensor ,Raspberry Pi ,Arduino Uno.The data then collected and saved in the cloud using ThingSpeak.And data can be accessed by the users. If there is any variation with optimal value the message is sent to the saved individual .Data can be retrieved from system locations and on any system devices. Patient monitoring is a pivotal part of the healthcare system nowadays, either at hospitals or at home. This paper proposes an intelligent patient monitoring system that automatically screens the patient’s health condition through various sensors. The data is then processed using a Raspberry Pi and useful information is saved to the IoT cloud. Primarily the system would be extracting the bio signal, ECG using an ECG sensor. Through continuous

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monitoring and graphical representation of the patient's information, doctors/nurses/relatives can remotely check the patient's condition. Furthermore, if the condition becomes critical, a notification is sent to the doctor/nurse/relative to inform them and either party will have the opportunity to start a video call.

2. Dr.T.Jagannada Swamy and T.N.Murthy, published an "eSmart: An IoT based Intelligent Health Monitoring and Management System for Mankind", IoT based smart health monitoring system plays a vital role in telemedicine concept for the mankind. With the help of advance communication and information technology, it has led to the Internet of Things (IoT) for various real world applications. Many physical devices capture transmit data, and provides data to various interoperability methods in IoT. The basic functionalities of IoT is for storage, display and communicate the information. Hence the e-Health monitoring system with IoT is adapted for distant patient monitoring on a continual basis and aggregated, analyzed the data. It can bring about a massive positive transformation in the field of eSmarthealth management for the rural or urban patients. This may help the people who wants or having good opinion on the technology diagnosis. In this paper, a novel IoT system is proposed and developed with the help of oxygen saturation (SpO2) measurement sensor, Temperature sensor, Blood Pressure sensor, Bluetooth, Arduino, and APP

technologies or techniques. Based on the measured results and its analysis, the proposed device with sensors and the app technology based information is one of the most suitable for distinct patients health monitoring and diagnosis.

3. Gulam Gaus Warsi, Kanchan Hans, published an "IOT Based Remote Patient Health Monitoring System", Remote patient health monitoring system is an IoT device which could be used with patients or elderly at our homes whose real time health readings such as temperature, blood pressure and electro-cardiogram could be monitored remotely on a hand held device. This IoT device will automatically send alert to the users in case of an emergency which in this case would be fluctuation of the readings of the sensors beyond the normal range. This device is built using thermometer, electro-cardiogram sensor and sphygmomanometer attached to an arduino which transfer its data to servers using a wifi-module. The servers then compute the data which can be displayed on handheld devices. In case the values received from the sensors are outside the normal range then an alert will be sent to the user from the server.

4. R.Kumar, proposed an "IOT based Patient Monitoring System which provides data on Patient's Respiration",The main Objective of this project is to use Internet of Things(IOT) in healthcare to monitor the patient health status. This project makes medical equipments more efficient by allowing real time monitoring of patient health, in which sensor acquire data of patient's and reduces the human error. In Internet of Things patient's parameters get transmitted through medical devices via a gateway, where it is stored and analyzed. Internet of Things in the medical field brings out the solution for effective patient monitoring at reduced cost and also reduces the trade-off between patient outcome and disease management. In this paper we discuss about, monitoring patient's body temperature, respiration rate, heart beat and body movement using 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.

5. Neethu Anna Mathew and K M Abubeker, proposed an " Iot based Real Time Patient Monitoring and Analysis using Raspberry Pi 3", The main objectives or goals of this project is as global ageing and chronic diseases are increasing day by day, the diagnosis from hospital centric to home centric is needed. The idea presented

here is a real time remote patient monitoring and analysis using Raspberry Pi 3. Raspberry Pi is credit card sized single board computer with ARM11 microprocessor with 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. This 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. By using this technique, the patient by sitting in home can measure Blood Pressure, Temperature, ECG and Heart Beat and can transmit those parameters wirelessly to the website.

6. Athira.A ,Devika.T.D ,Varsha.K.R ,Sree Sanjanaa Bose.S, proposed an "Design and Development of IOT Based MultiParameter Patient Monitoring System", Objectives of this work is to design a home based smart system for aged patients, Analysing of physical parameter using wireless intelligence, According to the data, It provide medical assistance according to the data received i.e. Heart rate, Spo2 etc. In this paper, we have designed an IOT based MPM system where four parameter namely heart rate, respiration rate ,oxygen saturation and temperature are monitored using corresponding sensors and an email is sent to patient's guardian in case of emergency. The project also focuses on improving the performance of MPM system using Support Vector Machine(SVM) algorithm. The classification accuracy of 95% has been achieved.

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IMPLEMENTATION

Procedure Involved In Execution of Project Arduino Uno is used for integrated development environment provides simplicity, security, and ease of use in developing software through iterative cycles of editing, building, and debugging. You can use the basic software tools for developing software for ESP32 MCUs immediately after the initial installation. Arduino Uno is also compatible with ESP32 hardware tools. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. Abundant extensions and functions for user support ensure a dependable environment for all users.

Figure 1: ESP32 Micro -Controller

Figure 3 : Temperature Sensor

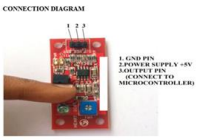


Figure 4 : Max 30100 Oxygen Sens

2. Hardware Assembly
Esp32.
Heartbeat sensor.
Temperature sensor.
Spo2 sensor.
Laptop.
System for THINGSPEAK

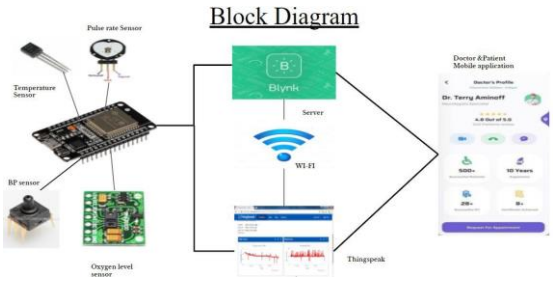
3. Software Development
Esp32.
Heartbeat sensor.
Temperature sensor.
Spo2 sensor.
Laptop.
System for THINGSPEAK

4. SYSTEM DESIGN

Shows the system architecture of the proposed system. The structure of the Patient Remote Monitoring system consists of eight components –ESP32 Micro-controller, Temperature sensor to know the body temperature, BP sensor to check the blood pressure of a patient, SpO2 sensor to know the saturation level, Pulserate sensor to know the heartbeat of a patient, Moisture sensor to know the moist level of the patient and to send information through ESP8266 Wi-Fi module to authorized users like doctor and patients through Thingspeak application to remotely control and stores the data in cloud through Thingspeak

System design of patient remote monitoring system

Our manifesto is established approaching routine of retrieving patient health related values from sensors connected to a device and granting this particulars to the cloud-Service for the motive of repository, transform, and dissemination using Thingspeak cloud and ESP32.The system involves four main components: sensors, Esp32, Thingspeak-server,



and Operators. These sensors are connected to ESP32 which looks through data from the sensor connected to ESP32 microcontroller and dispatches it to a Thingspeak-server. The Thingspeak-server additionally processes composed data and provides it to discrete users like the Thingspeak-cloud Service, operators to distinguish and observe health problems. We use the LM35 (Temperature Sensor), (SEN11574)Pulse Rate sensor, MAX-2000 (blood Pressure sensor), MAX30100 (Oxygen-level sensor) in order to observe the patient's body Data Values. Sensors start sensing. Then we will set the threshold values for heart beat and temperature. If the value exceeds the threshold value then it will give an indication of abnormality. The patient must be sent to hospital. In order to sort out this set of circumstances, we narrate the outline of ESP32 microcontroller for efficient performance in a health monitoring system. ESP32 is a 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

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controller and D2A controller . Below mentioned are the traits of suggested limitation : (i). Collection of health data : In order to determine the health status of a patient, we need to consider various health parameters and instead of using different devices for the collection of data, this single IOT device will collect real time and accurate data. (ii). Analyzing the data : The data collected will be stored in the cloud.The variations in the data for specific duration can be plotted as graphs.This graph helps the doctor to analyze the patient's responsiveness to the medication.(iii).Prediction of recovery rate: After Analyzing the data, we can predict the recovery rate of the Patient accurately in real-time using Machine-Learning Algorithm considering the dataset.

Motivation

The existing system requires many separate components to be carried by an individual to measure their own pulse rate , blood pressure, temperature and so on.

It restricts doctors assigned to every individual patient to be present in patients all the time.
It needs more staff members to operate and which in turn increases the probability of being infected.
It doesn't provide the complete historical data to analyze and do the prediction of the recovery rate.

Future Scope

Future work may include chatting for better communication between the doctor and the patient.

We can include alerts if it is outside the normal range for detecting the disease of the patient and providing the medications.
Another work in the future could be implementing the location information about the patients.
Working Testing is an important phase in the development life cycle of the product. This is the phase, where the remaining errors, if any, from all the phases are detected. Hence testing performs a very critical role for quality assurance and ensuring the reliability of the software. During the testing, the program to be tested was executed with a set of test cases and the output of the program for the test cases was evaluated to determine whether the program was performing as expected. Errors were found and corrected by using the below stated testing steps and correction was recorded for future references. Thus, a series of testing was performed on the system, before it was ready for implementation.It is the process used to help identify the correctness, completeness, security, and quality of developed computer software. Testing is a process of technical investigation, performed on behalf of stake holders, i.e. intended to reveal the quality- Context in which it is intended to operate. This includes, but is not limited to, the process of executing a program or application with the intent of finding errors. The quality is not an absolute; it is value to some person. With that in mind, testing can never completely establish the correctness of arbitrary computer software; Testing furnishes a 'criticism' or comparison that compares the state and behavior of the product against specification. An important point is that software testing should be distinguished from the separate discipline of Software Quality Assurance (SQA), which encompasses all business process areas, not just testing. There are many approaches to software testing, but effective testing of complex products is essentially a process of investigation not merely a matter of creating and following routine procedure. Although most of the intellectual processes of testing are nearly identical to that of review or inspection, the word testing is connoted to mean the dynamic analysis of the product-putting the product through its paces. Some of the common quality attributes include capability, reliability, efficiency, portability, maintainability, compatibility and usability.

A good test is sometimes described as one, which reveals an error; however, more recent thinking suggest that a good test is one which reveals information of interest to someone who matters within the project community. System testing of software or hardware is testing conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub-assemblies, assemblies and/or a finished product. It is the process of exercising software with the intent of ensuring that the software system meets its requirements and user expectations, and does not fail in an unacceptable manner. There are various types of testing. Each test type addresses a specific testing requirement. prediction of the recovery rate.

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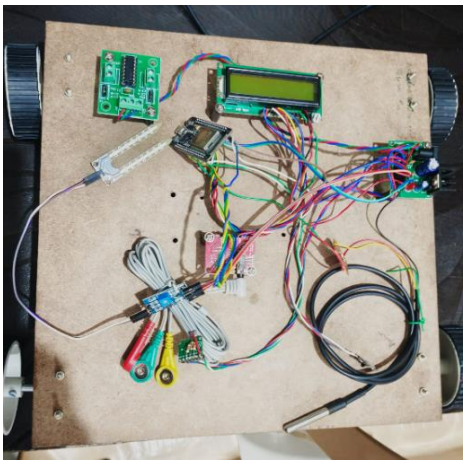

Basically, the existed system had three modules which are given below,

1) Collection of health data 2) Analyzing the data 3) Prediction of recovery rate .

In order to determine the health status of a patient, we need to consider various health parameters and instead of using different devices for the collection of data, this single IOT device will collect real time and accurate data. This proposed system will have a single device which has been designed and developed by incorporating all sensors .These sensors will collect biological behaviours of patients and then it will be transferred to the cloud. These stored data will be analyzed, processed and then through these datas, the proposed system can identify critical status of the patient's health. Analyzing the data. The data collected will be stored in the cloud. The variations in the data for specific duration can be plotted as graphs.This graph helps the doctor to analyze the patient's responsiveness to the medication. The user is required to login with his/her login credentials in order to look into his/her estimated data via system application thereby the user is redirected to his/her detailed estimated data page where one can find estimated data and predicted recovery rate of that specific user and the medications that are required to take by the user and an option to have a video chat with concerned doctor.

Prediction of recovery rate

After Analyzing the data, we can predict the recovery rate of the Patient accurately in real-time using Machine-Learning Algorithms by considering the health data-set. Using some Machine Learning Algorithm via PYTHON language in Anaconda Jupyter Notebook, we in turn retrieve the recovery rate in system applications created via THINGSPEAK. In order to have efficient communication between system application created using THINGSPEAK , an id is generated and pasted in the code for an id selector in Esp8266 wifi module code which in turn generates a hotspot region. Installation and Usage of Arduino Uno Initializing the packages of Arduino Uno IDE, Tools of Arduino Uno IDE

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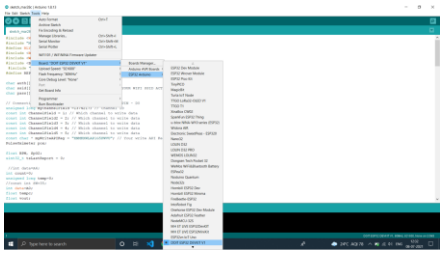


Figure 15 : Arduino Uno IDE

Create your account

1. Go to the Thingspeak cloud home page. Choose Create a New Thingspeak Account.
2. Note: If you've signed in to Thingspeak recently, it may say Sign In to the Console instead.
3. Choose Create a new Thingspeak account.
4. Note: If Create a new Thingspeak account isn't visible, choose Sign in to a different account first, and then choose Create a new Thingspeak account.
5. Type the requested account information, and then choose Continue.
6. Choose Personal or Professional.

Note: These two account types are identical in functionality.

Type the requested company or personal information.

Note: Choose Personal

Read the Thingspeak Customer Agreement, and then check the box.

Choose Create Account and Continue.

Note: After you receive email to confirm that your account was created, you can sign in to your new account using the email address and password you supplied. However, you must continue with the activation process before you can use Thingspeak services

Verify your email id

On the Email Verification page, type a email id that you can use to accept incoming emails.

Enter the code displayed in the captcha.

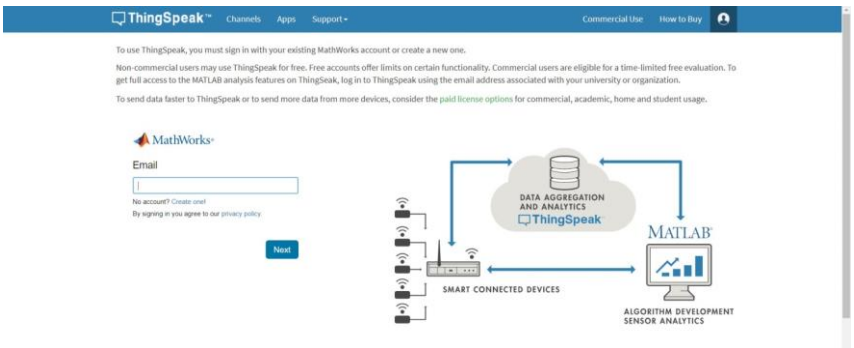
After you receive the verification code, enter the same in email verification page.

After the process has completed, choose Continue.

Again sign in to the console

Resolution

Here's an overview of the process: Check your email for requests for additional information Occasionally, Thingspeak



requires additional information from you in order to activate your account. In these cases, you'll receive an email describing what information is required and how to provide it. Check your email to see if Thingspeak requires any more information from you to complete the activation process. Contact Thingspeak Support If it's been 24 hours and you're still not sure why your account isn't activated, contact Thingspeak Support for help. Be sure to mention any of the steps that you've already tried, so Support can more effectively troubleshoot the issue. Note: Do not provide sensitive information, such as credit card numbers, in any correspondence with Thingspeak.

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BACK-ENDTECHNOLOGIES

1. FLASK

Flask is a web framework, it's a Python module that lets you develop web applications easily. It's has a small and easy-to-extend core: it's a microframework that doesn't include an ORM (Object Relational Manager).

What is a Web Framework?

A Web Application Framework or a simply a Web Framework represents a collection of libraries and modules that enable web application developers to write applications without worrying about low-level details such as protocol, thread management, and so on.

What is Flask?

Flask is a web application framework written in Python. It was developed by Armin Ronacher, who led a team of international Python enthusiasts called Poocco. Flask is based on the Werkzeg WSGI toolkit and the Jinja2 template engine.Both are Pocco projects.

WSGI: The Web Server Gateway Interface (Web Server Gateway Interface, WSGI) has been used as a standard for Python web application development. WSGI is the specification of a common interface between web servers and web applications.

Werkzeug: Werkzeug is a WSGI toolkit that implements requests, response objects, and utility functions. This enables a web frame to be built on it. The Flask framework uses Werkzeg as one of its bases.

jinja2: jinja2 is a popular template engine for Python.A web template system combines a template with a specific data source to render a dynamic web page.

2. SQLITE3

What is SQLite?

SQLite is an in-process library that implements a self-contained, serverless, zero-configuration, transactional SQL database engine. It is a database, which is zero-configured, which means like other databases you do not need to configure it in your system.

SQLite engine is not a standalone process like other databases, you can link it statically or dynamically as per your requirement with your application. SQLite accesses its storage files directly.

Why SQLite?

- SQLite does not require a separate server process or system to operate (serverless).
- SQLite comes with zero-configuration, which means no setup or administration needed.
- A complete SQLite database is stored in a single cross-platform disk file.
- SQLite is very small and light weight, less than 400KiB fully configured or less than 250KiB with optional features omitted.
- SQLite is self-contained, which means no external dependencies.
- SQLite transactions are fully ACID-compliant, allowing safe access from multiple processes or threads.
- SQLite supports most of the query language features found in SQL92 (SQL2) standard.

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- SQLite is written in ANSI-C and provides simple and easy-to-use API.
- SQLite is available on UNIX (Linux, Mac OS-X, Android, iOS) and Windows (Win32, WinCE, WinRT).

SQLite A Brief History

- 2000 - D. Richard Hipp designed SQLite for the purpose of no administration required for operating a program.
- 2000 - In August, SQLite 1.0 released with GNU Database Manager.
- 2011 - Hipp announced to add UNQl interface to SQLite DB and to develop UNQLite (Document oriented database)

3.3.2. FRONTEND TECHNOLOGIES:

1. HTML

What is HTML?

HTML is an acronym which stands for Hyper Text Markup Language which is used for creating web pages and web applications. Let's see what is meant by Hypertext Markup Language, and Web page.

Hyper Text: HyperText simply means "Text within Text." A text has a link within it, is a hypertext. Whenever you click on a link which brings you to a new webpage, you have clicked on a hypertext. HyperText is a way to link two or more web pages (HTML documents) with each other.

Markup language: A markup language is a computer language that is used to apply layout and formatting conventions to a text document. Markup language makes text more interactive and dynamic. It can turn text into images, tables, links, etc.

Web Page: A web page is a document which is commonly written in HTML and translated by a web browser. A web page can be identified by entering an URL. A Web page can be of the static or dynamic type. With the help of HTML only, we can create static web pages.

3. JAVASCRIPT

What is JavaScript?

JavaScript is a dynamic computer programming language. It is lightweight and most commonly used as a part of web pages, whose implementations allow client-side script to interact with the user and make dynamic pages. It is an interpreted programming language with object-oriented capabilities.

JavaScript was first known as LiveScript, but Netscape changed its name to JavaScript, possibly because of the excitement being generated by Java. JavaScript made its first appearance in Netscape 2.0 in 1995 with the name LiveScript. The general-purpose core of the language has been embedded in Netscape, Internet Explorer, and other web browsers.

The ECMA-262 Specification defined a standard version of the core JavaScript language.

- JavaScript is a lightweight, interpreted programming language.
- Designed for creating network-centric applications.
- Complementary to and integrated with Java.
- Complementary to and integrated with HTML.

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- Open and cross-platform

RESULT

The existing system requires many separate components to be carried by an individual to measure their own pulse rate ,blood pressure, temperature and so on.

It restricts doctors assigned to every individual patient to be present in patients all the time.

It needs more staff members to operate and which in turn increases the probability of being infected.

It doesn't provide the complete historical data to analyze and do the

CONCLUSION

We presented the design and implementation of a Patient Remote Monitoring System based on IoT, wireless automation using a cellular phone, Patient data can be retrieved on system phones as well as the recovery rate of patients. As the existing system requires many separate components, we had overcome it by integrating the components into a single unit and even we had overcome with monitoring the patient remotely for 24 hours in turn it had affected the staff limit. And also we had given the solution for the recovery rate. Confidentiality and data security could be achieved. The proposed model is extremely useful for the patients as well as wellness programmer.

Future work may include the chatting for better communication between the doctor and the patient. We can include alerts if it is outside the normal range for detecting the disease of the patient and providing the medications. Another work in the future could be implementing the location information about the patients.

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