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IoT Enabled Real Time Health Monitoring System

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ABSTRACT: The Comprehensive Health Monitoring System (CHMS) is an important tool that offers real-time health information to individuals. It uses various sensors, such as temperature, humidity, heart rate, and oxygen sensors, connected to an Arduino Uno microcontroller. The data collected can be viewed on an LCD screen or accessed through a mobile app. The Comprehensive Health Monitoring System (CHMS) offers a comprehensive approach to tracking key physiological parameters for individuals. It includes temperature and humidity sensors to monitor the surrounding environment, a heart rate sensor for continuous monitoring of heart activity, and an oxygen sensor for detecting respiratory issues early. Combining these sensors into one system provides a convenient and thorough option for monitoring health. Users can instantly view their health information on the LCD screen or mobile app, allowing them to make educated choices about their well-being. The CHMS is designed to increase health consciousness and encourage proactive health management, ultimately resulting in better overall health. Additionally, it will track the individual's live location through GPS.

I. INTRODUCTION

In the modern era, health monitoring has become increasingly important for maintaining well-being and preventing diseases. Monitoring key health parameters such as temperature, humidity, heart rate, and oxygen levels can provide valuable insights into an individual's health status. However, traditional monitoring methods often require specialized equipment and can be cumbersome for everyday use.

The Comprehensive Health Monitoring System (CHMS) aims to address these challenges by providing a user-friendly and accessible solution for health monitoring. By integrating multiple sensors into a single system, the CHMS offers a comprehensive approach to health monitoring that is both convenient and effective.

The CHMS utilizes state-of-the-art sensors, including a temperature sensor to monitor body temperature, a humidity sensor to track moisture levels, a heart rate sensor for cardiovascular monitoring, and an oxygen sensor to measure blood oxygen levels. These sensors are connected to an Arduino Uno microcontroller, which processes the data and displays it on an LCD screen in real-time.

One of the key features of the CHMS is its ability to provide continuous monitoring of health parameters, allowing individuals to track changes over time and detect any abnormalities early on. Additionally, the system is designed to be user-friendly, with a simple interface that can be easily accessed through a mobile application.

Overall, the CHMS represents a significant advancement in health monitoring technology, offering a comprehensive and accessible solution for individuals looking to take control of their health.

1.1 Area of interest

The CHMS contributes to the advancement of personal healthcare devices by integrating multiple physiological sensors into a single, user-friendly system. It aligns with the ongoing efforts to leverage technology for improved health monitoring, disease prevention, and patient care. By incorporating sensors such as temperature, humidity, heart rate,

and oxygen sensors, the CHMS falls within the growing field of wearable health technology. This area focuses on the development of portable and non-invasive devices that can continuously monitor various health parameters, providing real-time data to users and healthcare providers.

Mobile Health (mHealth) Applications: The CHMS includes a mobile application that allows users to access their health data remotely. This aligns with the broader trend of utilizing mobile technology to enhance healthcare delivery, improve patient engagement, and facilitate telemedicine services.

Internet of Things (IoT) in Healthcare: The integration of sensors with an Arduino Uno microcontroller and a mobile application positions the CHMS within the IoT ecosystem. IoT in healthcare involves interconnected devices that collect and exchange health data, enabling more efficient and proactive health management.

The CHMS supports preventive healthcare by enabling individuals to monitor their health continuously and detect potential issues early. This proactive approach can lead to better health outcomes and reduce the burden on healthcare systems.

1.2 OBJECTIVES OF THE PROJECT

- To provide real-time monitoring of vital health parameters by integrating temperature, humidity, heart rate, and oxygen sensors, enabling users to continuously track their health status and detect potential issues early.
- To enhance user accessibility and convenience by developing a user-friendly interface and a mobile application that allows users to easily access their health data and make informed decisions about their well-being.
- To improve health awareness and preventive care by empowering individuals with accurate and timely information about their physiological conditions, encouraging proactive health management and lifestyle adjustments.

II. RELATED WORK

- [1] **TITLE:** Data Visualization for Mental Health Monitoring in Smart Home Environment: A Case Study **AUTHORS:** Uichin Lee, Yunhee Ku, Chanhee Lee, Youngji Koh
ABSTRACT: Mental health care and monitoring are important. Advancements in smart home sensing technology also make tracking people's activities easy in the home, enabling the monitoring of mental health more effectively. Some related works have demonstrated the possibilities of mental health monitoring using sensor data collected in smart homes. However, there is a lack of prior research on how to effectively utilize smart home data visualization to help people understand how their everyday behaviors are related to their mental health status. This poster presents a case study on data visualization for mental health monitoring in a smart home environment.
- [2] **TITLE:** Development of Monitoring and Health Service Information System to Support Smart Health on Android Platform
AUTHORS: I Wayan Mustika, Fitri Yuli Zulkifli, A'isyah Nur Aulia Yusuf
ABSTRACT: Indonesia has relatively low health index compared to other countries, which is caused by increasingly complex disease patterns. One way to solve this problem is using the Smart Health concept, which enables monitoring of health conditions by patients and healthcare institutions, to prevent diseases. Researches related to health monitoring have been conducted. Most of them focus only on the reading and visualization of sensor data while the data management aspects including data storage, processing and synchronization between system, patients and healthcare institutions are not developed yet. This research proposes a design of health monitoring system named Mooble (Monitoring for Better Life Experience), a system to monitor patient health condition and to prevent diseases as early as possible.
- [3] **TITLE:** Smart Health Monitoring System Using Pulse and Temperature Sensor (Sensor-Based Health Observer)
AUTHORS: Vilas Rathod, Hemlata Ohal, Mrunal Fatangare
ABSTRACT: Smart healthcare is crucial for those who require ongoing monitoring that cannot be offered outside of hospitals. Additionally, it is crucial in rural areas where adjacent private clinics may converse with urban hospitals on the health of their patients. This study intends a smart, sensor-based health observer system that notifies the concerned party through SMS while monitoring the patient's state using biomedical sensors. Here, the biomedical sensors are interfaced with a Wi-Fi module controller, which reads the data, and outputs it to an LCD or serial monitor. For a smartphone to show data, SMS must be used. A message sent by the patient's family members to make accessing the patient's information simple. Monitoring the patient at home and regularly checking on their health is a particularly difficult chore in routinely busy work. It is important to periodically check older people's health to prevent serious medical emergencies.

[4] TITLE: Smart Health Monitoring System For The Elderly

AUTHORS: Adwaith Sreedher, Nehaa Pravin, Haritha Nair, Prabha. P Lakshmi

ABSTRACT: Smart health monitoring device provide improved health management and monitoring, and they also give doctors measured medical data for quicker patient diagnosis and better treatment planning. The project's goal is to create a working prototype for geriatric health monitoring using various sensors and sent alert messages to doctors and family members in the event of abnormal vital signs. The sensors used in this smart health monitoring system include a heartbeat sensor, a GSR for stress detection, a temperature sensor, an accelerometer sensor for fall detection as well as for step counting, along with these sensor GPS Tracker, Arduino Nano, node MCV, and a display are used. Arduino receives data from the sensors and through node MCV these sensor values from the Arduino are transmitted. The sensor values are subsequently stored in the cloud by the node MCV after the data transfer.

2.1 SUMMARY OF EXISTING SYSTEMS

Traditional health monitoring systems often rely on standalone devices for monitoring specific health parameters. For example, thermometers are used for measuring body temperature, pulse oximeters for oxygen saturation levels, and blood pressure monitors for heart rate. These devices provide valuable information but are often bulky, require multiple devices for comprehensive monitoring, and lack integration with other health data.

DISADVANTAGES:

1. **Lack of Integration:** Existing systems often require multiple devices for comprehensive health monitoring, leading to inconvenience and complexity.
2. **Limited Mobility:** Standalone devices are often bulky and not designed for continuous, on-the-go monitoring.
3. **Costly:** Purchasing multiple devices for comprehensive monitoring can be expensive.
4. **Data Fragmentation:** Data from different devices may not be easily integrated, leading to fragmented health records.
5. **Limited Connectivity:** Standalone devices may not offer connectivity options for real-time data monitoring and analysis.

The concept of image inpainting was first introduced by Bertamio et al. [1]. The method was inspired by the real inpainting process of artists. The image smoothness information interpolated by the image Laplacian is propagated along the isophotes directions, which are estimated by the gradient of image rotated by 90 degrees. Exemplar Based method proposed by Criminisi et al. [2] used a best exemplar patch to propagate target patch including missing pixels. This technique uses an approach which combine structure propagation with texture synthesis and hence produced very good results. In [3], the authors decompose the image into sum of two functions and then reconstruct each function separately with structure and texture filling-in algorithms. Morphological technique is used to extract text from the images presented in [4]. In [5], the inpainting technique is combined with the techniques of finding text in images and a simple algorithm that links them. The technique is insensitive to noise, skew and text orientation. The authors in [6] have applied the CCL (connected component labelling) to detect the text and fast marching algorithm is used for Inpainting.

The work in this paper is divided in two stages. 1) Text- Detection 2) Inpainting. Text detection is done by applying morphological open-close and close-open filters and combines the images. Thereafter, gradient is applied to detect the edges followed by thresholding and morphological dilation, erosion operation. Then, connected component labelling is performed to label each object separately. Finally, the set of selection criteria is applied to filter out non text regions. After text detection, text inpainting is accomplished by using exemplar based Inpainting algorithm.

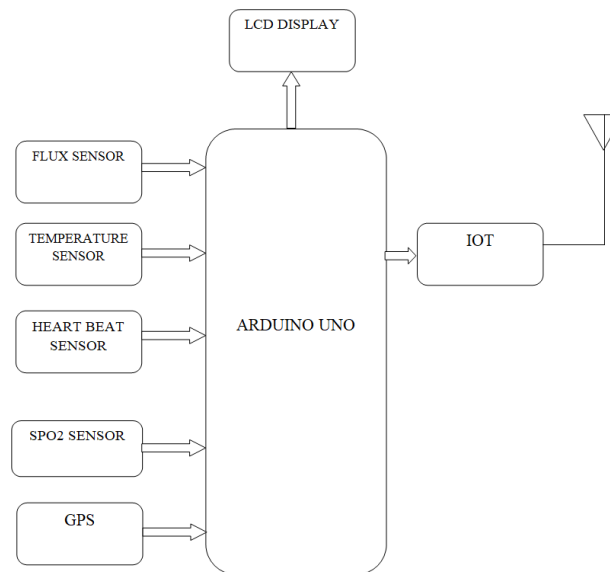
III. PROPOSED SYSTEM

3.1 AIM OF THE PROJECT

- The Comprehensive Health Monitoring System (CHMS) is a revolutionary approach to health monitoring that integrates multiple sensors into a single system, providing a comprehensive and user-friendly solution for individuals to monitor their health.
- The system includes sensors for temperature, humidity, heart rate, and oxygen levels, all connected to an Arduino Uno microcontroller.

- The data collected by these sensors is displayed in real-time on an LCD screen and can also be accessed through a mobile application.

3.2 PROPOSED BLOCK DIAGRAM:



1. Comprehensive Monitoring: The CHMS offers a comprehensive solution for health monitoring, integrating multiple sensors into a single system.
2. Convenience: With the CHMS, individuals can monitor their health parameters conveniently and in real-time, without the need for multiple devices.
3. Accessibility: The CHMS data can be accessed through a mobile application, allowing for easy monitoring and analysis.
4. Cost-Effective: The CHMS provides a cost-effective solution for comprehensive health monitoring, eliminating the need for multiple standalone devices.
5. Early Detection: Continuous monitoring provided by the CHMS enables early detection of health issues, allowing for timely intervention and prevention.

3 HARDWARE REQUIREMENTS

3.3.1 ARDUINO UNO

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

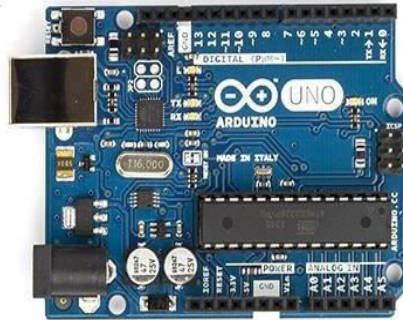


Fig 3.2 Pin Diagram for Atmega 328 Microcontroller



Fig 3.3 Atmega 328 Microcontroller

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

❖ **Technical Specification**

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	1 KB (of which 0.5 KB used by bootloader)

SRAM	2KB (ATmega328P)
EEPROM	1KB (ATmega328P)
Clock Speed	16 MHz
Length	68.6 mm
Width	53.4 mm
Weight	25 g

IV. METHODOLOGY

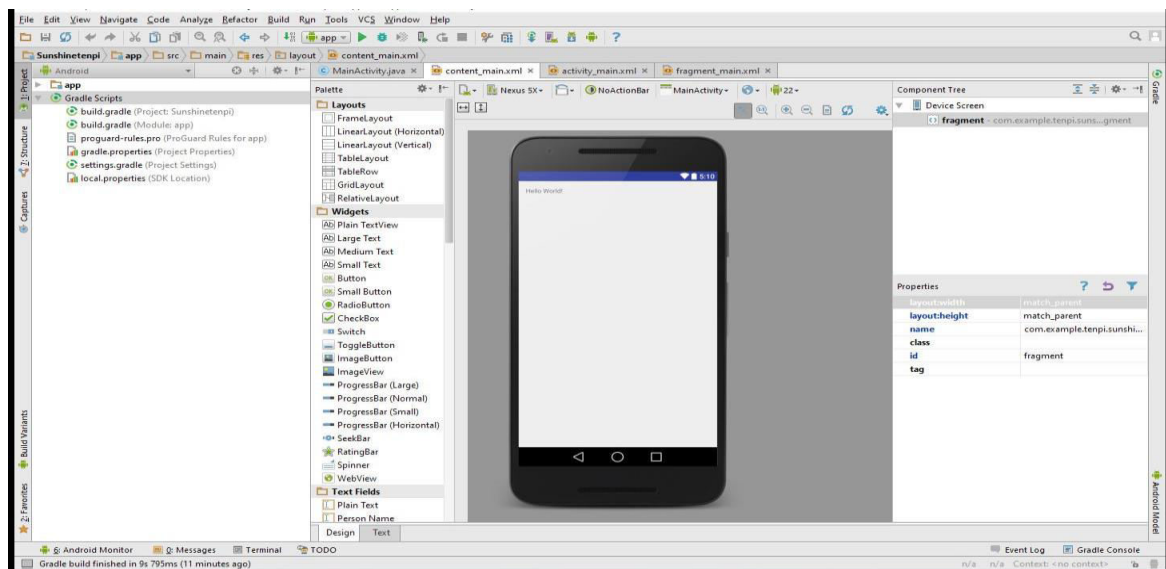
4.1 Working Principle ANDROID STUDIO:

Android Studio is a windowed environment. To make the best use of limited screen real-estate, and to keep you from being overwhelmed, Android Studio displays only a small fraction of the available windows at any given time. Some of these windows are context-sensitive and appear only when the context is appropriate, while others remain hidden until you decide to

show them, or conversely remain visible until you decide to hide them. To take full advantage of Android Studio, you need to understand the functions of these windows, as well as how and when to display them. In this chapter, we're going to show you how to manage the windows within Android Studio.

One of the essential functions of any integrated development environment (IDE) is navigation. Android projects are typically composed of many packages, directories, and files, and an Android project of even modest complexity can contain hundreds of such assets. Your productivity with Android Studio will depend in large measure on how comfortable you are navigating within these assets and across them. In this chapter, we're also going to show you how to navigate in Android Studio.

Finally, we'll show you how to use the help system within Android Studio. To take full advantage of this chapter, open the Hello World project we created in Chapter 1. If this project is already open in Android Studio, you're ready to go. Please refer to Figure 2-1 as we discuss the following navigation features.



The Editor

The primary purpose of any IDE is to edit files. As one would expect, the window that allows users to edit files in Android Studio is located in the center pane of the IDE. The Editor window is unique among windows in that it is always visible and always located in the center pane.

In fact, the Editor window is such a pervasive feature of Android Studio that from here on out, we refer to it simply as the Editor. All the other windows in Android Studio are called tool windows and cluster in side panes (left, bottom, and right) around the Editor. The Editor is a tabbed window, and in this respect it resembles a contemporary web browser. When

you open a file from one of the tool windows, from a keyboard shortcut, or from a context menu, the file displays as a tab of the Editor.

As you already discovered when you built your first project, Hello World, the MainActivity.java and the activity_main.xml files were automatically loaded in the Editor as tabs. Android Studio tries to anticipate which files you're likely to start editing, and then opens them automatically as tabs in the Editor upon completion of the New Project Wizard. Virtually any file may be opened in the Editor, though raw image and sound files cannot (yet) be edited from within Android Studio. You may also drag and drop a file from a tool window onto the Editor; doing this opens the file as a tab in the Editor.

Along the top of the Editor are the Editor tabs. Along the left margin of the Editor is the gutter, and along the right margin of the Editor is the marker bar. Let's examine each in turn.

Editor Tabs

To navigate among Editor tabs in Android Studio, use the Alt+Right-Arrow | Ctrl+Right-Arrow or Alt+Left-Arrow | Ctrl+Left-Arrow keys. Of course, you may always select an Editor tab with your mouse. The Editor tabs' options are located in the main menu bar at Window > Editor Tabs. Any action you select from this menu applies to the currently selected tab. Roll your mouse over the MainActivity.java tab and right-click (Ctrl-click on Mac) it. In the resulting context menu, shown in Figure 2-2, you will notice many of the same options that you discovered in Window > Editor Tabs. From this context menu, select the Tabs Placement submenu. The menu options Top, Bottom, Left, and Right allow you to move the tabs bar. Moving the tabs bar to the right or left accommodates more visible tabs, though at the expense of screen real-estate.

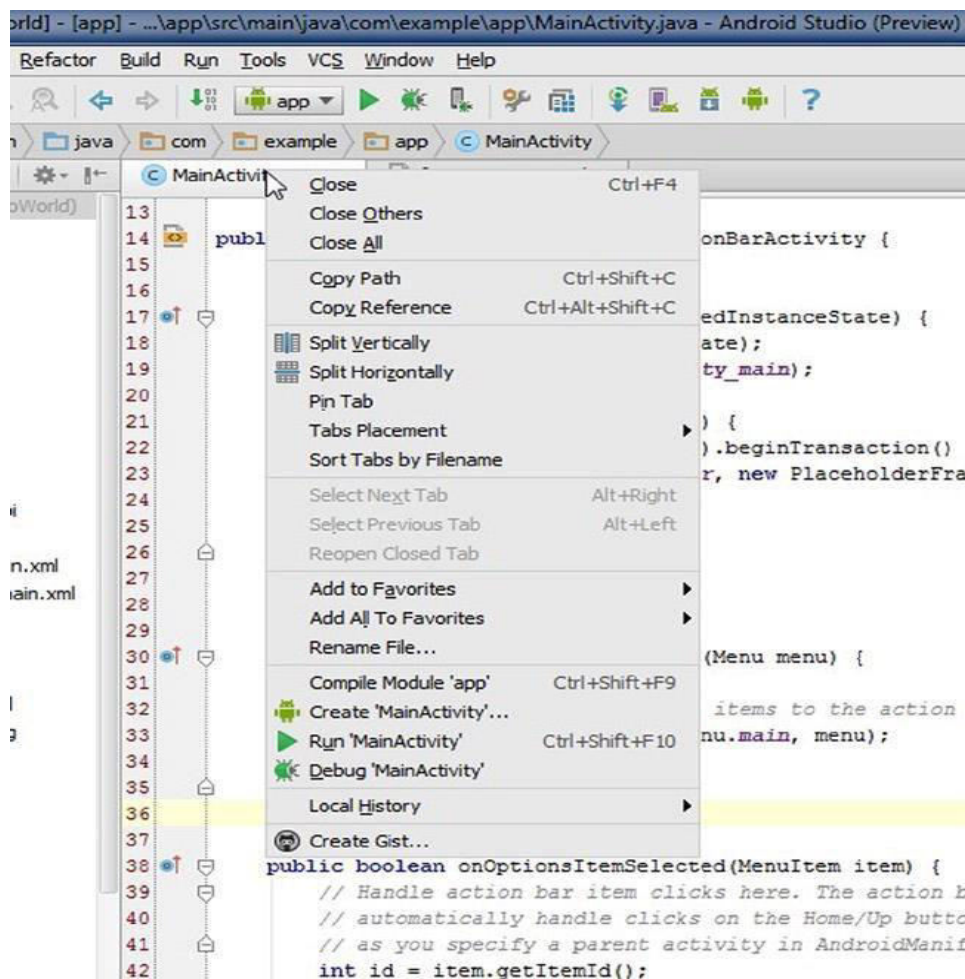


Figure 2-2. Editor tab context menu

The Close and Close All actions of the Editor tab context menu are straightforward. The Close Others action is used when you want to close all the tabs except the active tab. The Split Vertically and Split Horizontally actions are used to subdivide your Editor into panes. Split Vertically is particularly useful if you want to compare two files side by side. You may split panes ad infinitum, though the utility of such nested splits quickly diminishes. You may also drag and drop files from other windows to any pane of the Editor, or from one pane to another. Closing the last tab of a pane causes the entire pane to disappear.

ADVANTAGES:

- ❖ Comprehensive Health Monitoring
- ❖ User-Friendly Interface
- ❖ Real-Time Data Display
- ❖ Cost-Effective Solution
- ❖ Early Detection of Health Issues

4.2 Applications**Health and Well-Being:**

- ❖ Monitors anxiety levels.
- ❖ Enables proactive mental health management.
- ❖ Promotes self-awareness and timely interventions.

Education:

- ❖ Facilitates stress assessment in students.
- ❖ Supports interventions for academic stress.
- ❖ Enhances overall well-being in educational settings.

Workplace:

- ❖ Provides stress management tools.
- ❖ Fosters employee well-being.
- ❖ Enhances productivity and reduces workplace stress.

V. CONCLUSION

In conclusion, the Comprehensive Health Monitoring System (CHMS) represents a significant advancement in health monitoring technology, offering a holistic and user-friendly approach to monitoring key health parameters. By integrating multiple sensors into a single system and providing real-time data display through an LCD screen and mobile application, the CHMS provides users with convenient access to their health information.

One of the key strengths of the CHMS is its comprehensive nature, allowing users to monitor a range of health parameters including temperature, humidity, heart rate, and oxygen levels. This comprehensive monitoring capability enables early detection of health issues, allowing for timely intervention and prevention.

The user-friendly interface of the CHMS makes it accessible to individuals of all ages and backgrounds, ensuring that health monitoring is not only effective but also easy to understand and use. Additionally, the cost-effective nature of the CHMS makes it an affordable solution for individuals looking to take control of their health.

Overall, the CHMS has the potential to revolutionize the way health is monitored, providing individuals with the tools they need to make informed decisions about their health and well-being. By offering a comprehensive, user-friendly, and cost-effective solution, the CHMS stands poised to make a significant impact on the field of health monitoring.

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