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International Journal for Modern Trends in Science and Technology
Volume 12, Issue 03, pages 422-427.
ISSN: 2455-3778 online
Available online at: http://www.ijmtst.com/vol12issue03.html
DOI: https://doi.org/10.5281/zenodo.19122188

Design and Implementation of a Personalized Health Dashboard

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To Cite this Article
Manikanta.S.S, Chandra Sekhar Rayudu, Mounika Devi Pithani, Sukith Kumar Rapeti & Vardhan Vallapunneni (2026). Design and Implementation of a Personalized Health Dashboard. International Journal for Modern Trends in Science and Technology, 12(03), 422-427. https://doi.org/10.5281/zenodo.19122188

Article Info
Received: 16 February 2026; Revised: 15 March 2026; Accepted: 18 March 2026.

KEYWORDS

Raspberry Pi, 7-inch HDMI display, MAX30102 Sensor, MLX90614 Sensor.

ABSTRACT

A Personalized Health Dashboard is an intelligent embedded platform that combines health monitoring and daily information services into a single, easy-to-use system. Built around a Raspberry Pi, the system collects vital physiological data using a MAX30102 sensor for heart rate and blood oxygen level (SpO_2) monitoring, as well as an MLX90614 infrared sensor for contactless body temperature measurement. The sensed data is analyzed in real time using Python and presented clearly on a 7-inch HDMI display through an interactive graphical interface. Along with health parameters, the dashboard provides customized greetings, current date and time, weather conditions, and local news by accessing online services. With its compact design, low cost, and flexible architecture, the system is well-suited for home-based health tracking, elderly assistance, and modern smart healthcare applications.

INTRODUCTION

The Personalized Health Dashboard is a cost-effective, easy-to-use, automated, and intelligent health management system that monitors health in real time from a single location, using a 7-inch high-definition display for real-time health monitoring of the end user. The system consists of a Raspberry Pi as the computer, a 7-inch high-definition display as the interface, and health monitor displays as the user's health data. Using the dashboard, the end-user can view his/her body temperature, heart rate, pulse, and other vital health indicators. The visual interface offers other ways for the user to interact with the dashboard, including personalized welcome messages, local news updates, and real-time local and weather forecasts. By offering integrated health data and daily utility services on one platform, the Personalized Health Dashboard will be a valuable resource for users to manage their health on a daily basis.

Reliable infrared temperature sensors or MLX90614 sensors are accurate physiological data collectors that enable accurate physiological data collection through noncontact measurement of body temperature and other parameters, with high accuracy. Pulse oximeter sensors also provide an effective method of collecting this data through noncontact means. Data collected from these data collection devices (sensors) will be processed and displayed immediately, allowing individuals to monitor their physiological state in real-time. Memory cards are used for storing software and data for the entire software system; the system is powered with a 5V AC/DC power supply, thus allowing easy installation in the home, clinic, or wellness center.

A customized health dashboard that utilizes a Raspberry Pi provides a solution to that requirement. The health dashboard consistently collects and displays the most essential health metrics over time (for example: heart rate, SpO2 levels, Body Temperature) via continual monitoring of a user's physical well-being through optimized sensors. The dashboard also provides each user with a unique welcome greeting and the current date & time, as well as local weather and community-related news updates. The dashboard is compactly designed and at a price point that is low enough for it to be abundantly utilized at home, assisted living facilities, and smart home

environments. This type of dashboard promotes the integration of health tracking into everyone's daily digital lives while enhancing preventive healthcare, enabling individuals to have improved overall wellness.

OBJECTIVE

The objective of this project is to design and develop a cost-effective and intelligent personalized Health Dashboard using a Raspberry Pi for continuous monitoring of vital health parameters such as heart rate, blood oxygen saturation (SpO_2), and body temperature. The system aims to process and display real-time health data on a 7-inch HDMI display through a simple Python-based graphical interface, while also presenting daily information including date, time, weather updates, local news, and a personalised welcome message. The project focuses on creating a compact, reliable, and scalable solution that enhances user convenience, supports preventive healthcare, and is suitable for deployment in smart homes, elderly care environments, and IoT-based healthcare systems.

PROBLEM STATEMENT

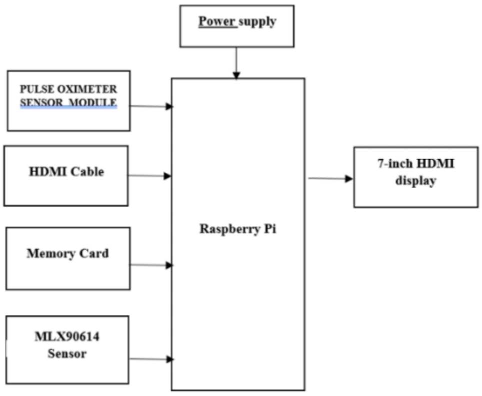
People regularly check health indicators such as heart rate, blood oxygen level (SpO_2), and body temperature to maintain aware of their well-being and identify problems early. Many current monitoring solutions depend on separate medical instruments, wearable devices, or hospital equipment, which are often expensive and inconvenient for routine home use. These systems mostly display only medical data and do not include basic daily information like weather or news, forcing users to rely on multiple devices. This reduces convenience, particularly for elderly users.

To overcome this, there is a need for a simple and low-cost solution that can monitor essential health parameters while also presenting everyday information on a single display. The system should be user-friendly, clearly present data, and support future upgrades. The proposed Personalized Health Dashboard integrates health sensors, internet-based information, and a Raspberry Pi-based display to provide a practical solution for home health monitoring.

PROPOSED SYSTEM

The proposed model introduces a smart and integrated Personalised Health Dashboard developed using a Raspberry Pi to monitor essential health parameters and display daily information on a single platform. The system employs a MAX30102 sensor to measure heart rate and blood oxygen saturation (SpO_2) and an MLX90614 infrared sensor to capture body temperature. The model is designed to be compact, economical, and easy to use, with a modular structure that allows future expansion, making it suitable for applications in smart homes, elderly care, and IoT-based healthcare systems. without physical contact. These sensor readings are processed in real time by the Raspberry Pi and presented on a 7-inch HDMI display through a Python-based graphical interface. The dashboard provides an altered welcome message, the current date and time, the weather, and local news through the internet in along with health data.

BLOCK DIAGRAM



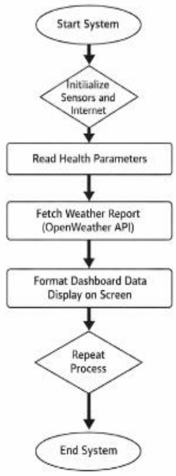
SYSTEM IMPLEMENTATION

The implementation of the proposed Personalized Health Dashboard is done through the coordinated integration of hardware components, software program modules, and internet-based offerings to allow continuous fitness tracking and real-time information display. The Raspberry Pi serves as the critical processing and management unit of the tool. It is configured with the required working system and tool libraries, and critical interfaces, along with I²C and Wi-Fi, are enabled to assist sensor communication and internet connectivity. Biomedical sensors, which include the MAX30102 for monitoring heart rate and blood oxygen saturation (SpO_2) length and the MLX90614 for non-touch frame temperature sensing, are interfaced with the Raspberry Pi through I²C conversion protocol. A 7-inch HDMI display is connected to the Raspberry Pi, providing a clear and continuous visual output of all system information.
All software applications employ the use of PYTHON owing to the flexibility, simplicity, and support provided by graphical libraries as well as interactions with sensors. Specialized software program utility applications for all tasks assist in ensuring modularity and maintainability. Both software program acquisition applications for the sensors, MAX30102 and MLX90614, work to enable the continuous acquisition of raw data from the sensors. While the MLX90614 provides real values of the temperature, measured in units of Celsius, the MAX30102 provides raw values of the photoplethysmographic signals that are filtered to obtain values of heart rate and Sp02. The strategies of mistake management assist in ensuring that disconnections or unusual values from the sensors are detected.

In addition to obtaining training facts, the machine integrates online services to obtain real-time statistics. Application Programming Interface (API) is used to get current weather conditions and local information updates through HTTP requests. The device also generates personalized welcome messages and receives real-time date and time information from the machine clock. All education parameters of the incoming email stream, environmental information, and factual content are synchronized and formatted before display to ensure some consistency and a clean update.

A graphical user interface (GUI) has evolved the usage of the Tkinter library to provide all the records in a long, readable, and user-friendly format on a 7-inch display. The GUI is designed to be routinely replaced at pre-described intervals, allowing non-forestall actual-time monitoring without purchaser intervention. Clear sectioning, appropriate font sizes, and simple format design are used to improve accessibility, especially for older users. The complete tool is examined under multiple working conditions to assess sensor accuracy, community reliability, interface responsiveness, and long-term stability. Calibration and optimization tactics are used to enhance dimensional accuracy and decrease latency throughout continuous operation.

After a successful tryout and validation, all hardware and software modules are included right into a single application configured for non-stop execution on machine startup. The very last implementation consequences in a dependable, low-value, and scalable Personalized Health Dashboard that effectively helps smart home environments, elderly care, and IoT-based healthcare programs, even as promoting preventive fitness monitoring and personalized digital help.



FLOW CHART OF PERSONALIZED HEALTH DASHBOARD

When a Pi is first powered on, it will perform one or more tests of the primary parts of the device that have been connected to it (e.g., display, microphone, etc.) and check for correct operation of each of these components, and then launch the main application, which will initialize the health sensor components. Once all of the health sensors are confirmed to be operating correctly, the Pi will use a network connection to connect to the internet in order to obtain any information that is required for the development of the health monitoring project. Once the Pi has verified that it has an internet connection, the Project will monitor the core set of primary health metrics (i.e., heart rate, blood oxygen saturation [SpO_2], and body temperature) and store data for each metric captured appropriately to ensure that there are no sudden increases or decreases in the data that would affect the user's confidence in the accuracy of the results of the monitoring process.

After the primary health metrics are captured, verified and stored, the project will reconnect to the internet for the purpose of obtaining current local weather data. Finally, all captured health metric data and associated timestamps, along with the associated current weather data, will be formatted and organized in an easy-to-read manner so that all monitoring and verification processes can be repeated until they are otherwise instructed.

The complete solution will keep collecting measurements on a continuous basis to maintain your state of health, as well as make them available at all times via the web. The system integrates medical sensors with information systems into one platform and allows for efficient use of hardware, and provides an environment that works well together. In addition, the prototype can operate effectively in the home and is a model that can be scaled to meet the needs of each user’s unique health monitoring and wellness applications.

PROTOTYPE HARDWARE IMPLEMENTATION

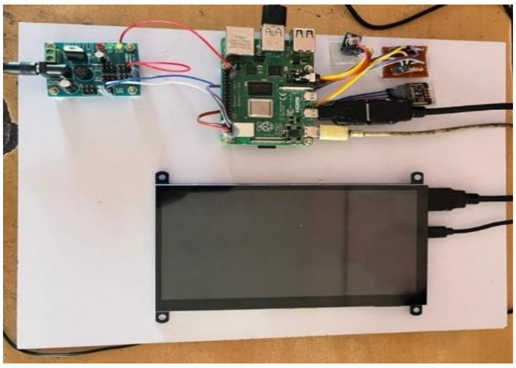


Fig 1: Circuit Setup in OFF state

The components shown in the figure are the hardware configuration of a Raspberry Pi board, which is connected to an LCD touch display, a power regulation module, and so on. This Raspberry Pi board is used as a processing module to process a large number of functions. This board has a connection to an LCD display, which is used to display the result of the process. There is a power module, which is a DC-DC module, used to provide a stable voltage to the Raspberry Pi board.

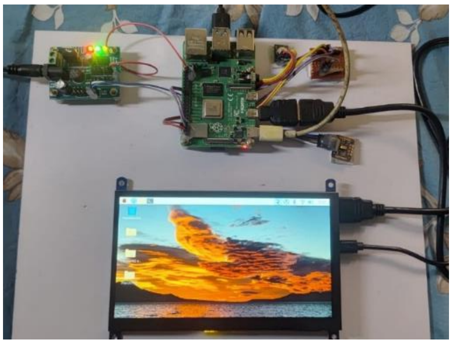


Fig 2: Circuit Setup in ON state

As illustrated in the figure, the Raspberry Pi is successfully booted and operational (as it can show the Raspberry Pi Operating System Interface), and the LCD screen is displaying an image showing the Power Module (as denoted by the illuminated Power Module Indicators) is properly connected with it to regulate voltage so that it meets the minimum voltage requirements for a stable power supply to the entire hardware and is operating within specification conditions. The ON image shows that the parts of the system - display, Raspberry Pi Board and Power Circuitry - are functioning correctly and are working together as intended.

SYSTEM OUTPUT RESULTS

Fig 3: Display output of the system

This figure shows the output that you would see on the LCD screen if you successfully booted the Raspberry

Pi, executed your program, and connected your hardware components to the Raspberry Pi (HDMI cables) using a USB port for your power supply. The LCD shows that data from your hardware components was processed by your software application and is displayed to the user. Additionally, the display shows that the power regulation board is providing stable power to your Raspberry Pi (indicated by an LED) and that the Raspberry Pi is receiving incoming data and updating its LCD screen.

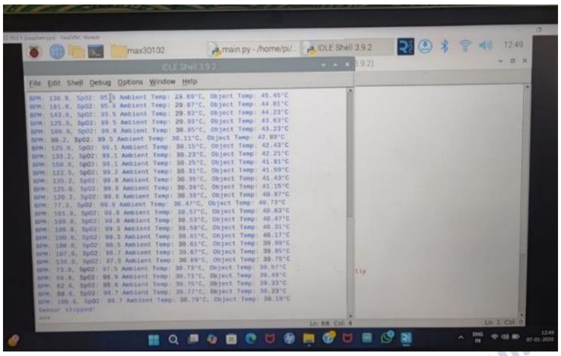


Fig 4: Data Output displayed on the serial monitor

The System is illustrated in the graphic above with all of the Data Values already processed for display on the screen by the Raspberry Pi. The software program, written by the Raspberry Pi, runs and generates continual data output as illustrated by the numerical output displayed and the data logging. The continual Data Output verifies that the software successfully reads, processes, and displays the information in real-time on the Pi's screen. The screen display serves as a functional output of the software that interfaces with the hardware environment.

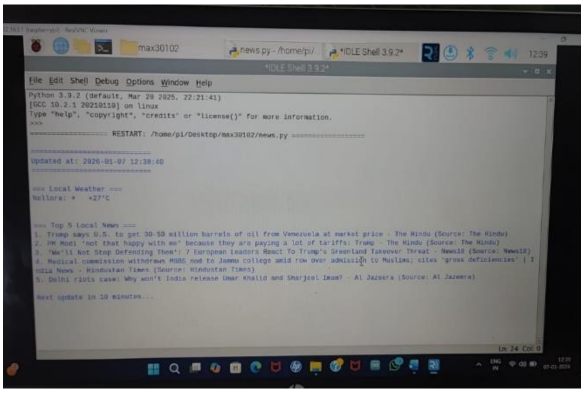


Fig 5: Serial Monitor Output

As can be seen from the figure above, when using the Serial Monitor of the Raspberry Pi, you can see both the Instantaneous Temperature readings and also see the Latest News through live updates from the system running that particular script. The Raspberry Pi has now finished executing the script and has displayed the sensor data, timestamps, and most importantly, latest news headlines on the terminal window. With this output, we can confirm that the data acquisition has been successfully integrated into the data processing and API based information retrieval processes. It has also been verified that this system can continuously provide updates to both the sensor values and Live News and provide those in a parsable format.

CONCLUSION

In this project, the design and implementation of a Personalized Health Dashboard utilizing an embedded system platform to combine real-time health monitoring features with daily informational utilities is presented successfully. The system uses a Raspberry Pi and vital parameter sensors to offer precise and real-time health information by displaying the data in a user-friendly interface. The combination of customized messages, weather information, and news enhances the engagement of the user and makes the system viable to use in daily life.

The solution suggested is cheap, simple to run and has been implemented well in smart home and personal healthcare applications. Its modular form can be expanded in the future by adding more sensors and connectivity to the system, showing the potential of embedded systems both in preventive healthcare and continuous health monitoring.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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