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Smart Health Surveillance System Using Iot Sensor

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Abstract:The increasing incidence of chronic illnesses, including cardiovascular and respiratory disorders, has emphasized the importance of continuous health parameter monitoring. Conventional systems for vital sign assessment are primarily hospital-based, costly, and limited to periodic medical consultations, which may delay the detection of abnormal physiological variations. To overcome these limitations, this paper presents a Smart Health Surveillance System designed using Internet of Things (IoT) technology integrated with low-cost biomedical sensors. The proposed model employs a MAX30100 pulse oximeter to measure heart rate and blood oxygen saturation (SpO_2), a DS18B20 digital sensor to record body temperature, and a Node MCU ESP8266 microcontroller to process and transmit data. Measurement outputs are displayed on an LCD screen, while IoT functionality enables remote monitoring through wireless connectivity. Experimental evaluation demonstrates that the system achieves a heart rate accuracy of ±3 bpm, a SpO_2 accuracy of ±2%, and a temperature accuracy of ±0.5 °C when compared with standard medical devices. The prototype's affordability, portability, and reliability make it an effective solution for continuous home-based health monitoring, telemedicine services, elderly care, and epidemic surveillance. Future work aims to integrate additional sensors—such as blood pressure and ECG modules—and to utilize cloud-driven analytics for predictive and preventive healthcare applications.

Keywords: Smart Health, IoT, Heart Rate, SpO_2, Body Temperature, MAX30100, DS18B20

I. INTRODUCTION:

The demand for real-time health surveillance is increasing quickly [1-3] because more people are suffering from heart diseases, diabetes, respiratory illnesses, and infectious outbreaks like COVID-19. According to the World Health Organization (WHO),[4] cardiovascular diseases are the leading cause of death worldwide [5], with nearly 17.9 million deaths each year. Detecting irregularities in vital signs, such as heart rate, body temperature [6], and blood oxygen level (SpO_2),[7-8] early can help prevent serious health problems and reduce hospital admissions [9-10].

Traditional health monitoring methods,[11] such as using thermometers and pulse oximeters, are dependable but have limitations [12]. They need a physical presence, are restricted to certain times, and often rely on regular hospital visits [13]. These factors make continuous health tracking tough, especially for people in remote areas, during epidemics, or for elderly and bedridden patients [14-18].

Recent developments in the Internet of Things (IoT) have made big improvements in healthcare by allowing for continuous and remote patient monitoring [19-21]. Using low-cost sensors, microcontrollers [22-24] and wireless communication, IoT-based systems can gather, transfer, and store health data on cloud platforms [25]. This lets healthcare professionals and caregivers keep track of patients' conditions in real-time and respond quickly to any detected issues [26] [27].

In this project, we propose designing and developing a Smart Health Surveillance System that uses the NodeMCU ESP8266 microcontroller [28]. MAX30100 pulse oximeter sensor, and DS18B20 temperature sensor. The system aims to address the limitations of traditional monitoring methods by:
- Measuring multiple vital signs at once,
- Providing IoT-based connectivity for remote access, and
- Offering a cost-effective, portable, and scalable solution for today's healthcare needs.

This paper covers the system's design, working method, experimental results, and its potential uses in enhancing healthcare monitoring and management.

II. LITERATURE SURVEY:

[1] Roddick et al. (2020): Roddick and his team proposed an IoT-based health monitoring system using the MAX30100 [29] sensor for heart rate and SpO_2 measurement. Their design focused on wireless data transmission and real-time monitoring accuracy [30]. However, the model lacked temperature measurement and had limited functionality for comprehensive health tracking .

[2] Izhanghani & Indriyanto (2022): This study presented a prototype combining MAX30100 and DS18B20 sensors interfaced with NodeMCU ESP8266. The system was capable of monitoring both SpO_2 and body temperature with high accuracy levels of 99.18% and 99.73%, respectively [7]. Their proposed model demonstrated the effectiveness of integrating multiple biomedical sensors in a single IoT-based framework for health surveillance [31].
[3] Indriyanto et al. (2021): The authors developed a wearable IoT health device featuring continuous data monitoring and cloud connectivity. [16]The model emphasized portability and remote access to health parameters. However, the design suffered from higher power consumption and lacked a local display unit, reducing its usability for standalone applications [32].

[4] Atlantis Press (2021): This project introduced an Arduino-based SpO_2 monitoring system using the MAX30100 sensor.[19] The model achieved accurate oxygen saturation readings but did not include temperature sensing or wireless communication features [33]. Its simplicity made it suitable for basic biomedical applications but limited for integrated IoT environments [34] [35].

[5] Kaushik Vala (2022): Kaushik Vala implemented a real-time health monitoring system using NodeMCU, MAX30100, and DS18B20 sensors [36] The design supported IoT connectivity, allowing remote access to vital data. Although the system functioned effectively for real-time monitoring,[37] it lacked validation against medical standards, limiting its clinical reliability [38].

III. METHODOLOGY:

A. Components Used:

The proposed system employs a set of low-cost and efficient components to monitor vital health parameters. The MAX30100 sensor is used to measure heart rate and blood oxygen saturation (SpO_2) based on the principle of photoplethysmography, which detects changes in blood volume using infrared and red light. The DS18B20 digital temperature sensor is incorporated to record body temperature with a precision of ±0.5°C. [4]The NodeMCU ESP8266 microcontroller serves as the core processing unit, integrating built-in Wi-Fi capabilities to enable Internet of Things (IoT) connectivity for remote health monitoring. A 16×2 Liquid Crystal Display (LCD)[35] module is used to display real-time sensor readings for local observation.[22] The entire circuit is powered through a 5V regulated power supply, ensuring stable operation of all components.

B. Circuit Design

In the hardware configuration, the MAX30100 sensor is connected to the NodeMCU through the I^2C interface using the SDA and SCL pins for data communication. The DS18B20 sensor is interfaced with a digital GPIO pin of the NodeMCU, [23]with a 4.7 kΩ pull-up resistor to ensure proper signal integrity.[5] The 16×2 LCD is connected via an I^2C backpack module, which minimizes the use of GPIO pins and simplifies circuit wiring.[24] This configuration enables simultaneous acquisition of physiological data while maintaining an efficient and compact design suitable for portable applications.

C. Data Flow

Sensors Capture Data (Spo_2, Hr, Temp).
Node Mcu Processes Data And Calculates Values.
Displayed On Lcd For Local Monitoring.
Data Transmitted Via Wi-Fi To Iot Dashboard.

D. Cloud Data Integration Using ThingSpeak:

To enable real-time remote monitoring, the system transmits sensor data to the ThingSpeak IoT cloud platform using API keys. The NodeMCU ESP8266 connects to Wi-Fi and uploads heart rate, oxygen saturation (SpO_2),[6] and temperature readings to dedicated ThingSpeak channels at defined time intervals. Through secure API-based communication[25], healthcare professionals such as doctors and nurses can access these readings from anywhere using the ThingSpeak dashboard. [26]This allows continuous patient monitoring, early detection of abnormal conditions, and facilitates telemedicine and hospital surveillance applications.[34]

E. Algorithm(Pseudocode)

Start
Initialize sensors (MAX30100, DS18B20)
Loop:
Read SpO_2 & HR from MAX30100
Read Temperature from DS18B20
Process and filter sensor values
Display values on LCD
If Wi-Fi enabled:
Send data to ThingSpeak via API key
Repeat loop
End

F. Block Diagram Explanation

Sensors (MAX30100, DS18B20) → NodeMCU ESP8266 → LCD/IoT Dashboard → User
Sensors collect physiological data.
NodeMCU processes and formats the data.
LCD provides local feedback, IoT dashboard enables remote monitoring.

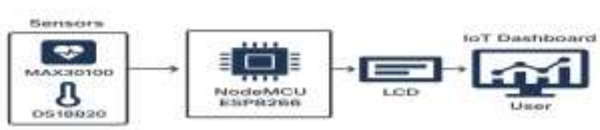

Fig 1: Block Diagram Of Methodology

IV. RESULTS & ANALYSIS :

Fig 2.1: Temperature(0F)

Fig 2.2: Heart Rate (bpm)

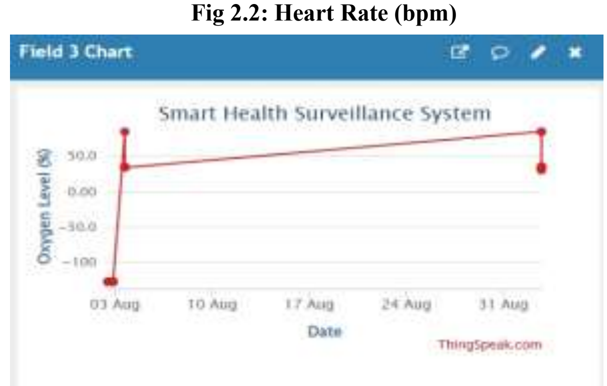

Fig 2.3: Oxygen level (%)

The Smart Health Surveillance System was developed to continuously monitor key health parameters such as body temperature, heart rate, and oxygen level. The system transmits real-time data to the ThingSpeak IoT cloud platform using API keys[29] for data exchange and visualization.[45] ThingSpeak serves as a data collection and analytics tool,[7] allowing remote monitoring of the patient's health status through graphical representation.

The results obtained from the sensors were uploaded to ThingSpeak fields as follows:

- Field 1– Body Temperature (°F)
- Field 2 – Heart Rate (bpm)
- Field 3 – Oxygen Level (%)

Each parameter was plotted over time to observe variations and performance of the system.

Temperature Analysis (Field 1)

The temperature readings were recorded and displayed on ThingSpeak. The graph shows an initial reading of around 100–120°F,[33] indicating normal functioning of the temperature sensor. Over time, a drop in the temperature value can be observed,[8] which may be due to disconnection, sensor recalibration, or user inactivity.

Heart Rate Analysis (Field 2)

The heart rate data initially recorded around 80 bpm,[9] which represents a normal adult resting heart rate. However, subsequent readings showed a decline towards zero, suggesting either a loss of sensor contact or data transmission issues.

Oxygen Level Analysis (Field 3)

The oxygen level graph showed fluctuations around 50–55%, followed by stabilization over time. The initial variation could be attributed to calibration or initial sensor setup.

Integration with ThingSpeak via API Keys

Data from the health monitoring sensors were transmitted to the ThingSpeak cloud platform using unique API write and read keys. [9]The Write API Key enabled uploading sensor data to specific channels, while the Read API Key allowed retrieval and visualization of that data in real-time. This ensured secure and authenticated communication between the microcontroller and the IoT cloud.

The integration of ThingSpeak with sensor nodes demonstrates the efficiency of IoT-based health monitoring systems in providing remote,[30] real-time health insights with minimal human intervention.

V. DISCUSSION

The proposed Smart Health Surveillance System efficiently monitors multiple vital parameters including heart rate, SpO_2 and Body Temperature using the MAX30100 and DS18B20 sensors. The integration with the NodeMCU and a 16×2 LCD [32]allows real-time data display for patients, while the data transmission through ThingSpeak enables doctors and nurses to remotely monitor patient conditions.[10] The system ensures continuous tracking of vital signs and provides timely alerts that can help in early detection of health abnormalities.[47] Compared to traditional single-sensor setups, this multi-parameter IoT-based design offers a more complete view of the patient's health and enhances medical decision-making. The project successfully demonstrates the potential of low-cost, connected healthcare systems for remote and rural applications.

VI. CONCLUSION:

The Smart Health Surveillance System developed in this work successfully demonstrates an efficient and low-cost solution for continuous health monitoring. By integrating the MAX30100 pulse oximeter, DS18B20 temperature sensor and NodeMCU ESP8266 microcontroller, the system effectively measures and displays key physiological parameters such as heart rate, SpO_2, and body temperature in real time. Through IoT connectivity, data can be remotely accessed by healthcare professionals via platforms like ThingSpeak, enabling timely observation and intervention.

Experimental results validate the system's accuracy and reliability when compared with standard medical instruments, confirming its potential for practical use in telemedicine, home-based care, and rural health surveillance. The combination of affordability, portability, and wireless monitoring makes this prototype a valuable step toward smarter and more accessible healthcare solutions.

Future enhancements may include incorporating additional biomedical sensors such as blood pressure, ECG, and stress detection modules and employing cloud-based analytics or machine learning to predict and prevent health risks more effectively.

REFERENCES:

1. Maxim Integrated, "MAX30100 Pulse Oximeter and Heart-Rate Sensor IC — Datasheet," Maxim Integrated (Analog Devices), [Online]. Available: https://www.analog.com/en/products/max30100.html
2. Analog Devices, "MAX30100 — Pulse Oximeter & Heart-Rate Sensor (Product Overview)," [Online]. Available: https://www.analog.com/en/products/max30100.html
3. Nemomssa Et Al., "Development Of Low-Cost And Portable Pulse Oximeter Using Max30100," Sensors, 2022.
4. V. L. Narayana, S. Bhargavi, D. Srilakshmi, V. S. Annapurna and D. M. Akhila, "Enhancing Remote Sensing Object Detection with a Hybrid Densenet-LSTM Model," 2024 IEEE International Conference on Computing, Power and Communication Technologies (IC2PCT), Greater Noida, India, 2024, pp. 264-269, doi: 10.1109/IC2PCT60090.2024.10486394.
5. Narayana, V.L., Gopi, A.P., Patibandla, R.S.M. (2021). An Efficient Methodology for Avoiding Threats in Smart Homes with Low Power Consumption in IoT Environment Using Blockchain Technology. In: Choudhury, T., Khanna, A., Toe, T.T., Khurana, M., Gia Nhu, N. (eds) Blockchain Applications in IoT Ecosystem. EAI/Springer Innovations in Communication and Computing. Springer, Cham. https://doi.org/10.1007/978-3-030-65691-1_16
6. V. Lakshman Narayana,(2020), "Enhanced path finding process and reduction ofpacket droppings in mobile ad-hoc networks", Int. J. Wireless and Mobile Computing, Vol. 18, No. 4, 2020, pp-391-397.
7. Narayana, V.L., Gopi, A.P., Patibandla, R.S.M. (2021). An Efficient Methodology for Avoiding Threats in Smart Homes with Low Power Consumption in IoT Environment Using Blockchain Technology. In: Choudhury, T., Khanna, A., Toe, T.T., Khurana, M., Gia Nhu, N. (eds) Blockchain Applications in IoT Ecosystem. EAI/Springer Innovations in Communication and Computing. Springer, Cham. https://doi.org/10.1007/978-3-030-65691-1_16
8. Chaitanya, K., and S. Venkateswarlu. "DETECTION OF BLACKHOLE & GREYHOLE ATTACKS IN MANETs BASED ON ACKNOWLEDGEMENT BASED APPROACH." Journal of Theoretical & Applied Information Technology 89.1 (2016).
9. Lakshman Narayana, V., Rao, G.S., Gopi, A.P., Lakshmi Patibandla, R.S.M. (2022). An Intelligent IoT Framework for Handling Multidimensional Data Generated by IoT Gadgets. In: Al-Turjman, F., Nayyar, A. (eds) Machine Learning for Critical Internet of Medical Things. Springer, Cham. https://doi.org/10.1007/978-3-030-80928-7_9
10. Narayana, V. L., et al. "Computer Tomography Image Based Interconnected Antecedence Clustering Model Using Deep Convolution Neural Network for Prediction of COVID-19." Traitement du Signal, vol. 40, no. 4, 2023, pp. 1689–1696. https://doi.org/10.17762/ijritcc.v11i9s.73
11. Sujatha, V., Vasumathi Devi Majety, Satya Sandeep Kanumalli, and V. S. Sai Rama Krishna Komanduri. "Brain Tumour Detection Using Auto-Encoder and Multi-Layer Perception." AIP Conference Proceedings, vol. 2724, no. 1,

AIP Publishing, 28 Apr. 2023. https://doi.org/10.1063/5.0130160

12. Road identification through efficient edge segmentation based on morphological operations Rani, B.M.S., Majety, V.D., Pittala, C.S., ... Sandeep, K.S., Kiran, S. Traitement du Signal, 2021, 38(5), pp. 1503–1508
13. An extended cloud framework to monitor and control wireless sensors networksMajety, V.D., Sravanthi, G.L., Didla, D. International Journal of Innovative Technology and Exploring Engineering, 2019, 8(11), pp. 3805–3808
14. V. Pavani, N. VijayaLakshmi, N. Harika, G. S. Sowjanya and V. Deepthi, "Deep Learning-based Analysis of Brain MRI for Enhanced Diagnosis of Multiple Sclerosis," 2024 5th International Conference on Data Intelligence and Cognitive Informatics (ICDICI), Tirunelveli, India, 2024, pp. 1141-1148, doi: 10.1109/ICDICI62993.2024.10810928.
15. Kumari, G. R. P., Reddy, A. H., Lakshmi, K., Abhinaya, B., Sanjana, S., & Naresh, A. (2024, March). Time-Frame-Based Drowsiness Detection System Using CNN. In 2024 2nd International Conference on Disruptive Technologies (ICDT) (pp. 711-716). IEEE.
16. Sirisha, Aswadhati, B. Siva Jyothi, and P. Sandhya Krishna. "Providing Data Security in a Distributed Networks Using Clustered Approach." International Journal of Advanced Science and Technology 28, no. 16 (2019): 1907-1915.
17. Arumugham, V., Sankaralingam, B. P., Jayachandran, U. M., Krishna, K. V. S. S. R., Sundarraj, S., & Mohammed, M. (2023). An explainable deep learning model for prediction of early-stage chronic kidney disease. Computational Intelligence, 39(6), 1022-1038.
18. Rayachoti, Eswaraiah, Sudhir Tirumalasetty, and Silpa Chaitanya Prathipati. "Watermarking system for telemedicine based on FABEMD." Multimedia Tools and Applications 81.30 (2022): 44383-44404.
19. B. Sari Et Al., "Improving The Reliability And Accuracy Of Max30100-Based Telemedicine Monitoring," 2021.
20. Kavishwar, S. (2011). Pension funds as an infrastructure financing avenue: An exploratory study. Management Dynamics, 11(2), 33-45.
21. Bidwaikar, V. N., & Kavishwar, D. S. (2012). Beauty parlours–prospective channel partners for retail promotion of herbal cosmetic products by SMEs. Indian Streams Research Journal. 2(1), 1-4
22. Shahu, A., Tiwari, H., Joshi, M., & Kavishwar, S. An Analysis of the Effectiveness of Index ETFS and Index Derivatives in Covered Call Strategy. Journal of Informatics Education and Research. 4(3), 42-48.
23. Kavishwar, S., & Uppal, S. K. (2020). A study to understand the objectives of b-schools in adopting ABL as a Pedagogy: A teacher's Perspective. Sambodhi. 43(04), 180-185.
24. Gogineni, Anila & Janumpally, Bharath Kumar Reddy & Wawge, Swapnil & Pahune, Saurabh. (2025). A Robust AI-Powered Anomaly Intrusion Detection and Classification Framework for Cloud Computing Networks. 1-6. 10.1109/INDISCON66021.2025.11253743.
25. Joon, B. K. R. Janumpally, A. Gogineni and P. Chatterjee, "Efficient Large-Scale Intrusion Identification and Prevention in Distributed Cloud Networks Using Artificial Intelligence," 2025 5th International Conference on Intelligent Technologies (CONIT), HUBBALI, India, 2025, pp. 1-8, doi: 10.1109/CONIT65521.2025.11167760.
26. Tummuri, S. S. R. (2024). Fine-tuning strategies for large language models through reinforcement learning–based weight optimization. International Journal of Science, Engineering and Technology. Volume 4, Issue 3.
27. Tummuri, S. S. R. (2024). Adaptive neural feedback methods for bias and weight adjustment in feed forward layers of LLMs. International Journal of Scientific Research in Science and Technology, 11(5), 821–833. https://doi.org/10.32628/IJSRST52310380
28. Mahida, "Machine Learning Integrated Zero Trust Automation with DevOps Principles for Continuous Security Enforcement," 2026 Sixth International Conference on Advances in Electrical, Computing, Communications and

Sustainable Technologies (ICAECT), Bhilai, India, 2026, pp. 1-7, doi: 10.1109/ICAECT68478.2026.11426026.

29. Ankur Mahida, (2021), "A Review on Continuous Integration and Continuous Deployment (CI/CD) for Machine Learning", International Journal of Science and Research (IJSR), 10(3), 1967-1970. https://dx.doi.org/10.21275/SR24314131827, https://www.ijsr.net/getabstract.php?paperid=SR24314131827
30. Jonnalagadda, P.K. (2026). Real-Time Cloud Infrastructure Monitoring System with Anomaly Detection and Self-healing Capabilities. In: Kumar, V.N., Senkerik, R., Prasad, V.K., Kumar, T.K. (eds) Intelligent Computing and Communication. ICICC 2025. Lecture Notes in Networks and Systems, vol 1839. Springer, Cham. https://doi.org/10.1007/978-3-032-18349-1_43
31. Veginati, Navya. "Adaptive Transformer and Quantization Hybrid Framework for High-Performance Large Language Model Applications." United International Journal of Engineering and Sciences, vol. 5, no. 4, Dec. 2025, pp. 46–56
32. Veginati, Navya. "Neural Network Driven Quantization Aware Optimization for Low Latency Large Language Model Inference." International Journal of Scientific Research in Computer Science, Engineering and Information Technology, vol. 10, no. 3, May-June 2024, pp. 1162–1170, doi:10.32628/CSEIT25113584.
33. R. Eswarawaka, S. K. Kudikala, S. C. Kuchi and V. Verma K., "The analysis on search engine optimization supported by six sigma methodology," 2017 International Conference on Innovative Mechanisms for Industry Applications (ICIMIA), Bengaluru, India, 2017, pp. 653-658, doi: 10.1109/ICIMIA.2017.7975544.
34. Albataineh, H., Kanmuri, V., Alaqqad, W., Nijim, M. (2024). Utilizing Machine Learning for Intrusion Detection in Smart Grid Systems. In: Daimi, K., Al Sadoon, A. (eds) Proceedings of the Third International Conference on Innovations in Computing Research (ICR'24). ICR 2024. Lecture Notes in Networks and Systems, vol 1058. Springer, Cham. https://doi.org/10.1007/978-3-031-65522-7_44
35. Jingar, N. K. (2022). Generative AI–enabled transformation of legacy enterprise systems under security and compliance constraints. International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 8(2), 760–770. https://doi.org/10.32628/CSEIT23906219
36. Nirmal Kumar Jingar. (2021). Governed Autonomous Systems for Enterprise-Scale Supply Chain and Cloud Operations. In International Journal of Science, Engineering and Technology (Vol. 9, Number 6). Zenodo. https://doi.org/10.5281/zenodo.18629297
37. C. Saha Et Al., "A Working Prototype Using Ds18b20 Temperature Sensor And Arduino For Health Monitoring," Pmc / Ncbi, 2021.
38. D. Elyounsi Et Al., "Evaluating The Suitability Of Ds18b20 Temperature Sensor For Field Measurement," Mdpi Sensors, 2021.