HealthSense
Proximity Based Alert System with Predictive AI

Mr. Swarna H.R, Lekhan M, Lekhana Samudra, Mohammad Azmal, Mohammad Ali

Department of Computer Science Engineering

Srinivas University

Institute of Engineering and Technology Mukka, Mangaluru

swarnahrcse.cet@srinivasuniveristy.edu.in,lekhanm86@gmail.com,
lekhanasamudra19@gmail.com,mohammadazmal54@gmail.com,mali615753@gmail.com

Abstract—The overarching objective of this initiative is to enable remote of various aspects of a subject, such as their environment, health, and proximity to a specific location, by leveraging the Internet of Things (IoT) framework. By employing distance measurement techniques and health indicators, adjustments are made in the background to trigger alerts under specific conditions, including emergencies, ensuring accurate remote assessment. Furthermore, the data gathered from the subject is systematically stored in a database, where machine learning (ML) algorithms are applied to facilitate predictive analysis, offering insights into potential future reactions or outcomes for individuals with similar conditions. The broader goal also encompasses the development of a user-friendly prototype characterized by cost-effectiveness, low power consumption, and adaptable design.

Index Terms—keywords, temperature, equation, etc.

I. Introduction

IN the healthcare sector, ensuring safety measures is crucial due to the direct impact on lives. One significant challenge hospitals face is monitoring patients effectively, especially those requiring regular observation. To address this, a smart and affordable technology-based solution is proposed. This solution targets kids, senior citizens, and differently-abled individuals, or anyone needing supervision. The device is designed to alert caregivers or concerned individuals if the patient crosses specified boundaries or experiences adverse health conditions.

The solution leverages Internet of Things (IoT) and Machine Learning (ML) technologies. It falls within the scope of Smart Home applications, Security and Authentication systems, Automation processes, Data Science, Machine Learning, and Data Analytics in healthcare. By integrating these technologies, the device aims to improve patient monitoring, enhance safety measures, and provide timely alerts for better healthcare management.

II. Materials and Methods

The motivations for developing the technology-based device stemmed from the various challenges faced by hospitals and caregivers on a daily basis. These challenges have been identified and categorized into two distinct applications:

Hospital Application:

- Patients going missing from hospitals, often due to misconceptions surrounding COVID-19.
- The need for special and constant care for mentally unstable patients to prevent them from leaving their wards.
- Instances of newborn baby kidnapping in hospitals, often due to insufficient security measures.
- Compromised timely checks for patients due to a lack of healthcare staff, leading to potential threats to patients' lives.

The goal of the technology-based device is to address these challenges effectively, providing enhanced monitoring and alert systems in both hospital and home settings.

III. Research Area

The research area of this project concerns is healthcare and smart automation. The domain of technologies employed for this project is the Internet of things (IoT) and Deep Learning to facilitate the user with a sophisticated model/Prototype, accurate prediction for their respective application. The possibilities/ Problematic factors are resolved into three cases and the solution is envisioned as a smart yet affordable model which hospitals and people opt to employ for their wards or in their homes. The key idea is to develop a technology-based solution for Kids, Senior citizens, especially differently-abled individuals, or anyone who needs supervision

IV. System Architecture

The framework design of HealthSense includes two key components: Sense Wrist Band, a wristband prepared with sensors for wellbeing observing, and Sense Hub, a center gadget serving as a central point for information handling and capacity. Sense Wrist Band incorporates sensors such as the MAX30102 for measuring SpO2 and heart rate, whereas Sense Hub consolidates sensors just like the DHT11 for room temperature and stickiness checking, as well as the ADXL345 for development detection.The information stream inside the framework begins with Sense Wrist Band and Sense Hub collecting sensor information. Sense Wrist Band captures crucial wellbeing parameters, which are at that point transmitted to Sense Hub utilizing Bluetooth network. Sense Hub, being a center gadget, totals the information from Sense Wrist Band and its possess sensors. The collected information is handled utilizing Arduino IDE, where it is organized and arranged for transmission to Firebase, a cloud capacity platform.Firebase serves as the central store for all health-related information collected by the framework. It gives real-time information observing capabilities, permitting clients to get to and visualize the information remotely through web or portable interfacing. Also, Firebase encourages the integration
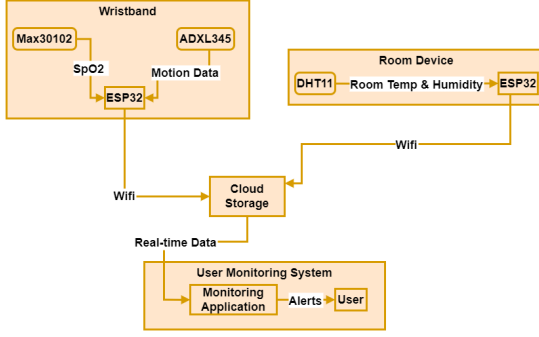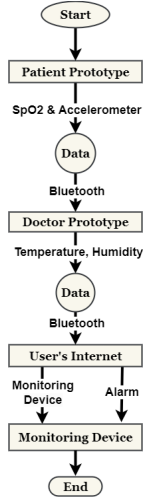
Fig. 1. System Architecture

Fig. 2. Flowchart

Fig. 3. Sense Wrist Band

Fig. 4. HealthSense Hub

of AI expectation models for wellbeing parameters. These AI models analyze the approaching information to foresee patterns, irregularities, or potential wellbeing dangers based on set up designs and algorithms.Overall, the framework engineering of HealthSense guarantees consistent information stream from sensors to cloud capacity, empowering real-time observing and AI-driven wellbeing parameter forecasts for upgraded healthcare administration and decision-making.

The system architecture emphasizes modularity and scalability. Each device has specific functionalities, allowing for easy integration of new sensors or enhancements. Firebase serves as a reliable and accessible cloud backend, managing data storage, synchronization, and real-time updates effectively. The use of Bluetooth for device communication enhances mobility and flexibility in deployment scenarios.

V. IMPLEMENTATION

The framework design of HealthSense includes two key components: Sense Wrist Band, a wristband prepared with sensors for well-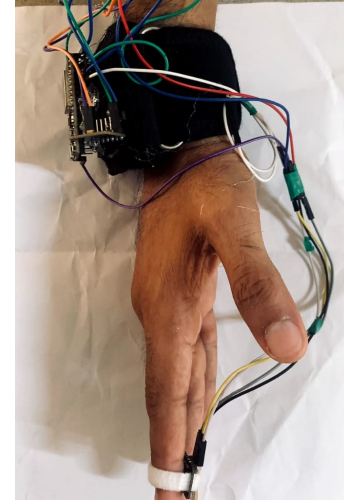being observing, and Sense Hub, a center gadget serving as a central point for information handling and capacity. Sense Wrist Band incorporates sensors such as the MAX30102 for measuring SpO2 and heart rate, whereas Sense Hub consolidates sensors just like the DHT11 for room temperature and stickiness checking, as well as the ADXL345 for development detection. The information stream inside the framework begins with Sense Wrist Band and Sense Hub collecting sensor information.

Sense Wrist Band captures crucial well-being parameters, which are at that point transmitted to Sense Hub utilizing Bluetooth network. Sense Hub, being a center gadget, totals the information from Sense Wrist Band and its possess sensors. The collected information is handled utilizing Arduino IDE, where it is organized and arranged for transmission to Firebase, a cloud capacity platform. Firebase serves as the central store for all health-related information collected by the framework. It gives real-time information observing capabilities, permitting clients to get to and visualize the information remotely through web or portable interfacing. Also, Firebase encourages the integration of AI expectation models for wellbeing parameters. These AI models analyze the approaching information to foresee patterns, irregularities, or potential well-being dangers based on set-up designs and algorithms. The framework engineering of HealthSense guarantees a consistent information stream from sensors to cloud capacity, empowering real-time observing and AI-driven wellbeing parameter forecasts for upgraded healthcare administration and decision-making.

VI. Result and Dicussion

The real-time wellbeing observing framework executed within the HealthSense venture illustrated commendable information exactness and framework execution amid testing. The sensor readings from Sense Wrist Band, counting SpO2 and heart rate, were reliably solid, with negligible deviations from set up therapeutic measures. This unwavering quality was significant in guaranteeing the adequacy of wellbeing parameter monitoring.However, a few challenges were experienced amid the execution stage. One noteworthy challenge was optimizing the communication and information exchange between Sense Wrist Band and Sense Hub, particularly considering the real-time imperatives forced by wellbeing checking. This challenge was tended to through fastidious code optimization and convention administration, coming about in effective information trade between the devices.Another challenge included guaranteeing the security and protection of patient information put away within the cloud utilizing Firebase. Strong encryption strategies and get to control components were executed to protect delicate wellbeing data, relieving potential security risks.The HealthSense framework offers a few benefits within the setting of real-time wellbeing observing. It gives persistent checking of crucial wellbeing parameters, empowering early location of irregularities or wellbeing issues. The integration of AI expectation calculations encourage improves the system's capabilities by giving prescient bits of knowledge into potential wellbeing patterns or crises, permitting for proactive mediation and management.However, the framework too has confinements that require thought. The dependence on Web network for cloud capacity and real-time checking presents reliance on organize solidness, which may be a impediment in certain situations or circumstances with restricted network. Moreover, whereas the framework gives important information for wellbeing examination, the elucidation of this information and decision-making forms still require human intercession and expertise.In conclusion, the HealthSense framework illustrates promising comes about in real-time wellbeing checking, with solid information precision, productive framework execution, and proactive AI-driven experiences. Tending to execution challenges and considering both the benefits and impediments of the framework are basic for its successful arrangement and utilize in healthcare settings.

The computer program advancement for Sense Wrist Band and Sense Hub was conducted utilizing the Arduino IDE stage, which offers a user-friendly environment for programming microcontrollers. We created custom firmware for both gadgets to handle sensor information securing, preparing, and transmission to the cloud. For Sense Wrist Band, the firmware incorporates calculations for extricating SpO2 and heart rate readings from the MAX30102 sensor information, as well as schedules for collecting temperature and stickiness information from the DHT11 sensor. Additionally, the firmware for Sense Hub joins code for deciphering accelerometer information from the ADXL345 sensor and planning it for transmission to the cloud. We utilized Arduino's libraries and instruments to streamline the improvement prepare and guarantee proficient information taking care of between the gadgets and the cloud platform. To
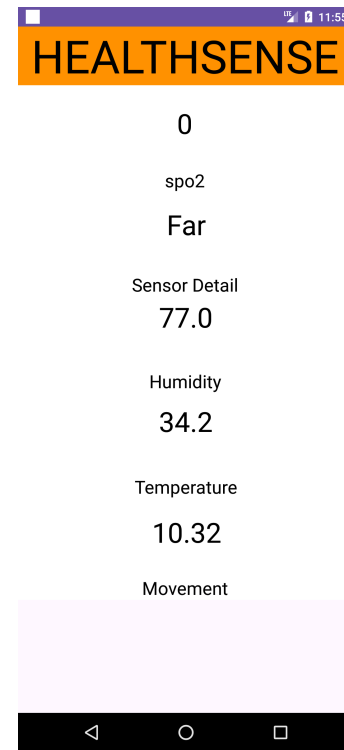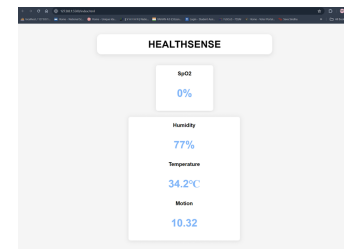

Fig. 5. HealthSense Mobile application

Fig. 6. Doctor Application

encourage cloud capacity and real-time information observing, we executed Firebase as our backend stage. Firebase offers strong highlights for information capacity, synchronization, and real-time upgrades, making it perfect for IoT applications like HealthSense. We made a Firebase venture and arranged it to get and store information from Sense Wrist Band and Sense Hub safely. The Firebase Realtime Database was utilized to store sensor readings and natural information, empowering consistent synchronization between gadgets and the cloud. Also, Firebase Cloud Capacitieswere utilized to actualize real-time information monitoring and alarming functionalities. This setup permitted us to screen wellbeing parameters and natural conditions in genuine time, giving convenient bits of knowledge and cautions as needed.Overall, the integration of these equipment components, program advancement in Arduino IDE, and Firebase setup empowered us to make a vigorous and versatile real-time wellbeing checking framework with progressed information capacity and observing capabilities.

VII. Conclusion

A solution is being developed to monitor patients, particularly focusing on kids, senior citizens, and differently-abled individuals, ensuring their safety by alerting caregivers if they cross predefined boundaries or experience health issues. This solution harnesses the capabilities of Internet of Things (IoT) and Deep Learning (DL) technologies. Its applications extend to various domains such as Smart Home systems, Security and Authentication setups, Automation processes, Data Science, Machine Learning, and Data Analytics in healthcare settings.

References

[1] M. A. Khan, I. U. Din, B.-S. Kim, and A. Almogren, "Visualization of remote patient monitoring system based on internet of medical things," *Sustainability*, vol. 15, no. 10, p. 8120, 2023. DOI: 10.3390/su15108120. [Online]. Available: https://doi.org/10.3390/su15108120.

[2] S. Hassani and U. Dackermann, "A systematic review of advanced sensor technologies for non-destructive testing and structural health monitoring," *Sensors*, vol. 23, no. 4, p. 2204, 2023. DOI: 10.3390/s23042204. [Online]. Available: https://doi.org/10.3390/s23042204.

[3] D. S. R. Krishnan, S. C. Gupta, and T. Choudhury, "An iot based patient health monitoring system," in *2018 International Conference on Advances in Computing and Communication Engineering (ICACCE)*, IEEE, 2018, pp. 01–07. DOI: 10.1109/ICACCE.2018.8441708. [Online]. Available: https://doi.org/10.1109/ICACCE.2018.8441708.

[4] V. Pardeshi, S. Sagar, S. Murmurwar, and P. Hage, "Health monitoring systems using iot and raspberry pi — a review," in *2017 International Conference on Innovative Mechanisms for Industry Applications (ICIMIA)*, IEEE, 2017, pp. 134–137. DOI: 10.1109/ICIMIA.2017.7975587. [Online]. Available: https://doi.org/10.1109/ICIMIA.2017.7975587.

[5] M. Z. Hasbullah, H. Mohamad, A. H. F. Sabillah, U. Mahamod, K. N. Z. Ariffin, and S. A. Rahman, "Iot based indoor air and water quality monitoring system using node-red," in *2023 9th International Conference on Computer and Communication Engineering (ICCCE)*, IEEE, 2023, pp. 161–166. DOI: 10.1109/ICCCE58854.2023.10246056. [Online]. Available: https://doi.org/10.1109/ICCCE58854.2023.10246056.

[6] S. Abdulmalek, A. Nasir, W. Jabbar Almuhaya, A. Bairagi, M. Khan, and S. Kee, "Iot-based healthcare-moni system towards improving quality of life: A review," *Healthcare*, vol. 10, 2022. DOI: 10.3390/healthcare10101993. [Online]. Available: https://doi.org/10.3390/healthcare10101993.

[7] P. Anirudh, G. A. E. S. Kumar, R. P. Vidyadhar, G. Pranav, and B. A. Aumar, "Automatic patient monitoring and alerting system based on iot," in *2023 8th International Conference on Communication and Electronics Systems (ICCES)*, IEEE, 2023, pp. 328–331. DOI: 10.1109/ICCES57224.2023.10192644. [Online]. Available: https://doi.org/10.1109/ICCES57224.2023.10192644.