Empowering Elderly Health with IoT and Cloud Computing

V. Jyothi, Karra Ashwini, Arravapa Mahendar and Gora Prudhwi Raj
Department of ECE, Vardhaman college engineering, Kacharam, Shamshabad, Telangana, India

Keywords: ESP8266, Cloud Computing, IoT, Blood Pressure, Pulse Rate, Fall Detection and Oxygen Saturation

Abstract: The number of elderly individuals living alone is rising, especially those with restricted mobility, so it's important to keep an eye on their health with the ability to track vital indications like heart rate, blood pressure, pulse rate, and oxygen saturation. These health monitors of elderly people at home are necessary. This information enables elders and those close to them to recognize possible health issues early on, enabling preventive measures and enhancing general well- being. IoT consists of physical devices, such as sensors and monitoring devices for elderly peoples (blood pressure, heart rate, pulse rate, oxygen saturation and activity monitoring, etc) to connect to the ESP8266 and Cloud computing. This work proposes a home healthcare system for elderly people. It keeps track of the health status of elderly people, alert about their health condition to us. It has been evaluated for three tasks 1) position estimate and activity tracking 2) fall detection and 3) medical advice.

1 INTRODUCTION

The growing number of elderly people living independently, especially those with limited mobility, creates a challenge in ensuring their well-being. The consequences of loneliness in this age group are far-reaching. It can lead to a decline in mental well-being, with increased risk of depression, anxiety, and regular health issues. Physically, loneliness can weaken the immune system, making seniors more susceptible to illness. Additionally, social isolation can exacerbate feelings of helplessness and decrease the likelihood of timely intervention for health issues. This system utilizes Internet of Things (IoT) technology, which includes sensors and monitors for vital signs like heart rate, blood pressure, and oxygen saturation. These devices connect to a central hub and potentially utilize cloud computing for faster data processing. There is a rising number of old-age homes, where constant care and monitoring are required for elderly residents. This proposes a solution: a smart home healthcare system by the system sensors take the input of patient's health parameters like temperature, heartbeat etc. The camera is placed in front of the patient side so we can observe patient condition whenever they want to over the internet by accessing and identifying falls and sending alerts for assistance. remote monitoring, and timely medical interventions that can empower older people. This proposes a solution: a smart home healthcare system, which uses system sensors to take input of patients' health parameters like temperature, heartbeat, etc. The camera is placed in front of the patient's side so we can observe the patient's condition whenever they want to over the internet by accessing and identifying falls and sending alerts for assistance. This research Paper IoT based elderly Health Monitoring System uses Temperature Sensor, Heart Rate Sensor, and Accelerometer Sensor & Respiratory sensor along with the Camera and NodeMCU Model. All these sensors are attached to the patient's body. The collected data is sent to the server in an encrypted format through the NodeMCU. A family member or doctor can see the real-time data on their system or on their smartphone at any-time and anywhere.

2 LITERATURE SURVEY

The concept behind our project, "Empowering Elderly health with IoT and Cloud Computing," is not very new. Numerous attempts were consistently made in the past by researchers in different fields at different times.

FEEL: Federated L Earning Frame work for Elderly (Ghosh and Ghosh, 2023) Health care Using Edge-IoMT was One of the major problems in IoMT domain is scarcity of labelled data and diverse need

Jyothi, V., Ashwini, K., Mahendar, A. and Prudhwi Raj, G.
Empowering Elderly Health with IoT and Cloud Computing.
DOI: 10.5220/0013623300004664

In *Proceedings of the 3rd International Conference on Futuristic Technology (INCOFT 2025) - Volume 3*, pages 513-521
ISBN: 978-989-758-763-4

of users. It is to develop collaborative healthcare model by combining and clustering users based on their habitual preferences and health status. FEEL is suitable for old age homes where constant healthcare support is required.

Junaid Mohammed et al used an IOIO-OTG Microcontroller to analyse the patient's ECG and track readings from anywhere in the world (Al-khafajiy, et al., 2019) A reading monitoring application for electrocardiograms was created for Android smartphones. The data can be transferred to the Android mobile via the IOIO (Input Output Input Output)-On the Go microcontroller via Bluetooth, NFC, or USB connection. After being gathered, the data is moved to the smartphone's Android application.

Mohammed S. Jasses et al's method is based on using a Raspberry Pi motherboard coupled to a cloud-based system to monitor a person's body temperature ((Mohammed, Lung, et al., 2014)). The Raspberry Pi's sensor recorded the temperature of the human body, and wireless sensor networks (WSN) are used to transmit.

The C8051F020 microcontroller was used by Karandeep Malhi et al. to assess heart rate and body temperature. The developed sensors were designed to be worn, receiving data and sending it to microcontrollers connected to Zigbee modules, which then sent it to the nearest available receiver.

This integration of modern IoT technology and AI, the Health Monitoring System provides a solid solution for maintaining the health of the elderly (Prasad, Mhnv, et al., 2019). Through the constant monitoring of vital signs including blood pressure, heart rate, and oxygen saturation, the system guarantees real-time monitoring and the early identification of possible health problems. The prompt intervention made possible by this proactive strategy improves the general well-being and safety of older people who live independently.

Its efficacy is increased by the addition of functions like environmental monitoring and fall detection.

Quar care - IoT Based Patient Health Monitoring System, recommends concentrating on using Internet of Things (IoT) technologies into the monitoring of patient health (Visvesvaran, Shankar, et al., 2021). The majority of the literature on this subject examines developments in Internet of Things (IoT) applications for the healthcare industry, with a focus on wearable device integration, real-time data collecting, and remote monitoring.

MHNV Prasad and P Munaswamy's article (Prasad, and, Munaswamy, 2013) Remote Health Monitoring and Security System for Elderly People using Raspberry" describes a system that uses the Raspberry Pi to keep an eye on the wellbeing and safety of senior citizens. The system probably has sensors to monitor security aspects (like intruder alarms or fall detection) and

vital indications (such blood pressure, pulse rate, etc.). Remote data monitoring enables caregivers to get emergency alerts and real-time information. The Raspberry Pi provides an affordable option for elder care by acting as the main controller for data processing and communication.

Interoperable End-to-End Remote Patient Monitoring Platform (Clarke, et al., 2017) by Malcolm Clarke, Joost de Folter, Vivek Verma, and Hulya Gokalp. In order to ensure that data from different medical devices can be shared, processed, and incorporated into healthcare information systems, this standard makes it easier for medical devices and health monitoring platforms to communicate. The platform's primary goal is to facilitate end-to-end remote monitoring, which involves gathering patient data at home and sending it to medical professionals for evaluation.

Patient Monitoring System Using GSM Technology describes a medical system (Rachana, , et al., 2016) that uses GSM (Global System for Mobile Communications) technology to remotely monitor patient health data. This device uses sensors to gather vital signs including blood pressure, temperature, and heart rate. It then sends the data to healthcare providers over GSM networks, allowing for real- time monitoring and emergency alerts. It provides these readings. In this way, the data is transmitted to a cloud-based website so that it can be monitored. practical and effective means of patient monitoring, particularly in isolated or rural locations with limited access to medical facilities.

IoT-based health monitoring and tracking system designed for soldiers (Iyer and Patii, 2017). This system, worn on the soldier's body, monitors health metrics and tracks location using GPS, sending data to a control room via IoT. Equipped with small, wearable sensors and transmission modules, the system offers a cost-effective way to enhance soldier safety on the battlefield.

Design and Implementation of a Feasible Model for the IoT Based Ubiquitous Healthcare Monitoring System for Rural and Urban Areas Real-time health monitoring systems powered by the Internet of Things (IoT) (Bhuiyan , et al., 2022) have greatly improved human wellbeing in both urban and rural locations. Because there is often no reliable communication infrastructure in underdeveloped nations like Bangladesh, many of these ideas are not really applicable. In this work, we offer a real-time, Internet of Things (IoT)-based health monitoring system that can test, track, and report people's health conditions from anywhere at any time.

Our suggested Internet of Things-based system has the ability to instantly send sensitive health data to caregivers and medical facilities. The suggested system measures body temperature, pulse rate, oxygen saturation, room temperature, and air quality in a smart home environment using Arduino UNO, Nodemcu, and GSM modules. Historical medical records for the patient may also be accessed by the system. We tried our solution using a few test scenarios, and it functions flawlessly and accurately. There is a lot of promise for both rural and urban areas in developing nations with the suggested method.

The difficulty of striking a balance between job and health in a society that moves quickly, pointing out problems including lengthy hospital stays and the requirement for ongoing medical monitoring (Gupta, Saeed, et al., 2017). It draws attention to the need for a health system that can monitor heart rate and other everyday health parameters and use GSM technology to send this information to the appropriate people. Numerous health monitoring systems have been made possible by technological advancements, which have improved user convenience. In order to determine areas for improvement and strategies to improve system performance, this study compares and evaluates current systems and examines new research and development in health monitoring.

The COVID-19 pandemic and the growing significance of healthcare technology, particularly IoT-enabled solutions (Reddy, Naik, et al., 2021).Continuous patient monitoring is difficult because of hectic schedules, particularly for elderly patients. To automate this, a novel method is suggested that would enable ongoing monitoring of vital health indicators such as blood oxygen levels, body temperature, heart rate, and humidity. The design and functionality of a patient monitoring system that collects critical health data from patients using sensors connected to a micro-controller are described in this study.

This paper discusses the design of an IoT-based health monitoring system (Masud, Serhani, et al., 2015) using temperature and pulse rate sensors to continuously track a patient's condition. The system allows doctors to remotely monitor patients via a computer. In case of abnormal readings, an email alert is sent to the doctor for immediate action. This enables timely diagnosis and potentially life-saving interventions. The primary goal is to provide real-time health updates and facilitate prompt medical response.

Smart Healthcare (Khan, Manju, et al., 2017) is important for people who need continuous monitoring which cannot be provided outside hospitals. It is also important in rural areas or villages where nearby clinics can be in touch with city hospitals about their patient's health condition. This work presents a smart health monitoring system that uses biomedical sensors to check a patient's condition and uses the internet to inform the concerned. The biomedical sensors here are connected to an Arduino UNO controller to read the data which is in turn interfaced to an LCD display/serial monitor to see the output. Data is uploaded to the server to store and converted into JSON links for visualizing it on a Smartphone. An android application has been designed in order to easily see the patient's information by their doctors and family members.

Objectives achieved:

To design a health monitoring system that can accurately identify falls, reducing the time it takes to contact for assistance and immediately informing family members. To Continuously monitor breathing patterns to identify potential ap-nea events and Trigger alerts for abnormal breathing patterns requiring attention. To Monitor pulse rate and to track temperature and humidity levels to ensure a comfortable and safe environment. Generate alerts if pulse rate, temperature, or humidity readings fall outside pre-defined safe ranges.

3 DESIGN AND PRINCIPLE OF OPERATION

3.1 Methodology

The workflow for this system begins with the central processing unit is the ESP8266. It collects all the data from the linked sensors, as well as direct inputs (camera, temperature, humidity, and breathing data) and processes inputs (humidity, temperature, and respiratory data) from the Arduino NANO. It can deliver messages or alerts based on the data collected by the sensors. Through the use of theESP8266 microcontroller, the system keeps an eye on

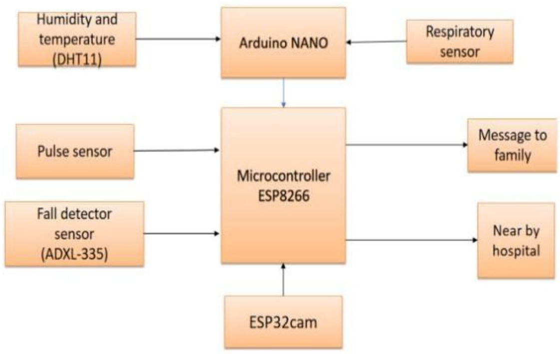

Figure 1: Block diagram of elderly health monitoring system

physical safety (falls), environmental factors, and vital signs. It then uses this information to send real-time notifications to medical facilities and family members.

The ESP32cam's addition makes visual monitoring possible. The NodeMCU board provides the central processing unit for this health monitoring system. It functions as a mini-computer, collecting information from two vital sensors: an accelerometer-based fall detection sensor and a heart rate sensor that tracks your pulse. The device activates if the accelerometer notices an abrupt shift in movement that could be the result of a fall.

3.2 Hardware Components:

3.2.1 ESP8266 Wi-Fi Module

Figure 2: ESP8266 Module

The ESP8266 is a unique microcontroller in the field. This tiny chip has strong Wi-Fi, so you can connect your projects to the internet right away. It offers a variety of programming options, is capable of running programs, and uses less energy for battery-powered applications. It is also less priced in comparison to other Wi-Fi microcontrollers. Even while its processing power might not be enough for very demanding tasks, its affordability, versatility, and ease of use make it a viable option for developing a variety of internet connected devices.

3.2.2 Arduino-Nano

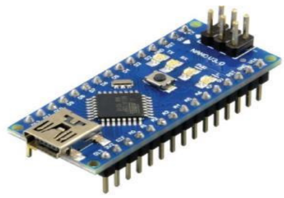

Figure 3: Arduino-Nano

The Arduino Nano is a small, compact, powerful device. Due to its breadboard-friendly design, this little microcontroller is often used for prototyping and experimentation. Its small size makes it ideal for projects requiring a lot of room, and you may realize your creative electronics projects thanks to its interoperability with a variety of sensors and actuators. The Nano is particularly user-friendly for novices, with onboard programming that eliminates the need for a separate programmer. With the Arduino Nano, you can explore electronics and programming at a reasonable price. The Arduino Nano boasts 30 pins, 22 of which cater to input and output functions. Among these, 14 digital IO pins (D0-D13) can be customized using pinMode(), digitalWrite(), and digitalRead() functions.

3.2.3 DHT11 Sensor

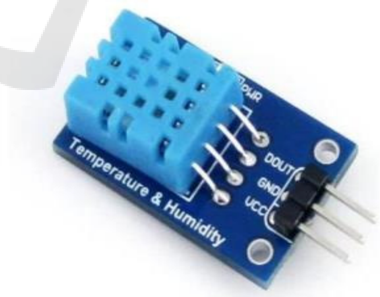

Figure 4: DHT11 Sensor

The DHT11 sensor is a reliable, affordable, and basic tool for measuring temperature and humidity. This digital sensor's signal can be easily interpreted by a microcontroller, like an Arduino, to provide environmental measurements. It generates an analog signal that needs to be processed by digitally formatting it. However, keep in mind that the DHT11 has a limited operating range, so it might not be suitable for very sensitive readings. DHT11 is a 4-pin sensor, these pins are VCC, DATA, GND and one pin is not in use shown in fig4.

3.2.4 Accelerometer sensor

Figure 5: Accelerometer sensor

Digital signals are output by the ADXL-335. This digital sensor's capacity to provide data that microcontrollers can easily grasp opens up a wide range of possibilities. The ADXL335 Module 3-axis Analog Output Accelerometer measures acceleration with a minimum full-scale range of ±3 g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

3.2.5 Pulse Sensor

Figure 6: Pulse Sensor

The pulse sensor measures variations in the volume of blood in your fingertip, which can be used to calculate your heart rate. The microcontroller can read the analog signal that is usually output by it. Their heart rate is then calculated using this information, giving you important details about your general health and level of exercise. The pulse sensor's price, usability, and capacity to deliver heart rate data.

3.2.6 ESP32Cam

This camera module is an add-on for the system. To connect it to the microcontroller, most likely, a connector intended for camera modules would be utilized. Video or image data can be recorded by the ESP32cam.The camera takes pictures or movies,

Figure 7: ESP32Cam

but the ESP32 core handles application processing and Wi-Fi connection establishment. Along with the other health and environmental sensors (pulse, fall detection, respiratory monitoring), the ESP32-CAM adds an extra layer of security by visually confirming the elderly person's status.

3.2.7 LCD (Liquid Crystal Displays)

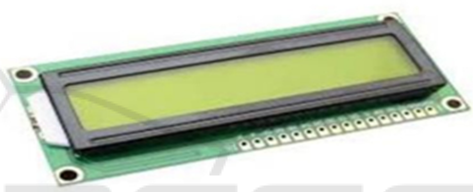

Figure 8: Liquid Crystal Display

LCDs, or liquid crystal displays, are a widespread technology seen in a wide variety of everyday items. This flat panel display uses backlighting and liquid crystals to control light to create the images you see. LCDs control light flow to produce images, as opposed to their relative, the LED (Light Emitting Diode), which emits light directly. Their low cost, low power consumption, and small profile make them a popular choice for TVs, computer screens, calculators, and many other electronic devices.

3.3 Flow Chart

The health monitoring system sensors are used to track vital indicators and identify possible medical emergencies. System initialization is the first step, which makes sure all software and hardware are prepared.

The oxygen saturation sensor tracks blood oxygen levels, and the ADXL-335 accelerometer detects falls or instability. In order to detect hypothermia or hyperthermia, which both need to be treated right away, a temperature sensor measures body temperature.

The device transmits information to the cloud if it detects anomalous conditions such as falls, irregular heartbeats, or low oxygen saturation. For caretakers or medical professionals, cloud storage guarantees safe data access. For improved health forecasts, it also permits sophisticated analysis through manual review or machine learning.

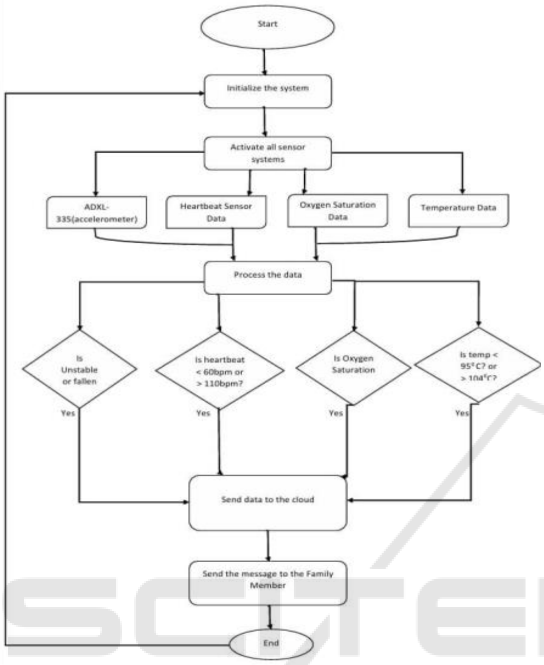

Figure 9: Flow Chart of elderly health-monitoring

This device continuously monitors vital indicators in an effort to protect users. It warns caretakers or family members about emergency, guaranteeing timely medical attention. The ultimate objective is to use real-time health tracking to promote wellbeing and safety. Cloud storage provides secure, remote access for caregivers and enables machine learning or professional review for advanced analysis.In order for the system to protect health, it continuously monitors and quickly alerts caregivers if there is an emergency. This holistic approach focuses on improving user safety and well-being.

4 SIMULATION RESULTS AND DISCUSSION

Firstly, connect the accelerometer and respiration sensor to the microcontroller of the ESP8266 (NodeMCU) and Arduino Nano to build a dependable and efficient fall detection and respiration monitoring system. To ensure reliable data interpretation, calibrate the sensors and create baseline values. Read sensor data continuously, then apply filters to lower noise and boost signal quality. Create an algorithm that uses predefined thresholds and time-based criteria to search accelerometer data for patterns that point to a fall, such as sudden free fall or impact. Simultaneously, measure the breathing rate by analyzing respiration sensor data, and use algorithms to identify irregular breathing explain the prosses of the dht11 sensor and respiratory sensor ,pulse sensor, accelelometer are connected to the node mcu and arduino nano also connected patterns like 19 tachypnea or apnea. When a fall or unusual breathing is detected, send an alert notification to predesignated contacts over a cellular network or WiFi. Think about saving sensor data as well for future research and system enhancement. A reliable and efficient monitoring system will be created by adhering to this structured development procedure.

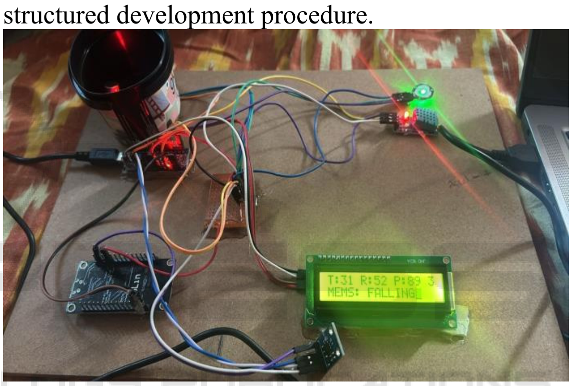

Figure 10: Hardware implementation for empowerig elderly health-monitoring

A wearable health monitoring device that tracks, analyses, and reports a person's vital health indicators continually using Internet of Things (IoT) technology. A body area network's sensors use accelerometers to gather information on motion, body temperature, and heartbeat. For instant visibility, these measurements are shown on a worn LCD panel. Wi-Fi is used to send the data to an IoT cloud platform, where it is processed and stored. Users can perform different tasks by using services provided by the data centres of the cloud through the internet and access the virtualized resources (hardware and services) provided by the cloud anytime and anywhere as long as there is active internet connectivity. It improves the capacity to track recovery, manage chronic illnesses, and guarantee preventative care through ongoing monitoring and timely alarms. This technology shows how continuous, connected care from wearable IoT devices can revolutionize healthcare.

The system first records accelerometer data while the device is kept at a 90° angle and the person is stable. This data serves as a baseline for typical activity. This calibration stage helps differentiate between normal movements and potential falls.

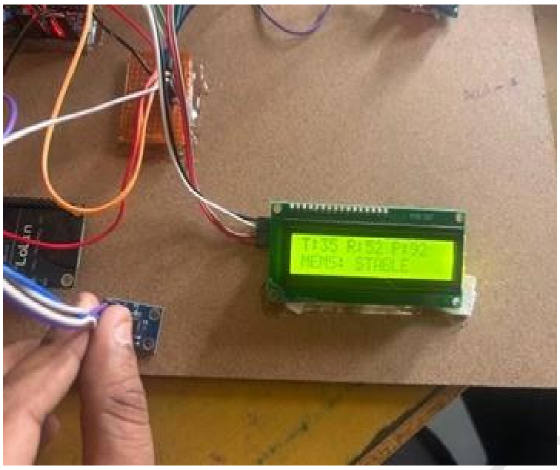

Figure 11: Output of normal state on LCD

An accelerometer keeps an eye on movement patterns all the time. The device sounds an alert if the sensor notices a sudden change in acceleration that could be the sign of a fall. Family members who have been pre-designated receive an alert message informing them of a possible fall occurrence.

Figure 12: Unstable alert message

The purpose of the device is to keep an eye on and control the user's vital signs, particularly their breathing rate. It tracks the user's breathing rate. Continually using a respiratory sensor and sets a threshold (e.g., 50 breaths per minute). The technology alerts family members to the anomaly if the measured breath rate surpasses this threshold, suggesting possible respiratory problems. The system can be equipped with extra sensors to track temperature and pulse rate, among other vital signs. The system sends out a warning message if these sensors pick up on a high pulse rate or rising temperature that is above typical values. Family members are prompted to check on the user or seek medical assistance if needed after receiving this alert, which may indicate a potential health risk.

Figure 13: Respiratory alert message

The technology alerts family members to the anomaly if the measured breath rate surpasses this threshold, suggesting possible respiratory problems.n order to improve its monitoring capabilities, the system incorporates extra sensors to monitor vital signs including temperature and heart rate.

The sensor detects anomalous readings, like an elevated temperature or a rapid pulse rate, and the system sends out a warning message. In order to address any possible health dangers, this alert asks family members to check on the user or, if required, seek medical attention. The system enables authorized individuals to visually examine the user's condition in real-time for increased safety and monitoring. In addition to addressing urgent safety issues, this system supports ongoing health research and monitoring. This methodical approach guarantees that the system will not only work efficiently but also have the capacity to grow and adapt in the future to meet new demands for health monitoring.

5 CONCLUSIONS

In conclusion, Health has become one of the global challenges for humanity. The design and implementation of a health monitoring system are presented in this study. Users can use this method to find their health indicators, which could help them manage their health in the long run.A significant advancement in real-time Seniors' safety, wellbeing, and quality of life can all be significantly improved by integrating IoT (Internet of Things) and cloud computing into healthcare. Healthcare systems are able to measure environmental conditions, detect crises (such as falls), and continually monitor vital signs through the use of a linked network of sensors, microcontrollers, and cloud platforms. Immediate action is made possible by real-time data collecting and processing, including alerting loved ones or medical professionals to potentially life threatening

situations. Elderly people can be watched over by family members and caregivers from anywhere, allowing for rapid action without requiring their physical presence all the time. Vital signs, such as heart rates, breathing issues, or fall detection, can send out instant alerts to family members or medical specialists. Large- scale health data can be stored and analyzed over time with cloud computing, allowing for more precise and individualized healthcare decisions based on patterns and trends. Elderly people feel more secure and independent thanks to IoT and cloud solutions, which also lessen the strain on caregivers by guaranteeing appropriate monitoring. By reducing needless hospital visits and enabling early diagnosis of health issues, the capacity to automate monitoring and communicate remotely can lower healthcare expenses. Overall, Healthcare for the elderly is being revolutionized bIoT and cloud computing, which is making it more efficient, individualized, and responsive. We can guarantee that elders live longer, healthier lives with more freedom by using these technologies.

By encouraging independence, lowering healthcare expenses, and facilitating early health issue identification and treatment, smart home healthcare solutions help the aged. By remotely monitoring well-being, they improve caregivers' peace of mind. Accuracy in fall detection and health monitoring is increased by integrating data from sensors such as gyroscopes, accelerometers, and bioimpedance devices. This data is analyzed by machine learning algorithms to anticipate and stop possible health issues. Better health outcomes and more effective senior care are guaranteed by this proactive strategy.

ACKNOWLEDGEMENTS

The author extends sincere thanks to Jyothi mam, Ashwini, Mahender, and Prudhwi Raj for their financial support for the conference and for their valuable contributions in discussing the results and providing feedback.

REFERENCES

Shreya Ghosh and Soumya K.Ghosh. "FEEL: FEderated LEarning Frame work for ELderly Healthcare Using Edge-IoMT". In: IEEE Transactions on Computational Social System Vol.10, No.4 (2023).

Al-khafajiy, M., Baker, T., Chalmers, C. et al. Remote health monitoring of elderly through wearable sensors. Multimed Tools Appl 78, 24681–24706 (2019). https://doi.org/10.1007/s11042-018-7134-7

A. Dohr, R. Modre-Opsrian, M. Drobics, D. Hayn and G. Schreier, "The Internet of Things for Ambient Assisted Living," *2010 Seventh International Conference on Information Technology: New Generations*, Las Vegas, NV, USA, 2010, pp. 804-809, doi: 10.1109/ITNG.2010.104.

J. Mohammed, C. -H. Lung, A. Ocneanu, A. Thakral, C. Jones and A. Adler, "Internet of Things: Remote Patient Monitoring Using Web Services and Cloud Computing," 2014 IEEE International Conference on Internet of Things (iThings), and IEEE Green Computing and Communications (GreenCom) and IEEE Cyber, Physical and Social Computing (CPSCom), Taipei, 2014, pp. 256-263, doi: 10.1109/iThings.2014.45.

Prasad, Mhnv & Pidugu, Munaswamy. (2019). Remote Health Monitoring & Security System for Elderly People using Raspberry.

C. Visvesvaran, B. M. Shankar, S. Kaviya, P. Kaviya, K. Monika and I. J. John Bharath Kumar, "Quarcare - IoT Based Patient Health Monitoring System," 2021 Second International Conference on Electronics and Sustainable Communication Systems (ICESC), Coimbatore, India, 2021, pp. 870-874, doi: 10.1109/ICESC51422.2021.9532652.

MHNV Prasad and P Munaswamy. "Remote Health Monitoring and Security System for Elderly People using Raspberry". In: International Journal of Science and Research (2013).

Clarke, Malcolm & de Folter, Joost & Verma, Vivek & Gokalp, Hulya. (2017). Interoperable End-to-End Remote Patient Monitoring Platform based on IEEE 11073 PHD and ZigBee Health Care Profile. IEEE Transactions on Biomedical Engineering. PP. 1-1

Rachana Ashok Late Heren Galani Deven Thanki Prof. S. E. Pawar Sourabh Dudakiya Amaad Shaikh. "Patient Monitoring System Using GSM Technology". In: International Conference on Electronics, and Optimization Techniques (2016).

Brijesh Iyer Niket Patii. "Health monitoring and tracking system for soldiers using Internet of Things(IoT)". In: International Conference on Computing,Communication And Automation.IEEE (2017).

M. N. Bhuiyan *et al.*, "Design and Implementation of a Feasible Model for the IoT Based Ubiquitous Healthcare Monitoring System for Rural and Urban Areas," in *IEEE Access*, vol. 10, pp. 91984-91997, 2022, doi: 10.1109/ACCESS.2022.3202551..

Naina Gupta Hera Saeed; Sanjana Jha; Manisha Chahande; Sujata Pandey. “Health monitoring and tracking system for soldiers using Internet of Things(IoT)”. In: International Conference on innovations in information, Embedded and communition system.IEEE (2017).

D Laxma Reddy; M.Raju Naik; D Srikar. “Health Monitoring System Based on IoT”. In: International Conference IEEE (2021).

Mohammad M. Masud, Mohamed Adel Serhani, and Alramzana Nujum Navaz“Resource-Aware MobileBased Health Monitoring”, 2168-2194 (c) 2015 IEEE.

Tarannum Khan; Manju K. Chattopadhyay “Smart health monitoring system”.International Conference IEEE (2017).

Wang, Z. Zhang, B Li, S-Y Lee and R.S. Sherratt, "An Enhanced Fall Detection System for Elderly Person Monitoring using Consumer Home Networks", IEEE Trans. on Consumer Electronics, vol. 60, no. 1, pp. 23-29, Feb. 2014.

Md Mashrur Sakib Choyon, Maksudur Rahman, Md. Mohsin Kabir and M. F. Mridha, "IoT based Health Monitoring & Automated Predictive System to Confront COVID-19", IEEE 17th International Conference on Smart Communities: Improving Quality of Life Using ICT IoT and AI (HONET),2020.

B. K and B. D, "Secured Smart Health Care Monitoring System Based on IoT", International Journal on Recent and Innovation Trends (IJRIT), vol. 3, no. 7, pp. 4958-4961, 2015.

J.A.-a. Wan, "Wearable IoT enabled real-time health monitoring system", J Wireless Com Network, vol. 298, pp. 1-11, 2018.

Z. Zhiao, Chnaowei and z. Nakdahira, "Healthcare application based on Internet of Things", Proc. IEET Int. ConfE. on. Technolgy. Application., pp. 661-662, Nov. 2013.

L-H Wang, Y-M Hsiao, X-Q Xie and S-Y Lee, "An Outdoor Intelligent Healthcare Monitoring Device for the Elderly", IEEE Trans. on Consumer Electronics, vol. 62, no. 2, pp. 128-135, May 2016.

V. Bazarevsky, I. Grishchenko, K. Raveendran, T. Zhu, F. Zhang and M. Grundmann, "BlazePose: Ondevice Real-time Body Pose tracking", CVPR Workshop on Computer Vision for Augmented and Virtual Reality, 2020.

L. S. Kondaka, M. Thenmozhi, K. Vijayakumar and R Kohli, "An intensive healthcare monitoring paradigm by using IoT based machine learning strategies", Multimedia Tools and Applications, vol. 81, no. 26, pp. 36891-36905, 2022.

A. Rahaman, M. M. Islam, M. R. Islam, M. S. Sadi and S. Nooruddin, "Developing IoT Based Smart Health Monitoring Systems: A Review", Rev. d'Intelligence Artif., vol. 33, no. 6, pp. 435-440, 2019.

D. V. Dimitrov, "Medical internet of things and big data in healthcare", Healthcare informatics research, vol. 22, no. 3, pp. 156-163, 2016.