Externship Program : Internet Of Things

Guided Project Report

Project Title : Elderly monitoring system

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1. INTRODUCTION

1.1 Overview

The project titled "Elderly Monitoring System" aims to provide comprehensive care and support for the elderly by utilizing advanced technologies. The system integrates various sensors, including an ESP2866-based platform, a temperature sensor for body temperature monitoring, an MP6050 accelerometer sensor for fall detection, and a potentiometer for heart rate monitoring. To streamline the data collection and analysis process, the system leverages technologies such as Node-RED, Wokwi, and IBM Watson. Node-RED, a visual programming tool, enables the easy configuration and flow of data between different components. Wokwi provides a virtual hardware simulation environment, allowing for testing and prototyping of the system before deployment. IBM Watson, a powerful AI platform, facilitates advanced analytics and insights from the collected data.

Additionally, the project includes the development of a user-friendly mobile application using MIT App Inventor. The app serves as an interface for caregivers or family members to access real-time data and receive notifications regarding the elderly person's vital signs, temperature, and fall incidents. The app provides a comprehensive overview of the elderly person's health status, ensuring timely intervention and assistance. Overall, the "Elderly Monitoring System" project combines IoT devices, sensor technologies, data analysis, and a mobile application to enhance the well-being and safety of elderly individuals, enabling prompt responses and personalized care.

1.2 Purpose

The purpose of the "Elderly Monitoring System" project is to enhance the care and safety of elderly individuals through the utilization of advanced technologies. The project aims to address specific challenges faced by the elderly population, such as health monitoring, fall detection, and timely assistance. By incorporating sensors like the temperature sensor, accelerometer sensor, and pulse sensor, the system can continuously monitor vital signs, body temperature, and detect potential falls. These real-time monitoring capabilities enable caregivers or family members to promptly respond to emergencies or changes in health conditions.

The integration of technologies like Node-RED, Wokwi, and IBM Watson allows for efficient data collection, analysis, and visualization. Node-RED facilitates seamless communication and data flow between different components of the system. Wokwi provides a virtual hardware simulation environment for testing and prototyping, ensuring

the system's reliability and effectiveness. IBM Watson enables advanced analytics and insights from the collected data, allowing for personalized care and intervention based on individual health patterns. The development of a user-friendly mobile application using MIT App Inventor serves as a convenient interface for caregivers or family members to access real-time data and receive timely notifications. The app provides a comprehensive overview of the elderly person's health status, empowering caregivers to make informed decisions and provide immediate assistance when needed.

Overall, the purpose of the "Elderly Monitoring System" project is to leverage technology to improve the well-being, safety, and quality of life for elderly individuals, while providing peace of mind to their caregivers and loved ones. It aims to enable proactive care, early intervention, and personalized support, ultimately promoting independence and ensuring a higher level of care for the elderly.

2. LITERATURE SURVEY

2.1 Existing problem:

Several existing approaches and methods aim to address the challenges of monitoring and caring for elderly individuals. Here are some commonly used approaches: Wearable Devices: Wearable devices equipped with sensors, such as smartwatches or fitness trackers, have gained popularity for monitoring vital signs, including heart rate and activity levels. These devices often provide real-time data and can be connected to mobile applications for remote monitoring. Fall Detection Systems: Fall detection systems utilize various technologies, such as accelerometers, gyroscopes, or pressure sensors, to detect falls. These systems can trigger alarms or notifications to alert caregivers or emergency services when a fall occurs.

. Machine Learning and AI: Machine learning and AI techniques can be applied to analyze data collected from various sensors and devices, enabling the detection of patterns, anomalies, and early warning signs of health issues. These technologies can provide valuable insights for caregivers and healthcare professionals, facilitating personalized care and intervention.

Cloud-based Platforms: Cloud-based platforms allow for the storage, analysis, and sharing of data collected from multiple devices and sensors. These platforms provide a centralized hub for managing and accessing elderly individuals' health data, enabling better coordination and collaboration among caregivers and healthcare providers. By combining and customizing these existing approaches and methods, the "Elderly Monitoring System" project can create a comprehensive solution that addresses the

specific needs of elderly individuals, providing a holistic approach to monitoring and care.

2.2 Proposed solution

The proposed solution for the "Elderly Monitoring System" project is to develop a comprehensive system that integrates various sensors, data analysis technologies, and a user-friendly mobile application. The solution aims to provide real-time monitoring, early detection of health issues, and timely assistance for elderly individuals. Here are the key components of the proposed solution:

1. Sensor Integration: The system will utilize an ESP2866-based platform to connect and integrate multiple sensors. These sensors include a temperature sensor for body temperature monitoring, an MP6050 accelerometer sensor for fall detection, and a potentiometer for heart rate monitoring. The sensor data will be collected and transmitted wirelessly to a central hub for further processing and analysis.
2. Data Processing and Analysis: The collected sensor data will be processed and analyzed using technologies like Node-RED and IBM Watson. Node-RED will enable the configuration and flow of data between different components, while IBM Watson will provide advanced analytics and insights from the data. This analysis will help identify patterns, anomalies, and potential health issues, enabling proactive care and intervention.
3. Virtual Hardware Simulation: Wokwi, a virtual hardware simulation environment, will be utilized for testing and prototyping the system before deployment. This will ensure the reliability and functionality of the hardware components, allowing for fine-tuning and optimization of the system.
4. Mobile Application Development: A user-friendly mobile application will be developed using MIT App Inventor. The application will serve as an interface for caregivers or family members to access real-time data and receive notifications regarding the elderly person's vital signs, temperature, and fall incidents. The application will provide a comprehensive overview of the elderly person's health status, enabling informed decision-making and timely intervention.
5. Remote Monitoring and Alerts: The system will enable remote monitoring of elderly individuals, allowing caregivers or family members to keep track of their well-being from anywhere. The system will send alerts and notifications to caregivers in case of abnormal vital signs, high body temperature, or fall detection, ensuring timely assistance and intervention.

By implementing this proposed solution, the "Elderly Monitoring System" project aims to provide a robust and effective platform for monitoring and caring for elderly individuals. The integration of sensors, data analysis technologies, and a mobile

application will enable proactive health management, early detection of health issues, and personalized care, ultimately improving the well-being, safety, and quality of life for the elderly population.

3. Theoretical Analysis

3.1 Block diagram

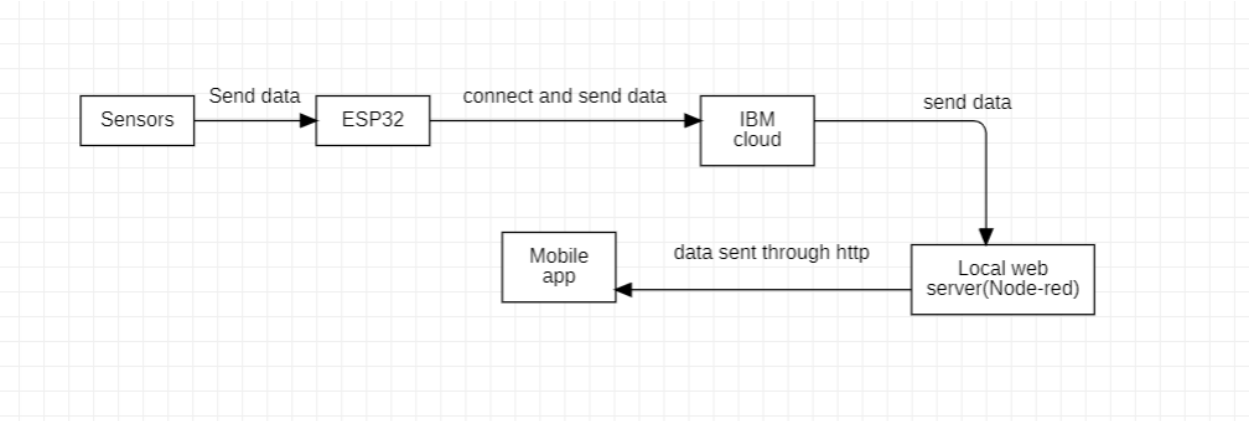


Fig 3.1.1 Block Diagram

3.2 Hardware / Software designing

3.2.1 Hardware requirements

- ESP32
- Temperature sensor
- Heartbeat sensor
- MPU6050 Accelerometer + Gyroscope

3.2.2 Software requirements

- Arduino IDE
- IBM cloud
- MIT app inventor
- Firebase
- Node-red

4. Experimental Investigations

When developing an elderly care app using IoT (Internet of Things) we conducted a comprehensive analysis of the needs and challenges faced by elderly individuals and their caregivers to gather insights about the specific requirements for care, safety, and communication. We also had to consider the security measures needed to protect sensitive data collected by IoT devices and transmitted to the app. We explored how the app can effectively monitor the well-being of elderly individuals in real-time. We also discovered the necessary sensors or wearable devices required to track vital signs, activity levels, fall detection, medication adherence, and other relevant parameters. For fall detection, to avoid false detections, after a heavy increase in acceleration and angle change is detected a virtual trigger is activated. After the trigger is activated if acceleration and angle change falls below the threshold(0.4g&10 degrees) for 0.5ms it is considered a fall.

5. Flowchart

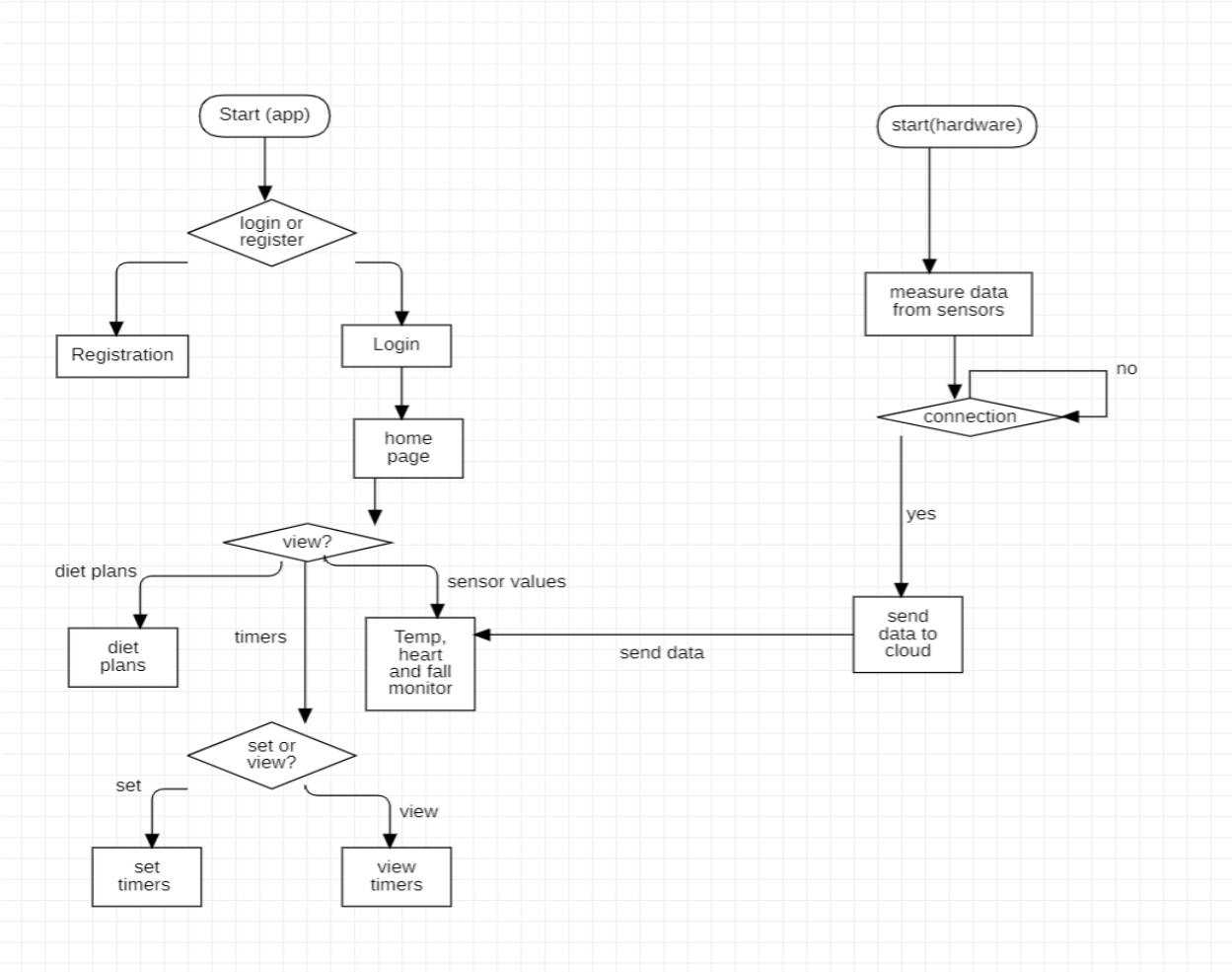


Fig 5.1 Flowchart

6. Results

Wokwi : https://wokwi.com/projects/368840838129154049

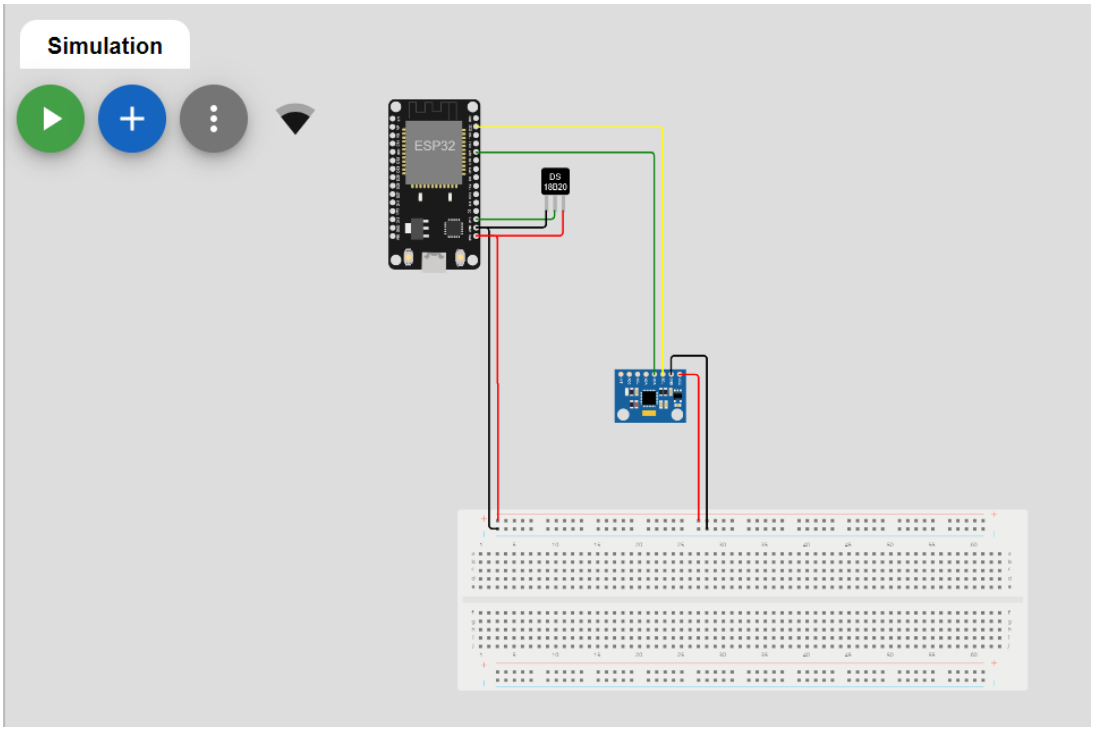


Fig 6.1 Wokwi sensor connections

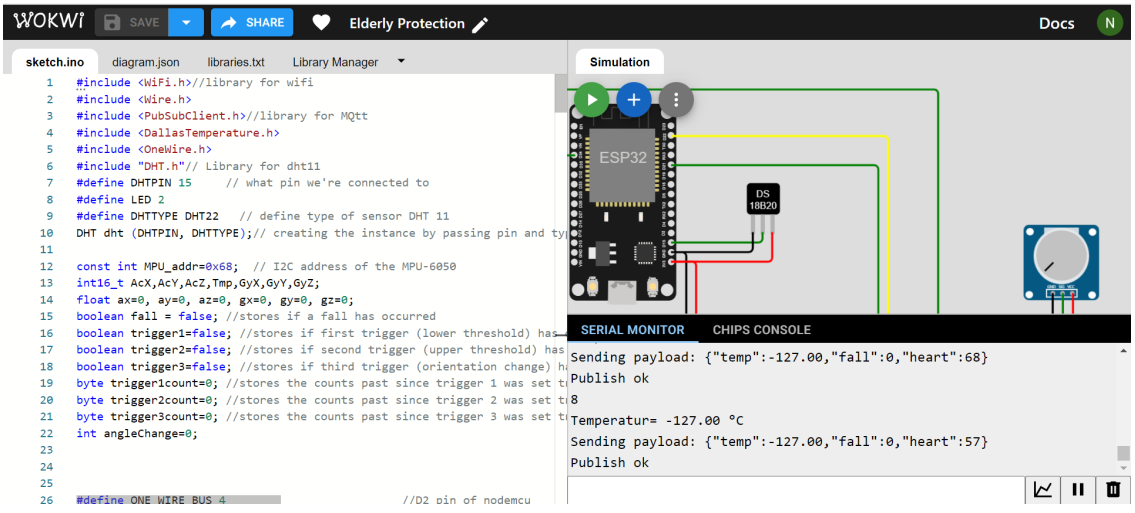


Fig 6.2 Wokwi result

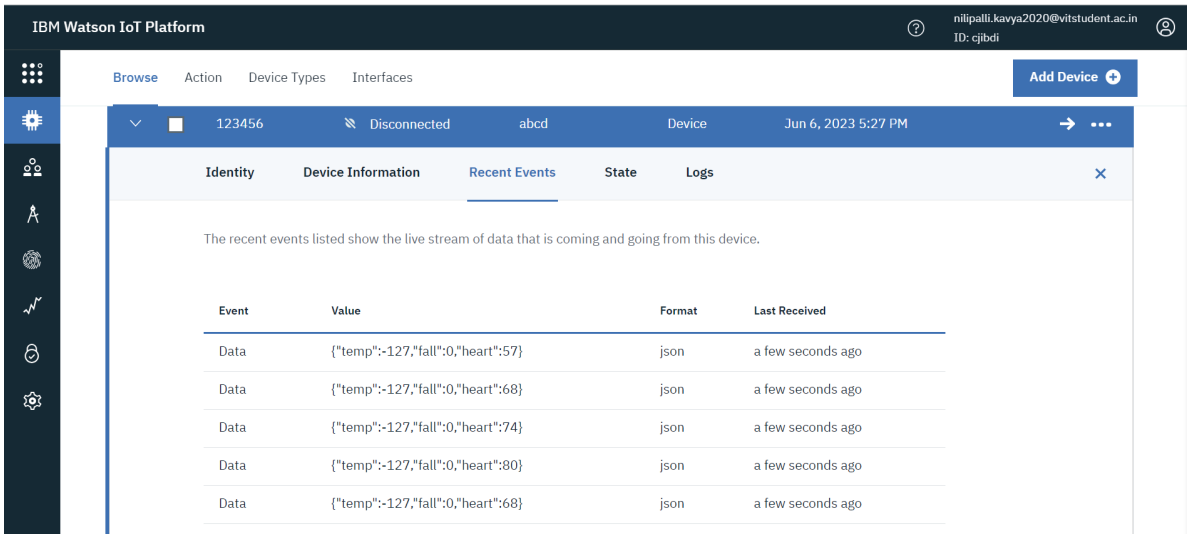


Fig 6.3 IBM cloud receiving data:

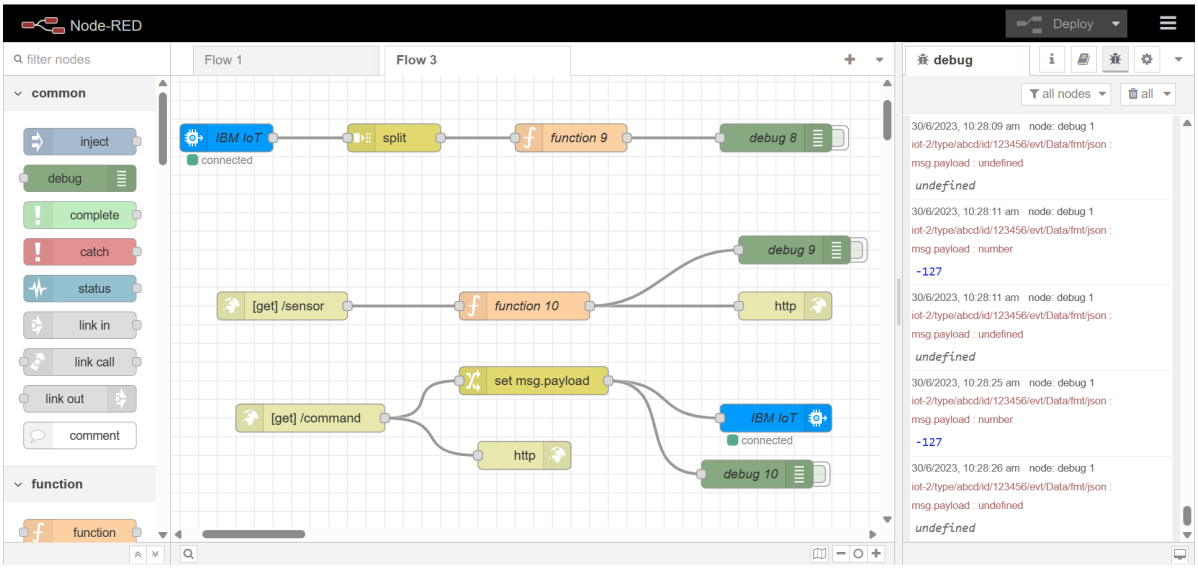


Fig 6.4 Node-red connections

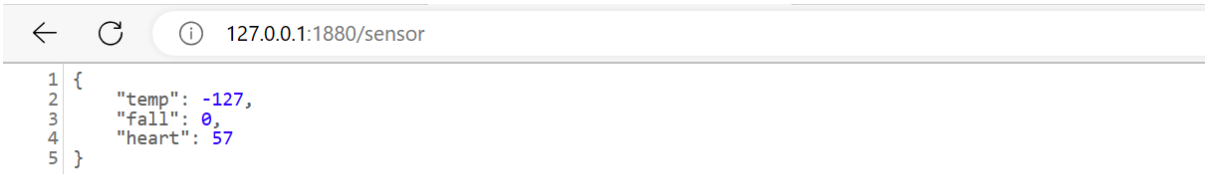
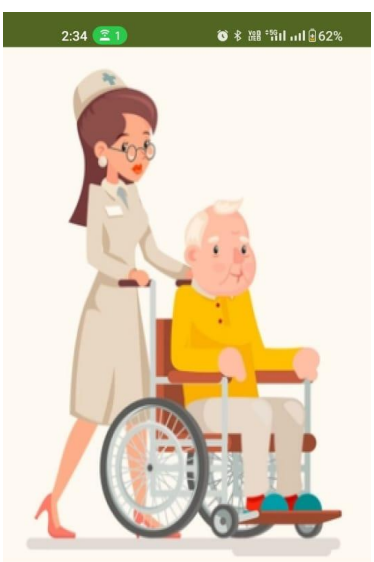
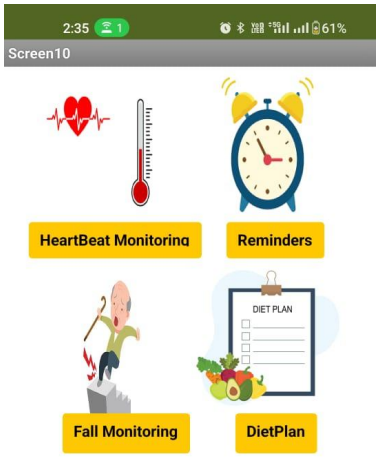
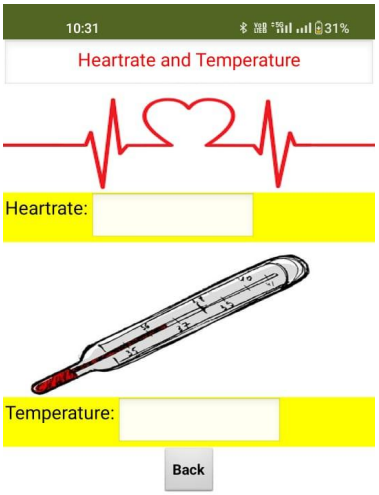


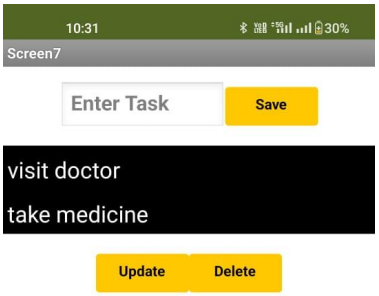
Fig 6.5 Node-red result

MIT App Inventor:









7. Advantages and disadvantages of elderly care application:

Advantages:

- Remote Monitoring: IoT devices can be used to monitor the health and well-being of elderly individuals remotely. Vital signs, such as heart rate, body temperature and fall monitoring, can be monitored in real-time, allowing caregivers to intervene quickly if any abnormalities are detected.
- Fall Detection: IoT sensors can be placed strategically in the home to detect falls or unusual movements. This feature can alert caregivers or emergency services immediately, ensuring timely assistance and potentially saving lives.
- Enhanced Safety and Security: IoT devices can be integrated with home security systems to provide an additional layer of safety for elderly individuals. Features like video surveillance, door/window sensors, and smart locks can help deter intruders and ensure a secure living environment.

Disadvantages:

- Technological Complexity: IoT devices and applications can be complex, especially for elderly individuals who may not be familiar with technology. The learning curve and potential technical issues could pose challenges for adoption and usage.
- Digital Divide: Not all elderly individuals have access to the necessary technology or the digital literacy skills required to use IoT devices and applications. This could create a digital divide and exclude some seniors from benefiting from such solutions.

8. Applications

Elderly care apps have become increasingly popular and beneficial in recent years, offering various functionalities to enhance the well-being and support of older adults. Here are some common applications and features found in elderly care apps:

Medication Reminders

Many elderly care apps include medication reminder features that help seniors manage their medication schedules. These apps send notifications and alerts when it's time to take a specific medication, ensuring they stay on track with their prescribed doses.

Health Tracking

Elderly care apps often provide features for monitoring and tracking health-related information. They can help seniors keep a record of their vital signs, such as blood pressure, heart rate, blood glucose levels, and more. Some apps can even sync with wearable devices to collect real-time data.

Emergency Assistance

Emergency assistance features are crucial in elderly care apps. These apps may have emergency call buttons that connect seniors directly to emergency services or their designated contacts. Some apps can also automatically detect falls or unusual activity and notify emergency contacts.

Caregiver Communication

Apps designed for elderly care often facilitate communication between seniors and their caregivers or family members. They may include messaging features, video calling, or even shared calendars for scheduling and coordinating care activities.

Daily Activity Monitoring

Some apps track and monitor seniors' daily activities, such as steps taken, sleep patterns, and overall physical activity. This information can help seniors and their caregivers identify any changes or potential health concerns.

Social Engagement

Social isolation is a common concern among older adults. Elderly care apps can include features that promote social engagement, such as virtual communities, forums, or video chat functionalities to connect seniors with their peers, family members, or support groups.

Cognitive Stimulation

Certain apps offer cognitive exercises and games to help seniors maintain mental sharpness. These activities may include puzzles, memory games, brain teasers, or even language learning programs.

Reminders and Calendar Management

Elderly care apps often have reminders and calendar management functions to help seniors stay organized. These features can assist in remembering important appointments, events, or tasks.

Nutrition and Meal Planning

Some apps focus on nutrition and meal planning, providing access to healthy recipes, meal suggestions, and grocery lists. They may also take into account dietary restrictions and allergies.

9. Conclusion

In conclusion, utilizing MIT App Inventor, Wokwi, and Node-RED in the development of an elderly care app can provide a comprehensive and versatile solution to meet the specific needs of older adults. These platforms offer a range of functionalities that can enhance the overall well-being, safety, and support for seniors.

MIT App Inventor allows for the creation of user-friendly and intuitive interfaces, making it easier for older adults to navigate and interact with the app. Its visual programming environment empowers developers to design customized features such as medication reminders, health tracking, emergency assistance, caregiver communication, and social engagement.

Wokwi, a simulation platform, enables developers to test and refine their app designs before deploying them on actual devices. This feature can be particularly beneficial for ensuring the app's usability, reliability, and user satisfaction, as it allows for real-time feedback and debugging.

Node-RED, a visual programming tool, provides a powerful backend system for connecting different data sources, devices, and services. It enables seamless integration with various APIs and databases, enhancing the functionality of the elderly care app. With Node-RED, developers can implement features like daily activity monitoring, cognitive stimulation, reminders and calendar management, nutrition and meal planning, and transportation and service coordination.

By leveraging the strengths of MIT App Inventor, Wokwi, and Node-RED, developers can create a robust and user-friendly elderly care app. This comprehensive solution can contribute to improving the quality of life for older adults by promoting their health, safety, social engagement, and overall well-being.

10. Future Work

Machine Learning and AI Integration

Integrating machine learning algorithms and artificial intelligence capabilities into the app can enable advanced features such as predictive health analytics, personalized recommendations, and early detection of health issues. This can further enhance the app's ability to monitor and support the well-being of elderly individuals.

Wearable Device Integration

Connecting the elderly care app with wearable devices, such as smartwatches or fitness trackers, can provide real-time health data and activity tracking. This integration can enhance the accuracy of health monitoring and enable proactive interventions based on the collected information.

Gamification and Social Features

Incorporating gamification elements into the app can make health monitoring and engagement more enjoyable for seniors. Additionally, enhancing social features by creating virtual communities or facilitating connections with peers can help combat social isolation and foster a sense of belonging.

Data Analytics and Insights

Building analytics capabilities within the app can provide actionable insights for caregivers and healthcare professionals. Data visualization, trends analysis, and personalized recommendations based on the collected data can empower users to make informed decisions about their health and well-being.

Integration with Telemedicine Services

Integrating the app with telemedicine services can enable virtual doctor consultations, remote monitoring of health conditions, and medication management. This integration can offer convenience, accessibility, and timely medical support for elderly individuals, especially those with limited mobility.

Enhanced Security and Privacy Measures

Strengthening security measures and ensuring robust data privacy protocols are critical for an elderly care app. Implementing encryption, user authentication, and secure data storage will protect sensitive information and build trust among users and their caregivers.