

Patient Monitoring System

Introduction:

The objective of this project was to develop a healthcare platform to monitor patients' health using different healthcare devices. This platform allows the users to effortlessly activate or deactivate various healthcare devices, tailoring the experience to their specific needs.

With its intuitive and user-friendly interface, the platform ensures effortless integration and smooth operation of different healthcare devices. By centralizing data collection on cloud, it simplifies the process of gathering vital health information of patients from various sources, providing a comprehensive overview of a patient's well-being.

Client Details:

Name: Confidential | **Industry:** Healthcare, IoT | **Location:** USA

Technologies:

Backend: Django, Django Rest Framework, PostgreSQL

Cloud Services: AWS EC2, Lambda, S3, SES, SQS, CloudWatch, API Gateway, RDS, IAM

Integration: AT&T

Project Description:

The client's requirement was to develop a comprehensive system capable of managing and storing data from various healthcare IoT devices. Upon careful analysis, our team proposed a solution that catered to this need comprehensively. The system allows an administrative user to register and manage different customers and distributors within the platform. This ensures smooth coordination and accessibility for all stakeholders involved.

Both the admin and distributors have the privilege to add different healthcare devices to the customers they serve. Simultaneously, customers also have the option to independently add devices to their accounts, fostering a flexible and user-friendly approach to device management.

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The main features of this platform are as follows:

- Healthcare Device Management
- Telemetry Data Capturing and Processing
- Customer Billing
- Customer/Distributor Management

Healthcare Device Management and Telemetry Processing

The focal point of the system is the seamless integration of healthcare devices, which collect and record vital measurements. These measurements are stored in our database, ensuring the preservation of accurate and up-to-date health data. Furthermore, the historical data of each device is diligently maintained in the system for a period of 7 days. This historical tracking proves to be beneficial for comprehensive health analysis and enables medical professionals to identify trends and patterns in a patient's health over time.

The system is designed with a robust data storage infrastructure, adhering to security and privacy standards. It guarantees the confidentiality and integrity of sensitive health information, providing peace of mind to both healthcare providers and patients alike.

The client's requirement involves storing recorded data in the system and facilitating its transmission to the customer's server. Two types of healthcare devices are identified:

- **Bluetooth-enabled Devices:** To efficiently manage data from Bluetooth-enabled devices, our development team has designed dedicated applications for both Android and iOS platforms. These applications establish seamless connections with the devices and retrieve data from them as soon as a measurement is taken. Once retrieved, the data is securely transmitted to the server for processing and storage. At the server side, stringent measures are implemented to validate the authenticity of each device, ensuring the integrity of the collected data. The data is then standardized to a uniform format, making it easy to interpret and analyze. Subsequently, the processed data is stored securely in the database

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and also forwarded to the respective customer's server, ensuring that the vital health information is readily accessible for medical professionals. Different type of Bluetooth-enabled devices are Blood Pressure , Scale, Glucometer, Pulse ox, Activity Tracker, Smart Watch and Thermometer.

- **Cellular Devices:** The system also caters to cellular healthcare devices, which have inherent cellular connectivity. These devices are capable of transmitting data directly to our server immediately after a measurement is taken. Upon receipt at our server, the data goes through a rigorous authentication process to verify the device's identity and data integrity. Once validated, the data is formatted in a standardized manner for consistency and clarity. Subsequently, the authenticated and processed data is securely stored in our database and promptly sent to the customer's server, ensuring real-time access to critical health data. Different types of cellular devices are Blood Pressure, Scale and Glucometer.

Additionally, the client has opted for a Bluetooth hub, which serves as a central management point for Bluetooth devices. Each client's portal features a dedicated hub section where hubs can be easily added. The Bluetooth hub allows multiple Bluetooth-enabled devices to be connected and managed efficiently. Data received from the connected devices is transmitted to the server via the hub, where it undergoes the same rigorous authentication and processing procedures before being stored in the database and relayed to the customer's server.

Customer and Distributor Management

In addition to comprehensive device and data management, the platform offers differentiated user logins based on specific roles, ensuring a tailored experience for each user category. The distinct logins include:

Admin Login: The administrative login grants access to system-wide functionalities, empowering administrators to manage various aspects of the platform. Admins have the authority to add and configure devices, hubs, customers, and distributors. They can also activate or deactivate devices and hubs as needed, ensuring a streamlined and efficient healthcare device ecosystem.

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Customer Login: A customer is typically a small clinical care or a hospital. Customers are provided with personalized logins that enable them to manage their individual healthcare devices and associated data. Through their login, customers can add new devices and users (e.g., staff in hospital) to their accounts, view and analyze measurement data, and keep track of their health insights conveniently. They have the flexibility to activate or deactivate devices and hubs under their purview, tailoring the healthcare devices according to their preferences and requirements.

Distributor Login: A distributor can purchase healthcare devices from the platform provider. Distributors are granted specialized logins that empower them to oversee and manage multiple customers under their portfolio. They can efficiently add and configure devices and hubs for each customer they serve. The distributor login provides a centralized view of all their customers' devices, facilitating seamless device management and ensuring a superior level of service.

User Login: The user login is specifically designed for individuals who play a vital role in assisting customers and distributors in efficiently managing their work within the system. There are two types of user logins:

- **Customer User:** Customer users are representatives or support personnel designated to assist customers in effectively utilizing the platform. With their login access, they can interact with customer accounts, devices, and data. They have the authority to address customer queries, offer technical support, and provide guidance on optimizing device usage.
- **Distributor User:** Distributor users are responsible for supporting and collaborating with distributors to streamline their operations. Their login access allows them to access distributor accounts, view their device inventories, and assist in device configuration and management.

Both types of user logins are equipped with specific permissions and access levels, tailored to their roles. This ensures that customer users can focus on assisting customers without compromising sensitive distributor-related information, and vice versa. The user login functionality adds an additional layer of support and expertise to the platform, fostering a collaborative environment that promotes efficient healthcare device management for all stakeholders.

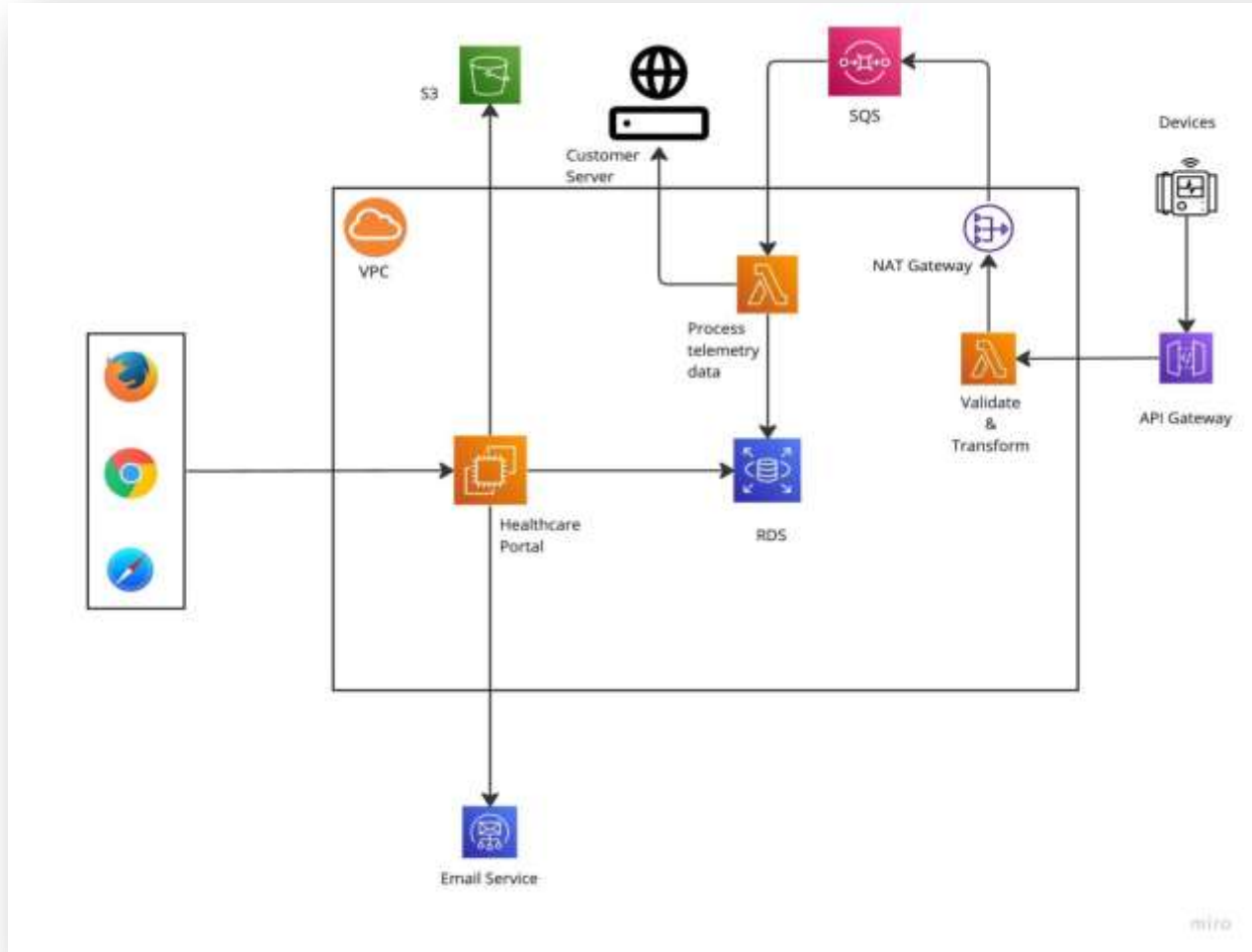
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Billing

The system has a billing functionality that automatically calculates and stores the billing details for each customer. The billing calculations are performed on the last day of each month, generating accurate and transparent billing statements based on individual usage. These statements reflect the cost of device usage, the number of active devices and hubs. Once the customer settles the bill, the system promptly updates the billing status, maintaining a reliable record of payment transactions.

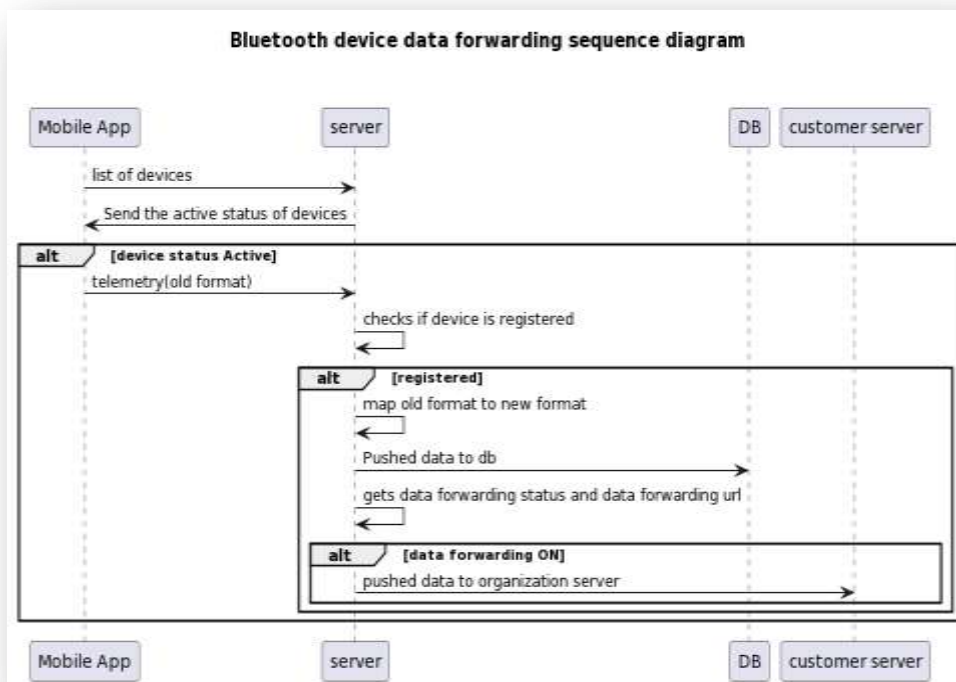
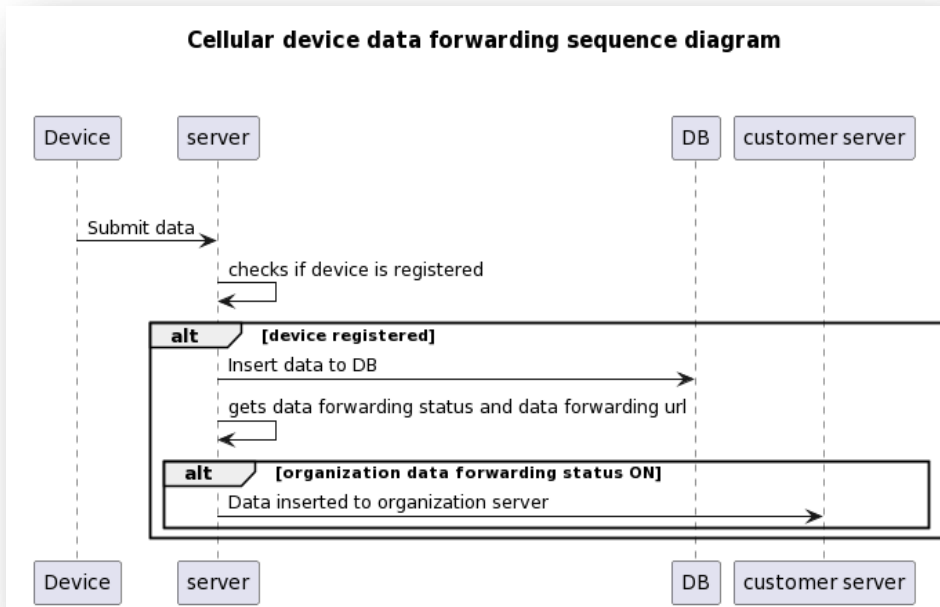
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Architecture Diagram:



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Workflow Diagram:



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Screenshots:

Distributor list page:

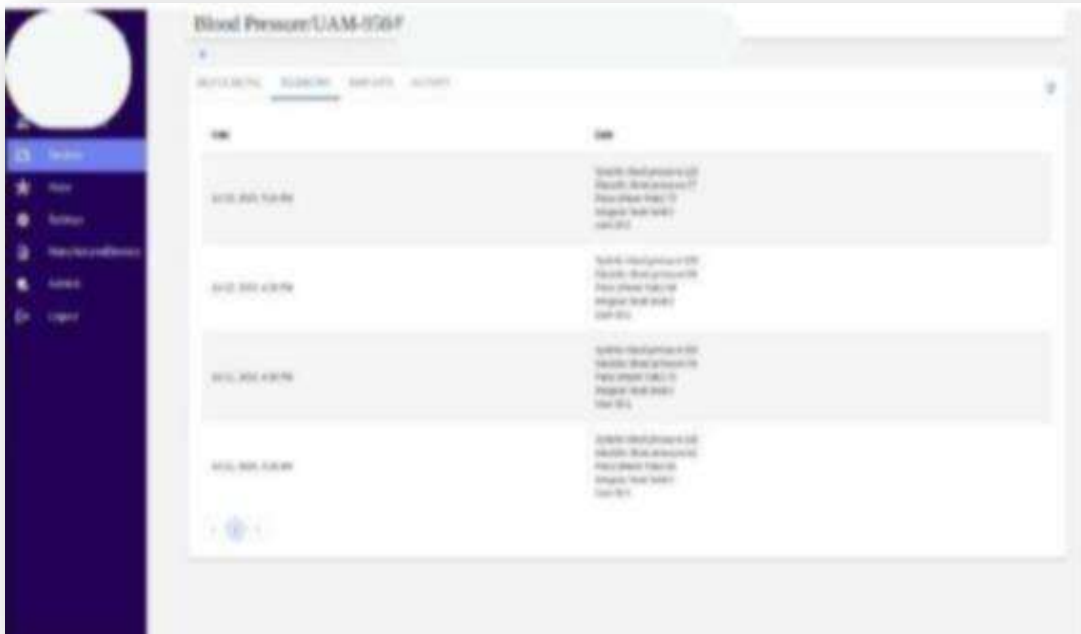


Device list:



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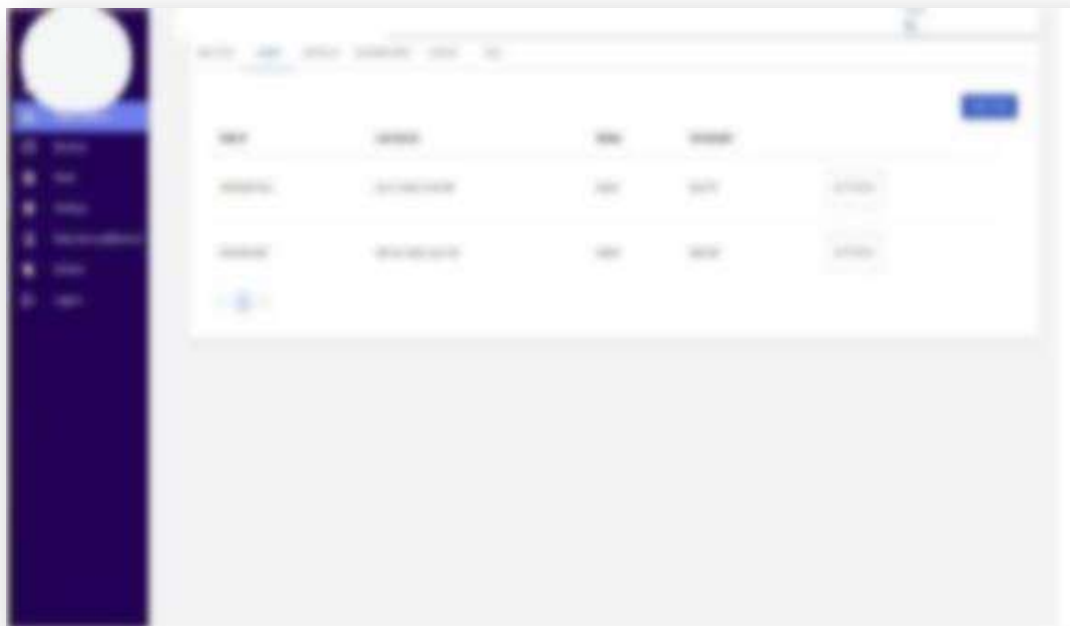
Blood Pressure Telemetry Sample:



The screenshot shows a web application interface for 'Blood Pressure (IAM-0267)'. It features a dark blue sidebar with navigation options: Home, Settings, My Recent Activities, Alerts, and Logout. The main content area displays a table with four rows of data. Each row contains a timestamp and a detailed log of blood pressure readings.

Time	Value
2012-08-14 10:00:00	120/80/60 mmHg 120/80/60 mmHg 120/80/60 mmHg 120/80/60 mmHg
2012-08-14 10:05:00	120/80/60 mmHg 120/80/60 mmHg 120/80/60 mmHg 120/80/60 mmHg
2012-08-14 10:10:00	120/80/60 mmHg 120/80/60 mmHg 120/80/60 mmHg 120/80/60 mmHg
2012-08-14 10:15:00	120/80/60 mmHg 120/80/60 mmHg 120/80/60 mmHg 120/80/60 mmHg

Hub List Page:



The screenshot shows a 'Hub List Page' in the same web application. It features the same dark blue sidebar. The main content area displays a table with three rows of data. Each row contains a timestamp, a patient name, and a status.

Time	Hub Name	Status
2012-08-14 10:00:00	Hub 1	Active
2012-08-14 10:05:00	Hub 2	Active
2012-08-14 10:10:00	Hub 3	Active