Faculty of Engineering - Department of Computer Science
CSI418L - Web Programming Lab
Supervisor: Dr. Samir Saad

Web Bluetooth Medical Dashboard

from physical hardware to digital data

Github repository

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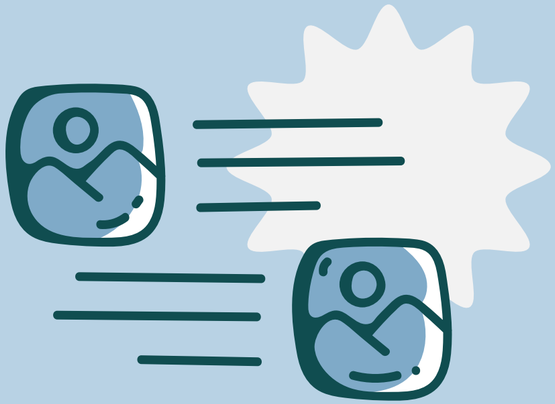

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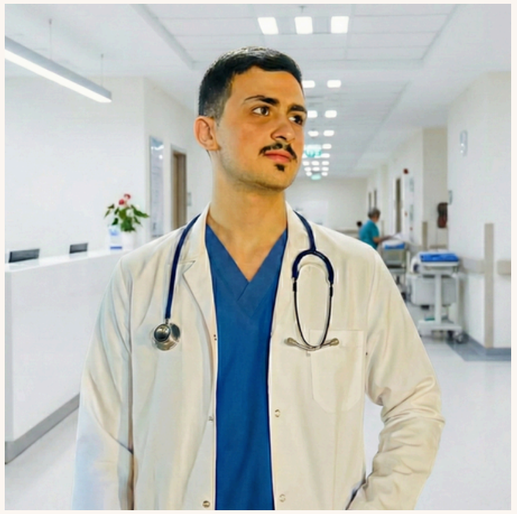

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Problem Statement

Platform Fragmation	Installation Friction
Native apps per OS (iOS/Android/Windows) → more dev work + inconsistent UX.	Users must find, download, install → lower adoption (especially occasional use).

Solution:
Web Bluetooth API

01. Cross-platform compatibility.

02. Zero-installation access via URL.

03. Real-time physiological data acquisition.

System Architecture

Presentation Layer

- HTML5/Razor views
- CSS3
- jQuery for dynamic UI updates.

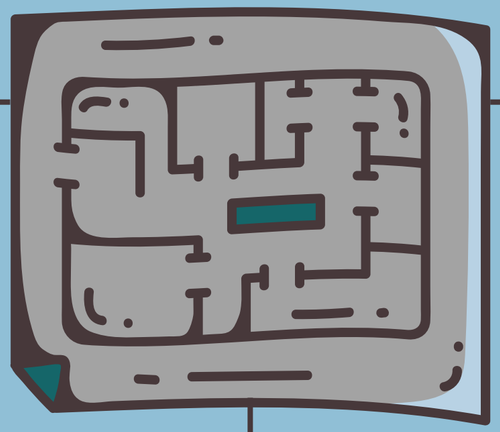
Application Layer

- ASP.NET Core 6 MVC controller handling logic and routing.

Data Layer

- In-memory storage processed via LINQ queries and exported via XML/JSON.

Technology Stack



Back-End

- ASP.NET Core 6 MVC
- C#
- LINQ for efficient data processing and querying.

Front-End

- HTML5
- CSS3
- JavaScript (ES6+)
- jQuery for DOM manipulation and AJAX.

Processing

- PHP scripts for supplementary logic (BMI, Heart Rate Zones)
- JSON/XML handling.

Core Feature: Web Bluetooth Integration

Workflow:

1. User Gesture (Click)
2. navigator.bluetooth.requestDevice()
3. Connect to GATT Server
4. Subscribe to Characteristics (e.g., 0x2A37)

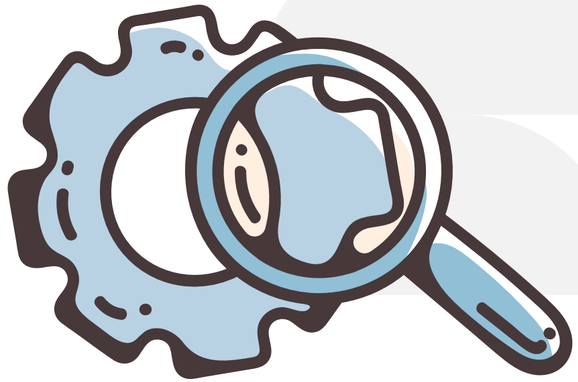
```
// A. User Gesture (Click Event)
$('#connectHeartRate').on('click', async function() {

    // B. Request Device
    const device = await navigator.bluetooth.requestDevice({
        filters: [{ services: ['heart_rate'] }] // Standard Heart Rate Service
    });

    // C. Connect to GATT Server
    const server = await device.gatt.connect();

    // D. Subscribe to Characteristics
    const service = await server.getPrimaryService('heart_rate');
    const characteristic = await service.getCharacteristic('heart_rate_measurement'); // UUID:
0x2A37
    await characteristic.startNotifications();
    characteristic.addEventListener('characteristicvaluechanged', handleNotifications);
});
```

Data Processing With LINQ

We utilize C# LINQ (Language Integrated Query) for powerful in-memory data manipulation, ensuring type safety and code readability.

```
// 1. Filtering by Device Type (Where)
public List<HealthReadingDto> GetReadingsByDeviceType(string deviceType)
{
    return _readings
        .Where(r => r.DeviceType.Equals(deviceType,
StringComparison.OrdinalIgnoreCase))
        .OrderByDescending(r => r.Timestamp)
        .ToList();
}

// 2. Real-time Aggregation (GroupBy)
public Dictionary<string, List<HealthReadingDto>> GetReadingsGroupedByDevice()
{
    return _readings
        .GroupBy(r => r.DeviceId)
        .ToDictionary(g => g.Key, g => g.OrderByDescending(r => r.Timestamp).ToList());
}

// 3. Calculating Statistical Averages (Average)
public Dictionary<string, double> GetAveragesByType()
{
    return _readings
        .GroupBy(r => r.DeviceType)
        .Where(g => g.Any())
        .ToDictionary(g => g.Key, g => g.Average(r => r.Value));
}
```

User Interface & Experience



Real-Time Feedback

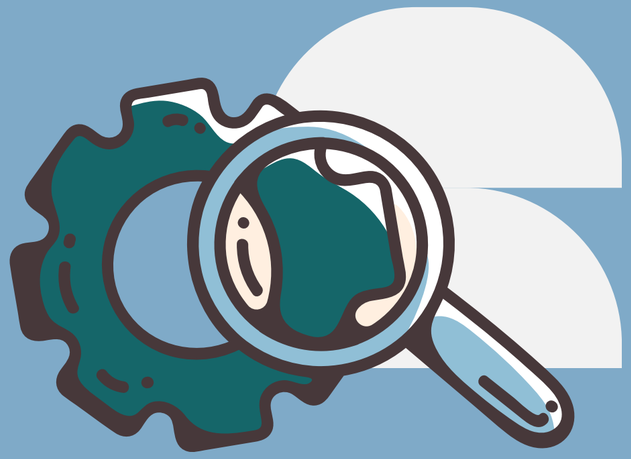
The dashboard employs jQuery animations to provide immediate visual feedback (pulse effects) when new data packets arrive.

Define the Pulse Animation (CSS)

```css
@keyframes pulse {
    0% { transform: scale(1); box-shadow: 0 5px 20px rgba(0,0,0,0.2); }
    50% { transform: scale(1.05); box-shadow: 0 10px 40px rgba(0,0,0,0.3);
}   100% { transform: scale(1); box-shadow: 0 5px 20px rgba(0,0,0,0.2); }
}

.pulse-animation {
    animation: pulse 0.5s ease-in-out;
}
```

Trigger it with jQuery when data arrives (JS)

```javascript
function handleHeartRateData(value) {
    // Update text
    $('#heartRateValue').text(value);

    // Trigger Animation
    $('#heartRateCard').addClass('pulse-animation');

    // Remove class after animation finishes so it can be triggered again
    setTimeout(() => $('#heartRateCard').removeClass('pulse-animation'),
});
```



Responsive Design

Built with Bootstrap 5 and custom CSS gradients, the interface adapts seamlessly to various screen sizes, maintaining usability across desktop and mobile devices.

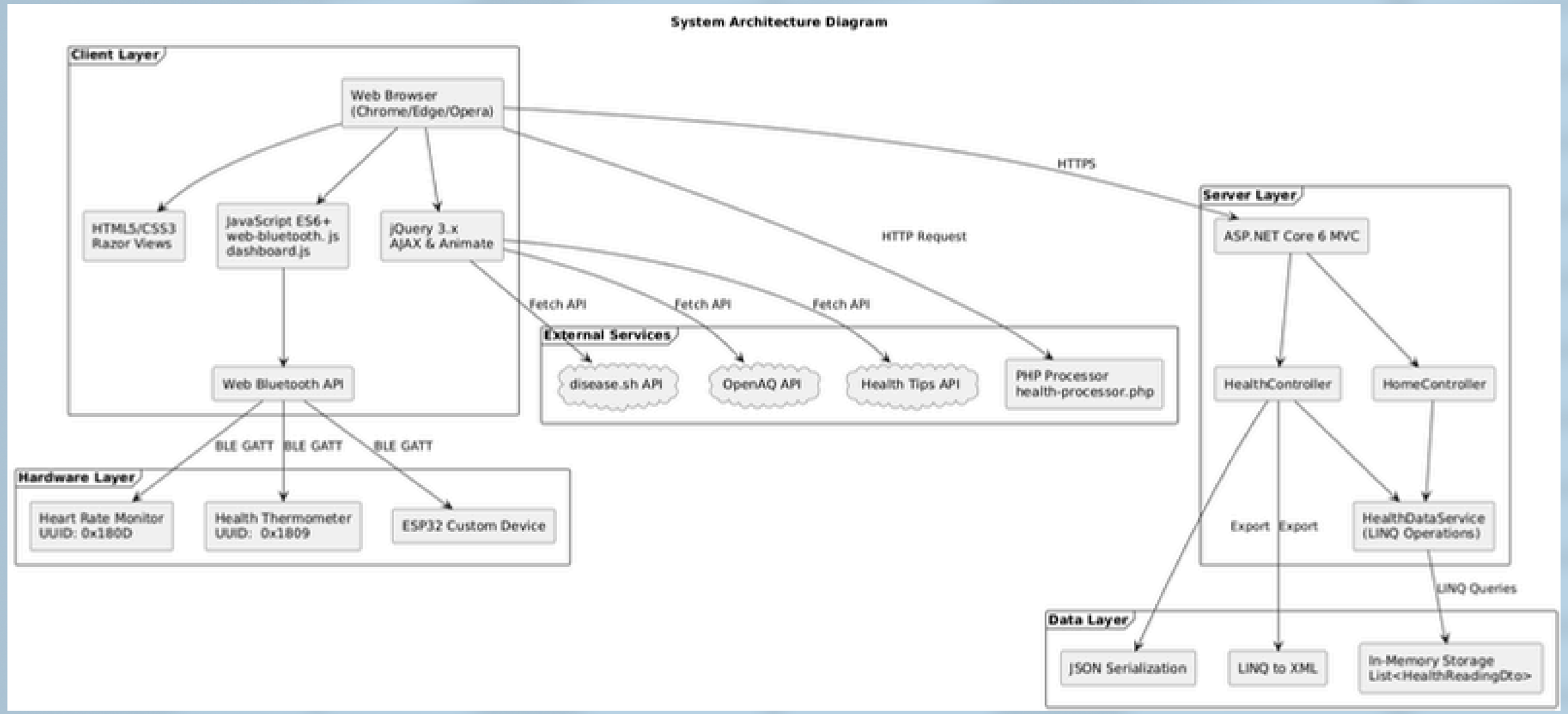
Bootstrap Grid System (HTML)

```
<div class="row mb-4">
    <div class="col-12 col-md-3">
        <div class="card shadow stat-
card">      <!-- Content -->
        </div>
    </div>
</div>
```

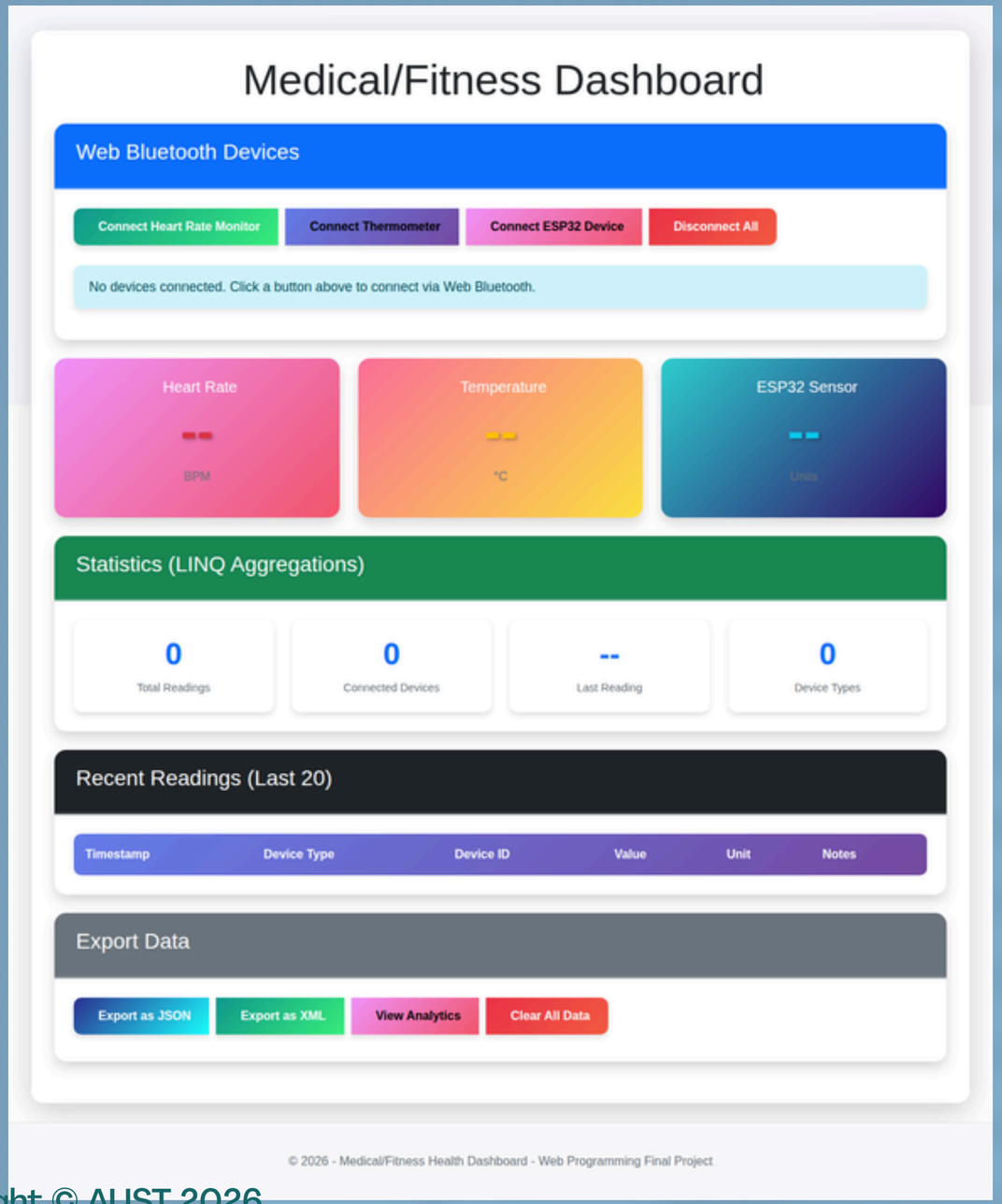
Custom Mobile Adjustments (CSS)

```
@media (max-width: 768px) {
    .stat-card .display-3 {
        font-size: 2.5rem; /* Smaller font for mobile */
    }

    .btn-group .btn {
        display: block;    /* Stack buttons vertically
*/      width: 100%;
        margin-bottom: 10px;
    }
}
```

How Does The System Work?



Main Dashboard View



Live Demo

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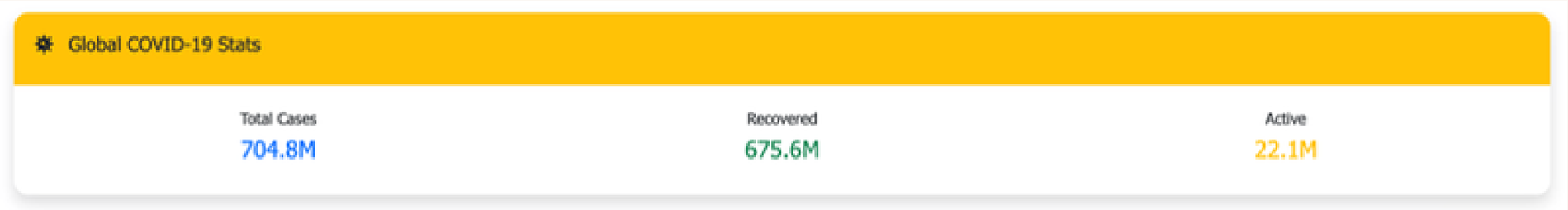
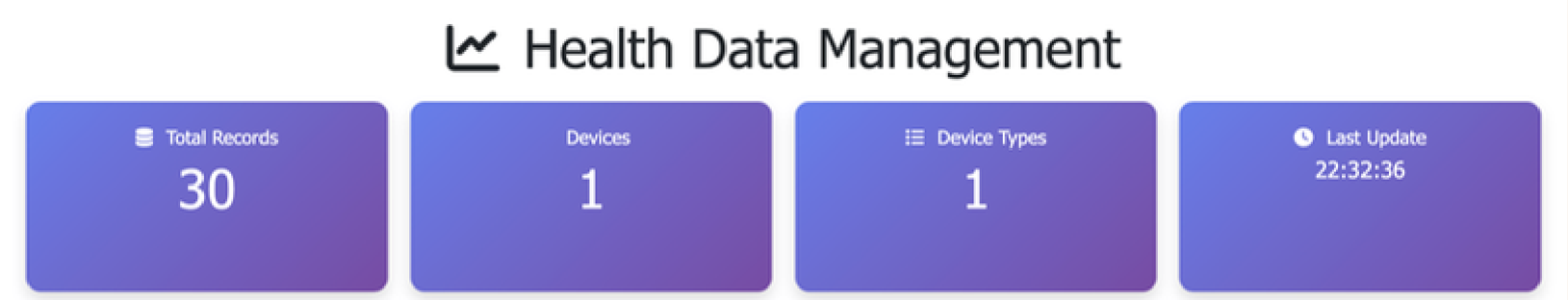


Analytics Model & Covid Data Fetch View



Future Roadmap

Persistence

- Transition from in-memory storage to a persistent database (SQL Server) for long-term tracking.

Mobile Apps

- Develop companion native apps using .NET MAUI for broader hardware support.

Analytics

- Integrate Machine Learning for anomaly detection and health trend prediction.

Thank you very much!