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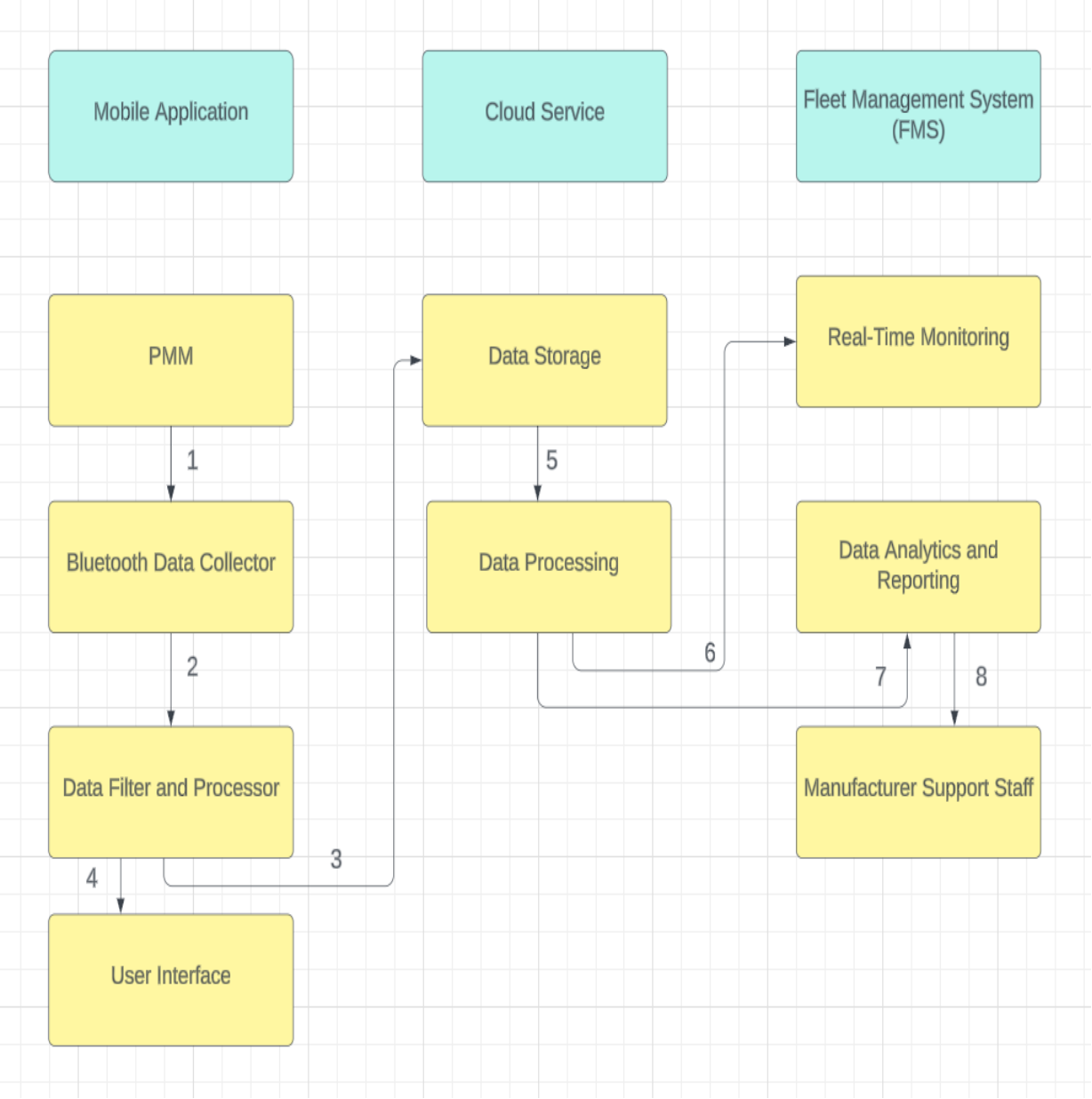
ADS Exercise: System Architecture for Electric Wheelchair Monitoring System

Data Flow Diagram



Connection Table

ID	Source	Destination	Data Description
1	PMM	Bluetooth Data Collector	Raw data including wheel speeds, battery life, user commands
2	Bluetooth Data Collector	Data Filter and Processor	Unfiltered PMM data
3	Data Filter and Processor	Cloud Service (Data Storage)	Filtered data including usage stats, battery levels, and commands
4	Data Filter and Processor	User Interface	High-level usage statistics
5	Cloud Service (Data Storage)	Cloud Service (Data Processing)	Stored PMM data for analysis
6	Cloud Service (Data Processing)	FMS (Real-Time Monitoring)	Processed data for real-time wheelchair monitoring
7	Cloud Service (Data Processing)	FMS (Data Analytics and Reporting)	Aggregated fleet data for analytics
8	FMS (Data Analytics and Reporting)	Manufacturer Support Staff	Reports and analytics accessed via web browser

Writeup

Public Health:

This project has significant implications for public health by ensuring that wheelchair users have access to reliable and safe mobility devices. The ability to monitor real-time usage data, such as battery levels, wheel speeds, and overall system health, allows for dynamic management of potential issues. For instance, if a wheelchair's battery is nearing depletion or if there is an unusual pattern in the wheel speeds indicating possible mechanical failure, the system can alert the user or the manufacturer before a critical failure occurs. This early detection is crucial in preventing accidents that could lead to injuries, thus safeguarding the physical well-being of the users. Additionally, by maintaining a fleet of well-functioning wheelchairs, healthcare providers and caregivers can offer better support to individuals with mobility challenges, reducing the burden on public health systems.

Safety & Welfare:

The safety and welfare of wheelchair users are the foundation of this system's design. The real-time monitoring capabilities ensure that users are constantly aware of their wheelchair's condition, allowing them to avoid situations where they might be stranded due to an unexpected equipment failure. For example, if the system detects a drop in battery performance, it can notify the user to recharge or replace the battery before it becomes critical. This approach minimizes the risk of users being left without mobility, which could be particularly dangerous in remote areas or during extreme weather conditions. The mobile app also empowers users by providing them with detailed information about their wheelchair's status, such as average miles traveled per charge or overall performance metrics, enabling them to make informed decisions about their mobility and maintenance routines.

Global Impact:

On a global scale, the implementation of this system could standardize the maintenance and monitoring of wheelchairs across different regions. This standardization ensures that regardless of where the wheelchair is used, the user has access to the same high level of safety and reliability. For manufacturers, this global applicability opens up new markets, as the system can be adapted to comply with local regulations and needs. Additionally, by providing consistent and reliable data on wheelchair performance globally, manufacturers can identify patterns and trends that might inform future product improvements, leading to better-designed wheelchairs that cater to the diverse needs of users worldwide. The global reach of this system can also contribute to reducing health disparities by ensuring that high-quality wheelchair monitoring and maintenance are accessible to users in both developed and developing regions.

Cultural Inclusivity:

The system's design is highly inclusive, recognizing the diverse needs and preferences of wheelchair users across different cultural contexts. The mobile application's user interface is customizable, allowing users to choose from multiple languages and cultural settings, which makes the system accessible to a broader audience. For instance, the app can be localized to display information in the user's native language and adapt to local measurement units, such as kilometers or miles. This level of customization ensures that the system is user-friendly and resonates with users from different backgrounds, enhancing their overall experience. Moreover, the system can be adapted to meet cultural expectations around healthcare and mobility, making it a valuable tool in promoting inclusivity in healthcare technology.

Social Impact:

Socially, this project plays a crucial role in fostering independence and confidence among wheelchair users. By providing real-time data and insights into their wheelchair’s performance, users can take control of their mobility, planning their activities with greater confidence and reducing their reliance on external assistance. This independence is particularly empowering for users who value autonomy in their daily lives. Additionally, the system's ability to provide caregivers and family members with access to usage data ensures that they can offer timely support when needed, without infringing on the user's independence. The project also has the potential to enhance social inclusion by enabling wheelchair users to participate more fully in society, knowing that their mobility device is reliable and well-maintained.

Environmental Sustainability:

From an environmental perspective, the system contributes to sustainability by promoting the longevity of wheelchairs through maintenance. By reducing the frequency of replacements and repairs, the system minimizes waste associated with the manufacturing and disposal of mobility devices. For example, by monitoring battery health and advising timely maintenance, the system can extend the lifespan of batteries and other components, reducing the need for new parts and lowering the overall environmental footprint. Additionally, the data collected can be used by manufacturers to design more durable and eco-friendly wheelchairs in the future, further supporting environmental sustainability. The system's focus on efficient resource use aligns with broader efforts to reduce waste and promote sustainable practices in the healthcare industry.

Economic Efficiency:

Economically, this project offers significant benefits to both users and manufacturers. For users, the system reduces the likelihood of unexpected repairs and replacements, leading to cost savings over time. By identifying potential issues before they become critical, users can address them through routine maintenance, avoiding the higher costs associated with emergency repairs or

purchasing new equipment. For manufacturers, the data collected through the system provides valuable insights into product performance, allowing them to optimize their service operations and reduce warranty costs. By leveraging data analytics, manufacturers can predict and prevent failures, improving customer satisfaction and reducing the financial impact of product recalls or repairs. Additionally, the system's ability to streamline maintenance processes can lead to more efficient operations, further enhancing economic efficiency.

Conclusion

This comprehensive system architecture for the Electric Wheelchair Monitoring System addresses critical factors across public health, safety, global applicability, cultural inclusivity, social impact, environmental sustainability, and economic efficiency. By integrating advanced monitoring and data analysis capabilities, the system provides a robust and user-centric solution that enhances the quality of life for wheelchair users worldwide. The detailed dataflow diagram and connection table offer a clear roadmap for developing and implementing this innovative solution, ensuring that it meets the needs of users, manufacturers, and other stakeholders alike.