# [**ITEC 2706 Section B - 23F**](https://remote.algomau.ca/d2l/home/15218)

# **GROUP NUMBER 21**

# **TOPIC: Smart Mobile Technologies in Intelligent Transportation Systems (Smart public transportation management system)**

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# **Smart public transportation management systems**

**What is it? (e.g., infrastructures, standards, etc.)**  
Smart public transportation management systems integrate modern technology and data-driven solutions to enhance the efficiency, security, and overall performance of public transportation networks. Key components include Intelligent Transportation Systems (ITS) for real-time monitoring, communication networks facilitating data exchange, data analytics for informed decision-making, and mobile applications providing passengers with real-time information and ticketing options. Smart infrastructure, such as adaptive traffic signals and digital displays at bus stops, contributes to seamless operations. Security systems address data security and overall system safety. Public engagement tools, including surveys and social media, ensure ongoing improvements based on user preferences. The ultimate goals include reducing traffic, increasing safety, improving transportation service quality, and fostering sustainable urban growth.

**What are the objectives? / What problems are solved?**

Smart public transportation management systems aim to address various challenges and improve the overall effectiveness, safety, and efficiency of public transportation. The key objectives and problems solved include optimizing system productivity by minimizing delays and improving routes to enhance commuters' preference for public transport. Ensuring the credibility of timetables is another objective, achieved by reducing delays, interruptions, and increasing the precision of arrival and departure times to build passenger trust. Enhancing security is a priority, utilizing real-time monitoring, surveillance cameras, and collision avoidance systems to lower accident rates and improve overall safety for both users and drivers.

Efficient utilization of resources is targeted by dynamically adjusting staffing levels, routes, and timetables based on actual demand, thereby reducing resource waste. The goal to cut down on traffic congestion involves promoting public transit as a practical alternative to private vehicles, contributing to a reduction in traffic jams and environmental impact. Improving the traveler experience is achieved through real-time information dissemination on routes, timetables, and service interruptions via mobile applications and digital displays. Encouraging sustainability in public transportation involves implementing eco-friendly practices, supporting green projects, maximizing fuel efficiency, and incorporating electric or hybrid vehicles. In summary, smart public transportation management systems aim to create a more reliable, efficient, and user-friendly transportation network, addressing challenges associated with public transit and meeting diverse demands of urban populations.

**What mobile technologies are employed in it?**

Key Technologies in Smart Public Transportation Management Systems:

* IoT (Internet of Things)
* Wireless Technology (Mobile Connectivity Standards)
* MEMS-based Sensors and Actuators
* Data Processing with Soft Computing and Artificial Intelligence

Mobile Technology Integration:

* Utilization of IoT-enabled devices for real-time data in vehicles and infrastructure
* Integration of MEMS-based sensors into mobile devices for traffic monitoring
* Application of wireless technology for data communication in transportation systems
* Inclusion of mobile applications for data processing, situation awareness, and decision-making. (Conceptualization, et al., 2020)

Monitoring and Detection Methods:

* Passive Monitoring:
* Video cameras
* Infrared cameras
* Signal transmitters
* Active Monitoring:
* Use of predefined inputs and trajectories
* Generation of test signals for vehicle systems and infrastructure.(Conceptualization, et al., 2020)

Application in Transportation Management:

* Enhancing efficiency through real-time monitoring
* Improving safety with active control and detection systems
* Supporting decision-making with data processing and AI
* Integration of technologies into a comprehensive Smart Public Transportation Management System. (Conceptualization, et al., 2020)

**What types of connectivity/communication technology does it use?**

* Wireless Communications: Wi-Fi enables internet connectivity for passengers and data exchange, while Bluetooth supports short-range communication for tasks like ticketing.
* Cellular Networks: 4G/5G facilitates high-speed data transfer, enabling real-time communication between vehicles, control centers, and passengers.
* GPS Tracking GPS Tracking provides accurate real-time location information for vehicles, aiding in route optimization and passenger information.
* RFID (Radio-Frequency Identification): RFID, including contactless smart cards, is used for electronic ticketing, allowing passengers to access public transportation services without physical tickets.
* Ethernet and Controller Area Network: Ethernet Connectivity is employed for in-vehicle communication networks, connecting various components and systems.
* Cloud Computing: Cloud Computing involves centralized platforms for data storage and processing, supporting efficient management and analysis of transportation-related data.
* IoT (Internet of Things): IoT Devices, embedded in vehicles and infrastructure, enable real-time data collection and monitoring, contributing to system efficiency and performance.
* Satellite Communication: Satellite Connectivity ensures continuous communication in areas with limited terrestrial network coverage, enhancing the system's reach and reliability.
* Inter-Vehicle Communication: Inter-Vehicle Communication, including Vehicle-to-Vehicle (V2V) communication, improves traffic flow and safety by enabling vehicles to share information and coordinate movements. (Mazur, 2022) (Media, 2022) (Locke, 2022)

**Diagram of the system from our design.**

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Home or Search and Offer

Create Account

User Profile

Reservation and Trip

Search

Emergency Service

Feedback

Payment Processing

**What are the special challenges in it?**

Putting in place a smart public transit system involves particular issues that must be carefully considered. To begin, integrating disparate technologies such as IoT and AI necessitates thorough planning to enable seamless compatibility across multiple components. This intricacy might be a significant impediment throughout the development and deployment phases.

Another significant difficulty is data security and privacy. To manage and defend the massive amounts of data created by smart transport systems while preserving passenger privacy, comprehensive cybersecurity measures and compliance with privacy legislation are required.

Financial restrictions are a key impediment, particularly in obtaining finance for the initial expenditures of deploying smart infrastructure. Cities with limited budgets may struggle to find resources to assist the development and deployment of these innovative transport systems.

It is a complicated problem to adapt current infrastructure to accept contemporary smart technology. Legacy systems may be incompatible with smart transportation's technological needs, needing complex upgrades and alterations.

The importance of user adoption and accessibility cannot be overstated. Providing the benefits of smart mobility to different user groups, including people with impairments, necessitates a commitment to inclusive design and extensive user education.

Navigating complicated regulatory frameworks and handling legal concerns such as data ownership, liability, and compliance with transportation rules adds another degree of difficulty to smart transportation system deployment.

The ability to withstand cyber assaults is a key problem. Because smart transport systems are vulnerable to hacking and ransomware attacks, it is critical to implement effective cybersecurity safeguards to ensure service continuity.

Concerns about job displacement, aversion to change, and the overall influence on everyday commute experiences all contribute to public perception and adoption of new transportation technology.

A significant concern is balancing the benefits of smart transport with environmental sustainability. While these systems seek to improve efficiency, their ecological footprint and overall environmental effect must be carefully regulated.

Finally, scalability and futureproofing pose issues in planning for changing urban population demands and reacting to technological advances. Long-term scalability must be carefully considered to ensure the sustained viability of smart public transit systems. (Stofan, 2023)

**The digital prototype for the mobile application with software Figma.**

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