KHATIB & ALAMI

SMART CITIES, SMART MOBILITY

A Whitepaper on Smart Urban Rail Solutions in the MENA Region

EXECUTIVE SUMMARY

According to the Population Reference Bureau (PRB), Washington DC, USA, the urban population in the Middle East and Africa region (MENA) is reaching 80% growth for the duration of 2001-2050. This rapid growth has imposed significant pressure on transportation infrastructure, increasing traffic congestion and air pollution. MENA governments are investing in smart urban rail solutions as viable options to address these challenges, enhancing mobility, reducing congestion, and minimizing environmental impact.

Despite efforts to enhance roads and public transportation and expand the rail transit systems, challenges such as prolonged travel times, higher transportation costs, operational inefficiencies, safety, passenger experience, and heightened air pollution persist. Without strategic intervention, these problems are projected to intensify. This whitepaper emphasizes the necessity of integrating smart mobility platforms into the rail transit ecosystems, moving to sustainable and connected rail transit systems.

Smart cities powered by digital technology are crucial to improving urban environments by mitigating traffic congestion, optimizing waste management, and improving air quality, among other things.

This whitepaper provides a roadmap for governments and transportation authorities in the MENA region, offering actionable insights and recommendations to develop smart urban rail systems that ensure high service quality and affordable prices for users. By addressing current transportation challenges, the region can promote an integrated, sustainable, and efficient urban rail network, ultimately enhancing communities' quality of life.

THE OPPORTUNITY

The MENA region has experienced rapid urban growth, and public transportation systems are being developed to serve the growing population better. Although there has been a heavy reliance on cars, efforts are being made to address issues such as traffic congestion, accidents, and greenhouse gas emissions. The aim is to enhance the daily commuting experience, support businesses, and improve communities.

To tackle transportation challenges, governments and public authorities have invested in roads and public transportation infrastructure to meet the increasing demand, focusing on roads and rail networks. This proactive approach will help improve the transportation network's capacity and create a more sustainable and efficient system. As the urban rail transit network expands, extended efforts are being made to improve passengers' experience and safety while keeping pace with growing demands, reducing congestion, and managing costs to ensure technical efficiencies.

If the right solutions are not found, daily commuters will continue to experience prolonged travel times and higher transportation costs. Businesses will face logistical inefficiencies and increased operational costs. The broader community will suffer from heightened air pollution as people return to using their private cars more and more. Without intervention, these problems will only intensify.

THE HISTORY

The MENA region has been making significant progress in urban transportation planning. With rapid urbanization, there has been a focus on developing adequate infrastructure to support the growing population. Efforts to modernize transportation systems are underway to improve public transportation options, primarily urban rail transit systems, and alleviate congestion on roadways in many cities across the region. These positive steps are expected to have a beneficial impact on daily life and the economy.

THE EVOLUTION OF URBAN RAIL IN THE MENA REGION.

The MENA region's urban rail has evolved over the years.

In the 19th and early 20th centuries, rail systems in the MENA region were primarily constructed for resource transportation, pilgrims' trips, and connecting strategic locations, such as the Hijaz Railway connecting Damascus and Medina and various lines in Egypt aimed at linking cities and ports.

In the 1970s and 1980s, Egypt began developing urban rail systems as part of broader modernization efforts. It introduced its first metro line in 1987. Oil revenues led to significant investments in road infrastructure, particularly in Gulf countries, which delayed the development of urban rail systems.

In the late 1990s, environmental concerns led to a shift towards public transportation. For instance, in 1997, Dubai leaders proposed that the Dubai Metro respond to escalating traffic demands. However, most investments continued to be directed towards road expansions rather than comprehensive public transport systems, including urban rail. In the early 2000s, Egypt and Iran began exploring modern urban rail projects, but more integration was needed to create efficient networks. By the 2010s, most MENA countries had urban rail transportation systems but faced growing demand and cost challenges. This period also saw the emergence of smart city concepts, which emphasized the integration of digital technologies into urban management, including transportation. Notable projects include the Dubai Metro, launched in 2009, the Riyadh Metro, the Doha Metro, and the Casablanca Tramway.

The present-day scenario highlights

a clear need for the MENA region to embrace smart urban rail systems, leveraging Information and Communication Technology (ICT) capabilities to transform urban mobility. This includes developing smart railway stations, rolling stock, and advanced Communication-Based Train Control systems (CBTC), ensuring a sustainable, efficient, and environmentally friendly transportation network for the region's continued urban growth.

To understand how ICT can transform urban mobility, we first must understand the types of urban rails that can benefit from these technologies.

TYPES OF URBAN RAIL TRANSIT SYSTEMS

Urban rail transit systems encompass various types of local rail transport systems that provide public transport in urban or suburban areas. These systems can be categorized into various types, sometimes overlapping because some systems or lines have aspects of multiple types.

TRAINS

Trains are wheeled vehicles running on tracks, typically two parallel steel rails. They are used for around 8% of passenger and freight transport worldwide. Thanks to their diesel or electrical locomotive power, they can carry heavy loads with greater energy efficiency and safety.

TRAMS

Trams are street-based transit systems with frequent stops and low capacity, powered by electric or diesel energy. Passengers typically board at street level, but low-floor trams may allow level boarding.
Modern trams can operate as self-propelled trains coupled through units, often part of light rail transit. However, trams differ because they frequently share the platform with vehicular traffic and do not have signal priority.

LIGHT RAIL TRANSIT (LRT)

The light rail transit (LRT) system is a rail-based transit system with higher capacity and speed than trams. It operates in an exclusive right-of-way separated from automobile traffic and generally operates with multiple units rather than single tramcars. Light rail transit evolved from trams/streetcars and varies in speed and capacity, ranging from slightly improved tram systems to rapid transit systems with level crossings. LRTs are powered by electricity or diesel.

AUTOMATED RAPID TRANSIT (ART)

Automated Rapid Transit (ART) systems are fixed guideways with suspension tracks that support and guide driverless vehicles along their length. These vehicles can be rubber-tired or steel-wheeled or use other traction systems such as air cushions, suspended monorail, and maglev. The guideway acts as both a physical support and a means of guidance, similar to a road. Due to shorter trains and stations, automated lines can be cheaper than conventional lines.

ART systems range from limited people-movers at airports to more complex automated train systems, including subway-like advanced rapid transit (ART) systems and personal rapid transit (PRT) systems, which offer direct point-to-point travel along a switched network.

MONORAIL

A monorail is a railway system with a single rail or beam, often found in large cities, airports, and theme parks. It can operate at ground level, below ground, or in subway tunnels.

Monorail vehicles can resemble LRT vehicles and can be operated with or without staff. They can be rigid vehicles, articulated single units, or multiple units coupled into trains. In urban areas, monorails are sometimes used alongside conventional parallel-railed metro systems like other ART systems. Monorails avoid red lights, intersection turns, and traffic jams and can collide only with other vehicles on the same system. Monorails can be quieter than diesel buses and trains. They draw power from the track structure, unlike other transit modes that may use third rail or overhead power lines and poles.

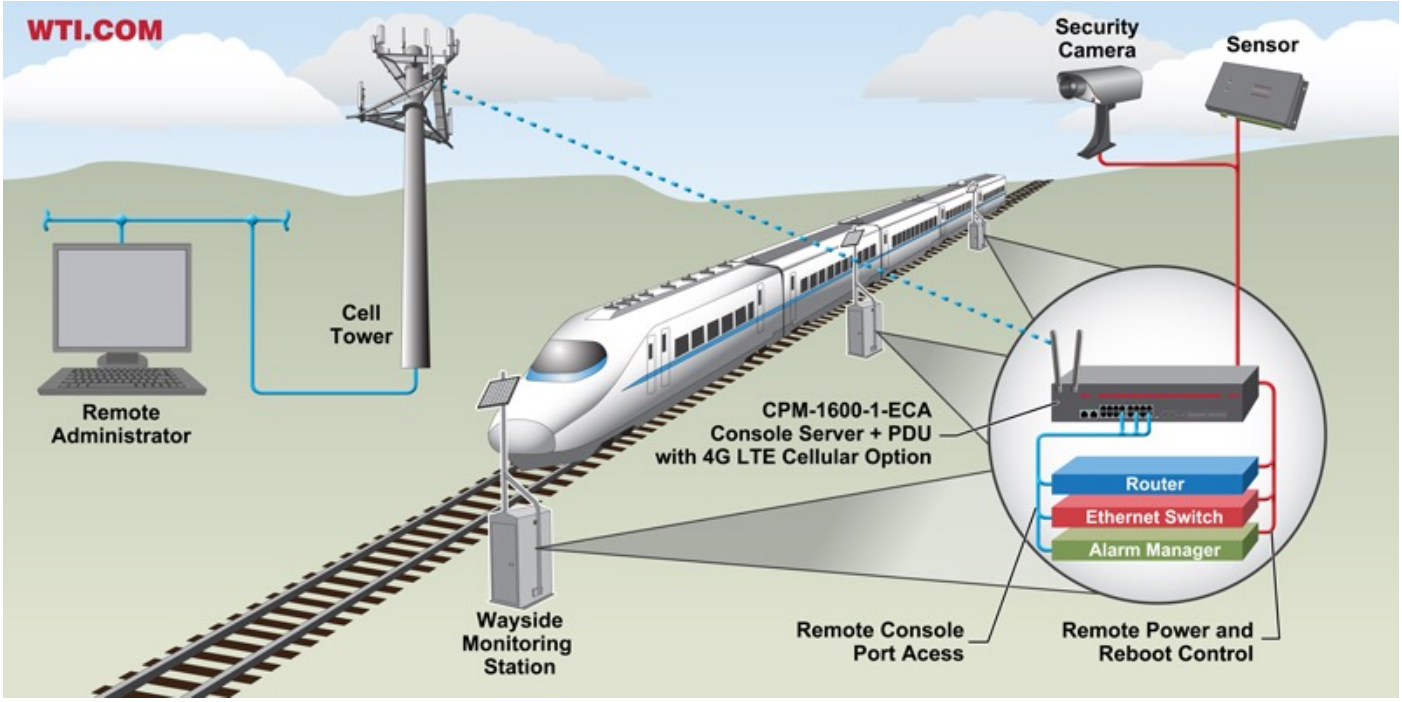
MASS RAPID TRANSIT (MRT)

The mass rapid transit (MRT) system, also known as the "heavy rail," is a high-capacity, frequent, and full-grade railway in urban areas, distinguishing it from light rail and bus rapid transit.

As the Middle East continues to make significant strides in urban development and connectivity, a wave of ambitious rail projects is set to redefine the region's transportation landscape: Dubai Metro Blue Line expansion, Abu Dhabi Metro, Riyadh Metro, Muscat Metro, Bahrain Metro, Kuwait Metro, Cairo Metro Line 6 expansion, Etihad Rail in UAE, UAE-Oman Rail, Iraq-Turkey Rail, KSA dream of the desert Rail, alula train in KSA, The Line-Oxagon High-speed rail in NEOM, and Riyadh-Kuwait City High-speed rail.

THE SOLUTION

The modern urban environment demands an advanced and efficient transport system to handle the increasing population and the corresponding mobility needs. The proposed solution emphasizes the integration of smart railway infrastructure, smart rail stations, smart rolling stock, and CBTC systems to create a comprehensive, efficient, and sustainable urban rail network.



Line Side ICT System

Smart Rail Infrastructure

Smart rail infrastructure includes all components necessary for safe and efficient railway traffic. This infrastructure is divided into railway tracks and line-side systems.

Ballasted and non-ballasted tracks

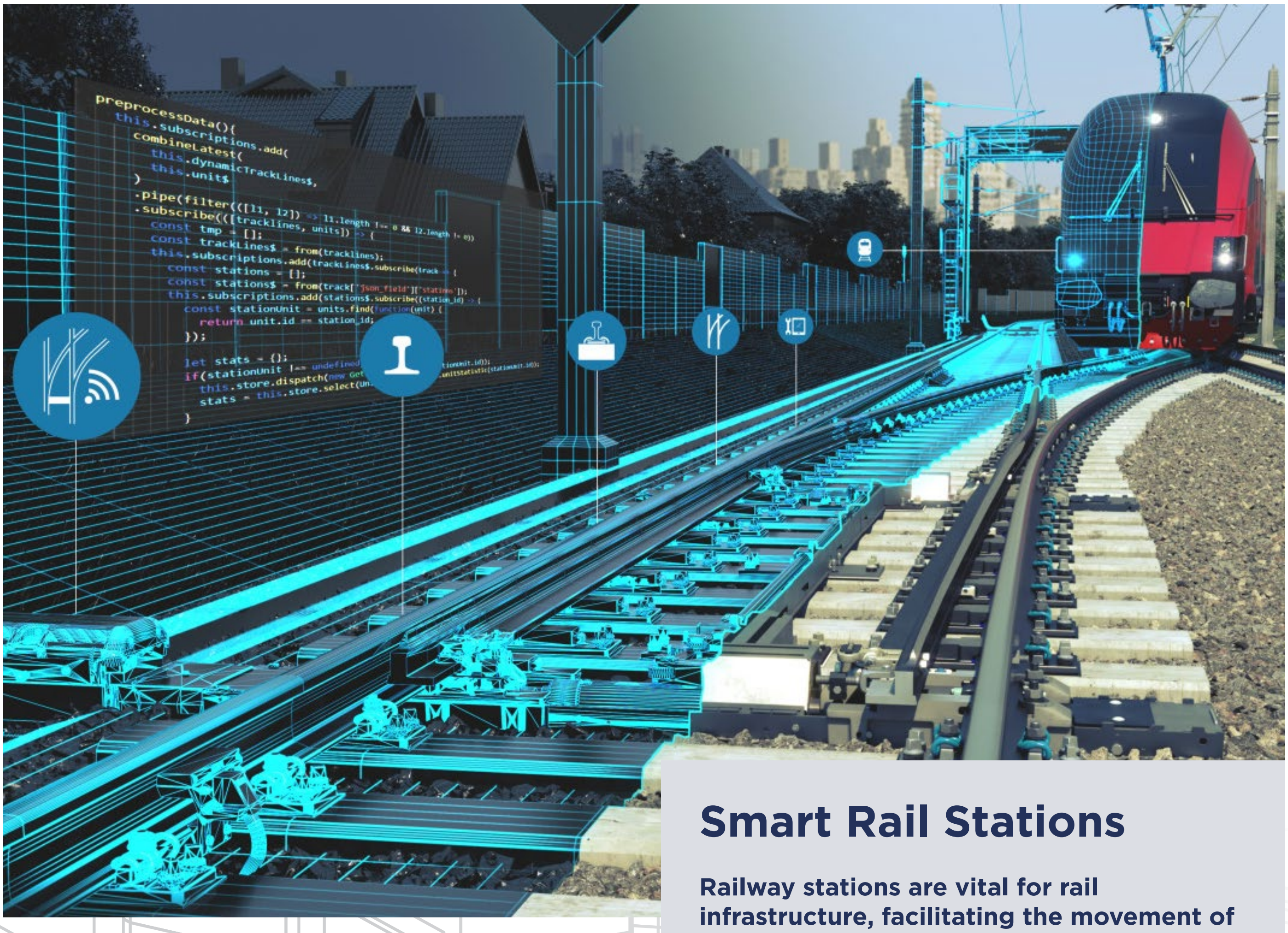
Overhead Electrification for railways

- Railway tracks are designed to support heavy rolling stock and consist of sub-components transferring static and dynamic traffic loads to the foundation. The lower part of the superstructure, called track bed layers, varies based on cost savings and maintenance requirements. For example, ballasted tracks are used above ground for lower speed. In contrast, non-ballasted tracks are preferred for underground track sections where maintenance requirements are restricted and stability and durability are required.

- Line-sided systems include level crossings, electrification, signaling, and telecommunication systems. They require specialized knowledge of power supply systems, low-voltage telecommunication, and automated control systems to ensure seamless operation.

Level Crossing

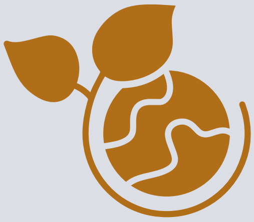
Third rail electrification



Smart Rail Stations

Railway stations are vital for rail infrastructure, facilitating the movement of people, goods, materials, and energy. They offer tailored services and play a crucial role in urban sustainability by enabling intramodality, environmentally friendly and active transportation and logistics, and accessibility. Smart railway stations are an essential part of a smart city. They aim to implement ICT and intelligence to improve accessibility and amenities for passengers accessibility and amenities. The principal drivers in developing stations for the future should be smart management, sustainable practices, and passenger experience.

Smart management:
smart management aims to enhance the passenger's experience by implementing micro-mobility modes and creating mini hubs within the city, offering amenities like Wi-Fi connectivity and information centers, making stations more attractive and efficient.



Sustainable practices:
smart rail stations improve economic growth and mitigate negative impacts like noise pollution. They can be energy-efficient, utilizing solar panels and geothermal systems that circulate hot water under the floor for sustainable practices.

Smart railway station as an active living space

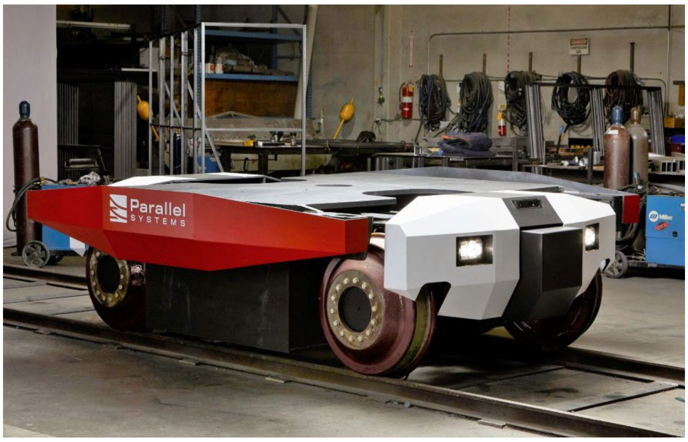
Enhanced passenger experience:
smart rail stations enhance accessibility and service convenience through mobile apps, e-ticketing, real-time passenger information, and pedestrian mobility sensors, improving traffic flow and overall passenger satisfaction.

AI-Based Smart waste management bins in stations

Locomotives

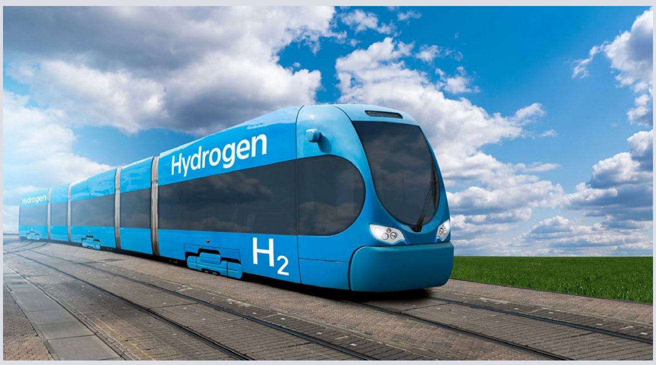
Single Rail Vehicle

Trailer Vehicle



Engineering Vehicle

Battery cell Locomotive



Hydrogen Locomotive

Smart Rolling Stock

There are four types of rolling stock: power vehicles, single rail vehicles, trailer vehicles, and engineering vehicles. Power vehicles or Locomotives are self-propelled and may be used to haul trailer vehicles, transport several passengers, or shunt.

Locomotives can be powered by steam, diesel, gas, or electricity, while single rail vehicles can be powered by diesel, gas, or electricity. Alternative propulsion technologies like hydrogen, batteries, or fuel cells are becoming new fuel technologies for urban rail services due to their low greenhouse emissions and mobile usage, considered future rail transportation technology.

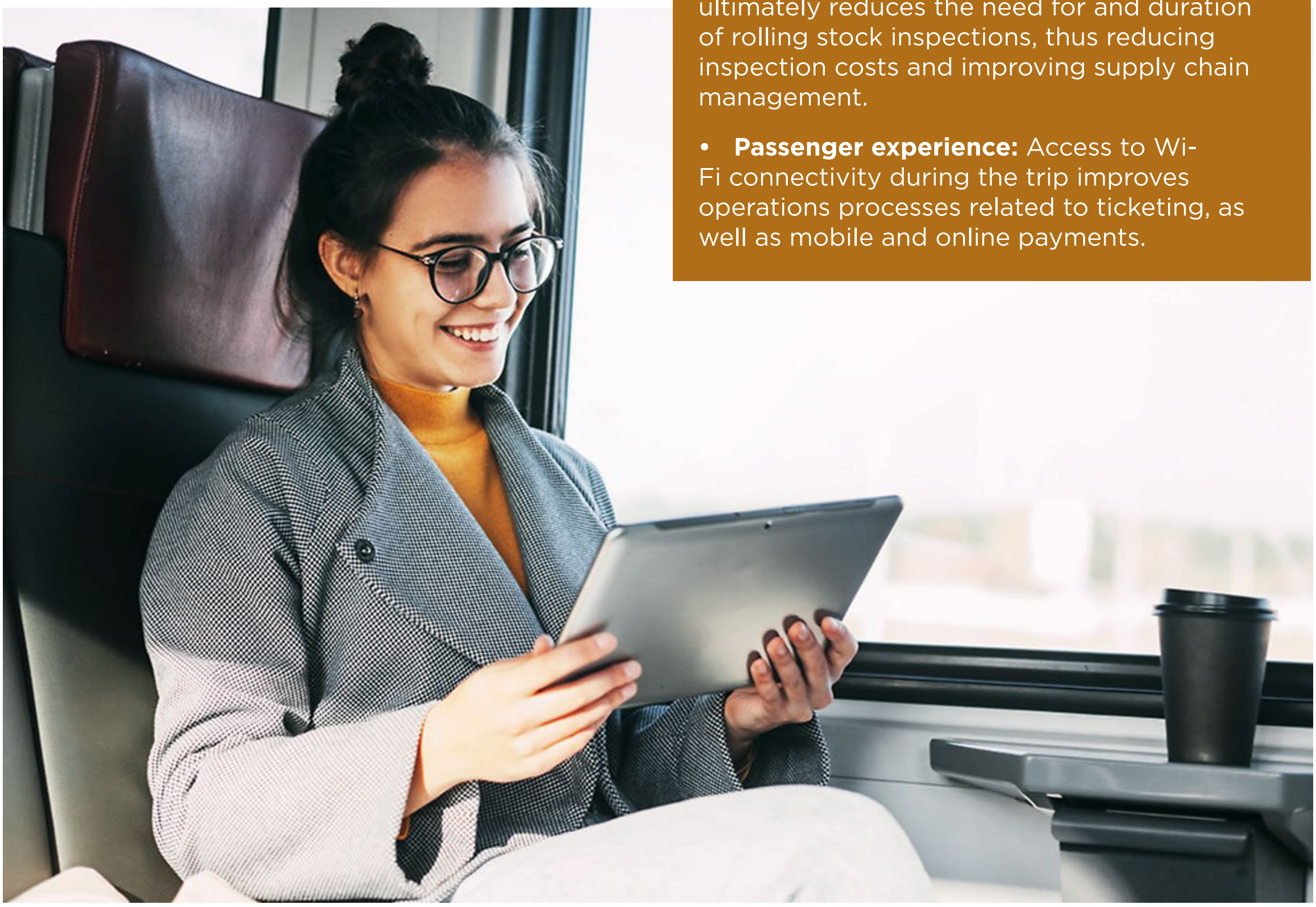
The rolling stock includes trailer cars for passengers or freight and engineering vehicles for track installations and maintenance. The locomotive powers the movement of the trailers. Each rolling stock consists of the vehicle body for passengers and the bogies (trucks) with small components and wheelsets that move on the rails, enabling the train's movement.

Bogy

Truck

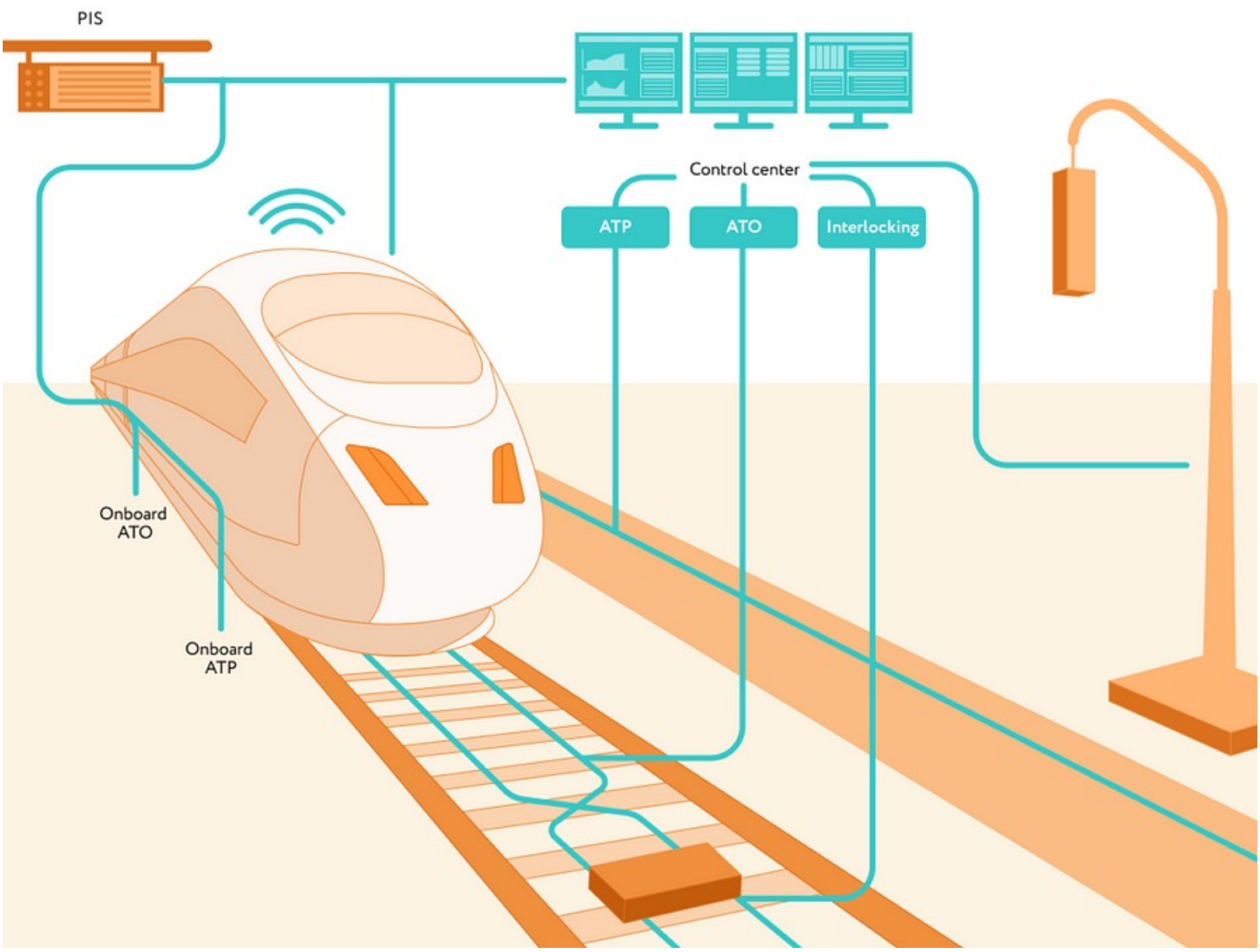
A smart rolling stock is not just a luxury feature with moderate cost for new trains; it is also a significant factor in improving Total Cost of Ownership (TCO) and operations in numerous ways. Continuous reporting of minor faults and redundancy losses allows for early identification of in-service failures. This means that a significant portion of these failures can be mitigated with corrective maintenance, and corrective maintenance activities can minimize many failures before they impact customers. There are many benefits to using intelligent rolling stock:

- **For operations:** the constantly updated health status reduces uncertainty about a train set's remaining capabilities and enables better usage of impaired trains.
- **For maintenance:** access to detailed onboard data allows for diagnosis activities while the train is still running, rather than waiting for it to be at the depot. It also enables anticipation of logistic issues, such as preparing a maintenance slot on a specialized track, ordering spare parts, or redirecting the asset to another depot. Detailed sensor data ultimately reduces the need for and duration of rolling stock inspections, thus reducing inspection costs and improving supply chain management.
- **Passenger experience:** Access to Wi-Fi connectivity during the trip improves operations processes related to ticketing, as well as mobile and online payments.



COMMUNICATION-BASED TRAIN CONTROL SYSTEM (CBTC)

CBTCs are designed to increase track capacity by reducing the time interval (headway) between trains, making railway traffic management safer and more efficient.



Advanced signaling: CBTC uses telecommunications between the train and track equipment to track the train's position precisely, reducing headways and improving safety. This system is essential for most high-capacity urban rails, such as ART, MRT, LRT rapid transit, commuter rail, and high-speed metros.

Components and Functions: CBTC systems include wayside equipment, onboard equipment, train-to-wayside communication subsystems, ATP (Automatic Train Protection), ATO (Automatic Train Operation), ATS (Automatic Train Supervision), and interlocking systems. These components work together to ensure safe and efficient rail operations, offering various automation levels up to fully driverless operations.

The reliability and performance of the CBTC system strongly rely on well-coordinated interactions between all its components to provide train detection and operational control via wireless protocols. CBTC is a complex system that requires the following components for its implementation:

- **Wayside equipment** includes the interlocking and the subsystems controlling every zone in the line or network (typically containing the wayside ATP and ATO functionalities). A central command, ATS, controls the system.
- **CBTC onboard equipment**, including ATP and ATO subsystems, is in the vehicles.
- **Train to wayside communication subsystem,** currently based on radio links.
- **The onboard ATP system** controls train speed and applies brakes as needed. It communicates with the wayside ATP subsystem to exchange necessary safety information.
- **The onboard ATO system** controls traction and braking, keeping the train within the ATP subsystem limits. It can facilitate driver functions, automatically operate the train, and adapt driving strategies to reduce power consumption.
- **Wayside ATP system** is a train protection system that ensures trains stay within permitted speeds set by signaling and activates the emergency brake if necessary.
- **The wayside ATO system** operates trains automatically with minimal driver supervision. It is a subsystem within the automatic train control, performing functions like programmed stopping, speed adjusting, and door operation. The Grade of Automation (GoA) indicates the degree of automation, with higher levels requiring no staff onboard. Lower grades of automation have a driver present to mitigate risks. Driverless automation is primarily used on automated guideway transit systems with isolated tracks for more accessible safety assurance.
- **Communication system** / CBTC systems use a digital networked radio system for bidirectional communication between track equipment and trains. They commonly use the 2.4GHz band, like Wi-Fi, but may also use other frequencies like 900MHz (US) or 5.8GHz.
- **ATS system** is commonly integrated with CBTC solutions to manage traffic and interface with external systems, among other tasks.
- **The Interlocking system** is responsible for vital control of trackside objects such as switches and signals. Its functionality may be integrated into the wayside ATP system in simpler networks.

Implementing these smart solutions within the MENA region will address current transportation challenges, encouraging an integrated, sustainable, and efficient urban rail network.
This comprehensive approach will alleviate traffic congestion and reduce environmental impacts, enhancing urban life quality.

THE BENEFITS

Adopting the smart railway solutions outlined in this white paper offers many tangible and intangible benefits that make a compelling business case for modernization. Integrating smart rail infrastructure, stations, rolling stock, and communication-based train control systems (CBTC) presents a transformative opportunity for urban rail transit networks. Below, we detail the significant benefits and provide a guide on what to consider when selecting a vendor.

By adopting these smart railway solutions, stakeholders will achieve:

- **Enhanced Operational Efficiency:** Advanced technologies like IoT real-time monitoring and predictive maintenance help minimize delays and improve overall operational efficiency.

- **Enhanced Safety:** Smart rail systems use sensors and AI to detect potential hazards, ensuring a safer travel experience for passengers and reducing the risk of accidents.

- **Increased Capacity and Reduced Congestion:** CBTC systems increase track capacity by reducing the headway between trains, leading to less congestion and smoother rail traffic flow. By increasing the efficiency and capacity of rail networks, cities can reduce road traffic congestion and the associated economic and environmental costs.

- **Improved Passenger Experience:** Features such as real-time information updates, Wi-Fi connectivity, and mobile ticketing enhance passengers' convenience and comfort.

- **Sustainability and Environmental Benefits:** Green technologies such as solar panels, geothermal systems in stations, and alternative propulsion technologies in rolling stock reduce carbon footprint and promote sustainability.

- **Economic Growth and Urban Development:** Enhanced rail systems boost urban areas' economic potential by improving accessibility, reducing traffic congestion, and stimulating local businesses and real estate development.

- **Operational Cost Savings:** Intelligent energy management systems optimize energy consumption, leading to significant cost savings and reduced environmental impact. Automation and efficient resource management result in lower operational costs.

- **Better Assets Management:** Predictive analytics and IoT enable proactive maintenance, extending the lifespan of infrastructure and rolling stock.

- **Traffic Management:** Smart systems help in better scheduling and routing of trains, reducing congestion and improving punctuality.

- **Data-driven decisions:** The collection and analysis of data from various sources enable better decision-making and strategic planning.

WHERE TO LOOK FOR SOLUTIONS

The components of rail systems demonstrate the diverse technical expertise required for implementation and operational services. This includes expertise in architecture, transportation engineering, power supply systems, structural mechanics, soil mechanics, ICT, planning, low voltage communication systems, automated control systems, and rolling stock technologies.

Rail transportation has evolved over the decades, thanks to the investment in research and development (R&D) by firms in countries with a long history of rail transport services, such as Germany, Japan, France, China, the USA, and the United Kingdom. International rail firms like Alstom, Hitachi, Bombardier, Thales, and Siemens Mobility specialize in all aspects of rail technology. In contrast, others, such as ABB, the China Railway Rolling Stock Corporation (CRRC), and Mitsubishi Electric, focus on specific elements such as propulsion systems for rolling stock, signaling, and electric systems.

The level of technology required for urban rail subsystems demonstrates the technical barriers to indigenization. Subsystems that require higher technology have evolved to improve commuters' safety, comfort, and reliability. It is difficult for new firms or technology latecomers in emerging economies to develop the current rail technology and compete with already established firms. As a result, businesses in the countries above have dominated the rolling stock subsystems.

Smart rail technology trends can be tracked through industry events such as InnoTrans and Railtex, publications like Railway Gazette, government initiatives such as the European Union's Shift2Rail, research institutions like the MIT Center for Transportation & Logistics, and professional associations like UITP and UIC.

Engaging with consulting firms that offer expertise in railway systems and urban planning will help ensure a holistic approach to modernization. By partnering with consulting firms specializing in railway systems and urban planning, such as **Khatib & Alami**, governments and authorities can ensure a comprehensive and well-rounded approach to modernizing their infrastructure. These experts offer valuable insights on maximizing the efficiency and effectiveness of upgrades. By carefully considering each vendor's cost and potential ROI, as well as their commitment to sustainability and support services, they can make informed decisions that will benefit communities and the environment in the long run.

Considerations for Selecting a Vendor

When selecting a vendor for smart railway solutions, consider the following criteria:

Proven Expertise: Choose vendors with extensive experience and successful implementations of similar projects.

Comprehensive Solutions: To ensure seamless integration, opt for vendors offering end-to-end solutions, including infrastructure, rolling stock, stations, and CBTC systems.

Technological Compatibility: Ensure the vendor's solutions are compatible with your existing infrastructure and systems. Check for interoperability with other technologies you might be using.

Customization and Flexibility: Select vendors capable of customizing solutions to meet specific needs and adapting to future technological advancements.

Sustainability Focus: Prioritize vendors committed to sustainability, offering green technologies and practices that align with environmental goals.

Support and Maintenance: Ensure vendors provide robust support and maintenance services, including predictive maintenance and real-time diagnostics.

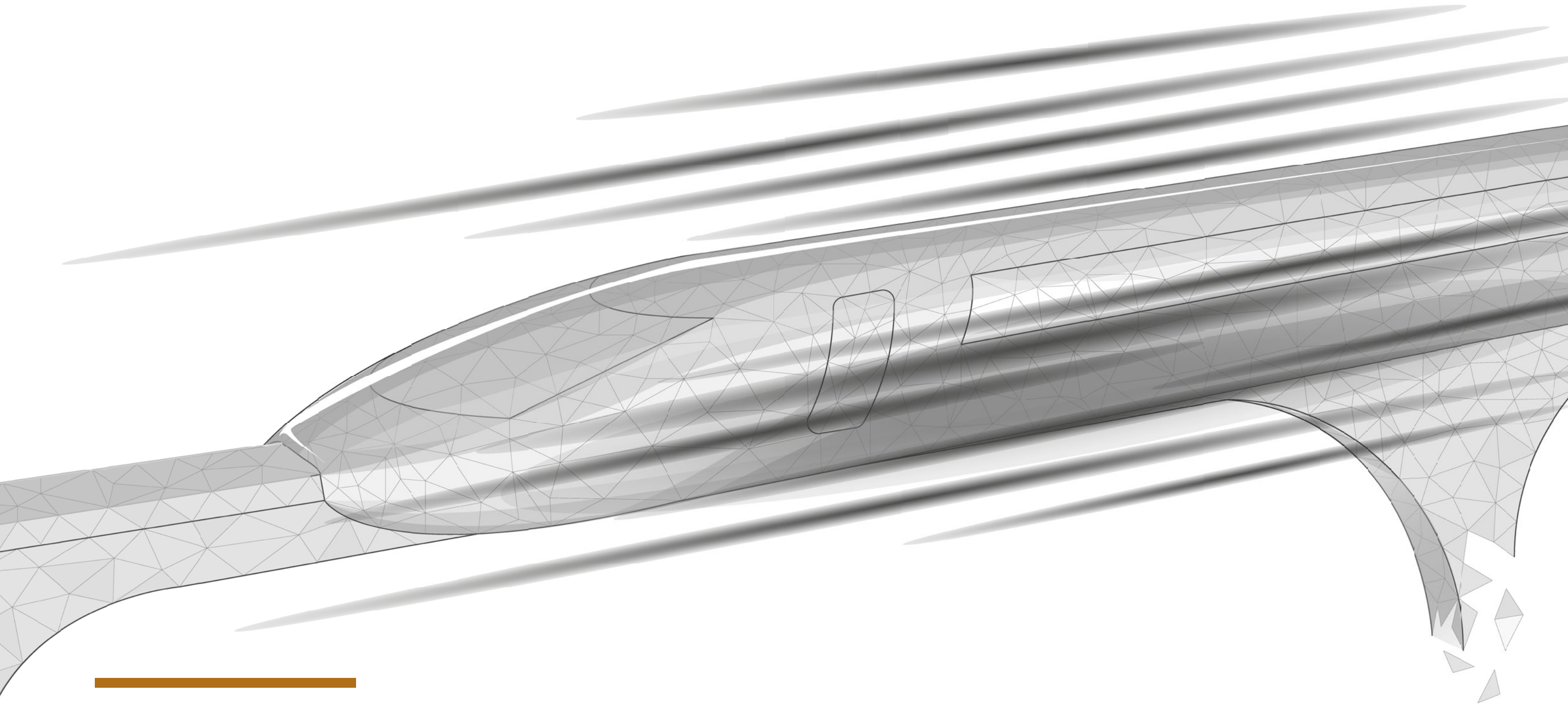
Cost and ROI: Evaluate the Total Cost of Ownership (TCO) and Return On Investment (ROI) to ensure financial viability.

Data Security & Privacy: Ensure the vendor adheres to stringent data security and privacy standards. This is critical for protecting sensitive operational data and passenger information.

Innovation and R&D: Consider the vendor's commitment to innovation and research and development. Vendors that invest in R&D are likely to offer cutting-edge solutions and stay ahead of industry trends.

Compliance and Standards: Ensure the vendor's solutions comply with industry standards and regulations. This is particularly important for safety and operational efficiency.

Partnerships and Collaborations: Check if the vendor has established partnerships with other key players in the industry. Strong collaborations can enhance the overall quality and integration of the solutions.



Adopting smart railway solutions offers a strategic pathway to modernize urban transportation, delivering significant benefits in operational efficiency, passenger experience, sustainability, and economic development. By carefully selecting experienced and innovative vendors, stakeholders can unlock the full potential of smart rail systems, creating a resilient and future-ready urban transport network.

UNDERSTANDING SMART URBAN RAIL TRANSIT SYSTEM IMPLEMENTATION TECHNICAL BARRIERS

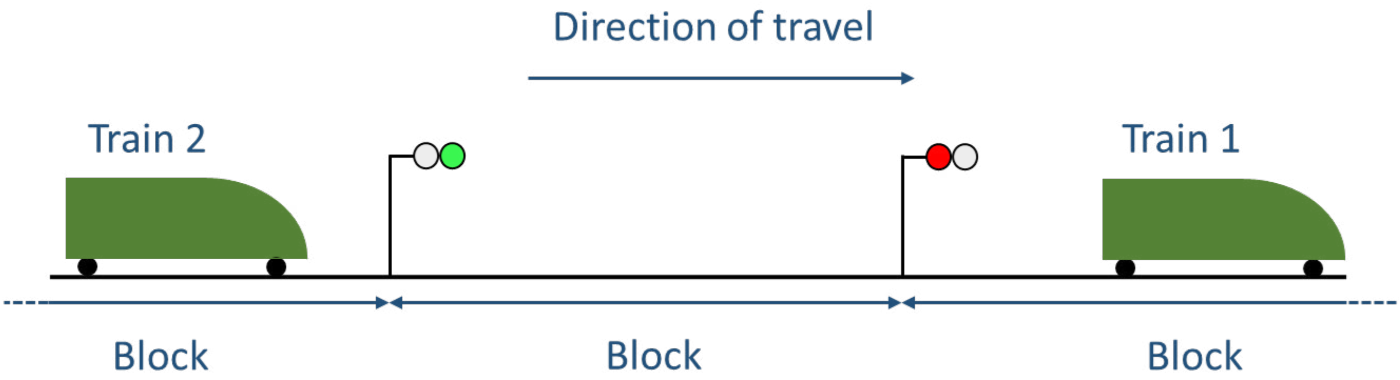
The adoption and development of smart railway solutions in the MENA region are essential to modernizing urban transportation networks, enhancing commuter safety and comfort, and improving operational efficiency. The divers e technical expertise required demonstrates the technical barriers to indigenization and the need for a gradual technology transfer process and capacity building.

Rolling Stock Challenges

Modern rolling stock requires advanced systems, including air conditioning, lighting, battery chargers, monitoring, onboard signaling, and communication equipment, for efficient operation and maintenance. Regenerative power technology converts braking energy into electricity, allowing it to feed back into the grid. However, the increased weight of rolling stock and increased energy requirements lead to higher maintenance costs and the need for enhanced traction and braking systems.

Signaling and Communication Systems Challenges

Signaling systems are critical for train safety, ensuring only one train occupies a rail section at a time. Advanced signaling technologies, including IoT and AI, enable real-time communication and autonomous driving capabilities. New MENA rail operators must adapt quickly to meet demand and ensure safety.



Infrastructure and Digitization Challenges

Electric trains offer advantages over diesel but require extensive electric infrastructure, including third-rail or overhead transmission systems. Urban rail systems require substantial civil engineering expertise, and integrating digital infrastructure for efficient transportation and payment systems is crucial. Cybersecurity and autonomous technology challenges also need to be addressed.

Path to Indigenization and Policy Recommendations

To overcome technical barriers and promote rail technology indigenization in the MENA region, a gradual process can be adopted:

- **Importation and Turnkey Projects:** Start with importing all components and tendering turnkey projects.
- **Local Production by International Firms:** Encourage international firms to produce locally.
- **Joint Ventures:** Form joint ventures between international and local firms.
- **Licensing Agreements:** Allow local manufacturers to produce under licensing agreements with international firms.
- **Independent Production:** Enable local firms to produce with their own intellectual property.

While cost is a significant barrier to rail implementation, the need for more technical expertise is a key reason for its low adoption in the MENA region.

POLICY MILESTONES FOR THE MENA REGION

Governmental policies should stimulate investment decisions and achieve several urban rail transit policy milestones, including:

- **Digital Transformation Projects:** Diversify the urban rail sector by applying the latest technologies in signaling and communication, such as IoT and AI.
- **Balancing Objectives:** Ensure digital transformation projects balance economic, social, and environmental goals.
- **Collaborative Learning:** Establish a collaborative experimental learning process involving all stakeholders, with feedback loops between learning, implementation, and impact measurement.
- **Support for Innovation:** Encourage innovative ideas and experimentation through Proof of Concepts (POCs).
- **Investment Considerations:** Consider the investment required for civil work construction and their long-term payback.
- **Capacity Building:** Focus on training and knowledge transfer across all levels and sectors, including civil engineering, electrical and mechanical, environmental, and information and communications.

By implementing a smart urban rail transit policy, the MENA region can follow in the footsteps of countries like China and India, achieving significant advancements in rail technology and urban mobility. Partnering with consulting engineering firms like **Khatib & Alami**, which have specialized teams in digital services, digital transformation, and capacity building, can help governments and authorities navigate the complexities of smart urban rail projects. Their expertise in implementing AI and VR into complex projects, data analytics, infrastructure design, and project management can ensure that smart urban rail projects are revolutionizing governments' approaches to urban mobility and establishing themselves as leaders in sustainable transportation solutions.

ABOUT THE WRITER

Dr. Houssam al Masri, Smart City Design Lead with 30+ years of experience, has managed broadband communication networks and smart city infrastructure projects. He was the Smart City Design Senior Project Manager at Khatib & Alami and led the master planning of the Jeddah Central Development Smart City project in Saudi Arabia.

Houssam managed telecommunication projects such as Smart Cities and Solutions, Smart Buildings and Smart Homes, Fiber to Homes, and Broadband Access in the MENA region. As a senior project manager for Alpinada Telematics, he increased market share by winning and completing various projects in Saudi Arabia and the UAE. Houssam holds a PhD in Computer Engineering from MIT and has been Chairman of the Smart City Opt. and App Committee in FiberConnect Council MENA since 2019. He is a member of the ESRI GIS community professionals, IEEE IT Society, and the Green Buildings Association. Houssam is also a member of the ISO Smart City Technical Committee.

KHATIB & ALAMI

ABOUT THE COMPANY

Khatib & Alami (K&A) is an international multidisciplinary consultancy comprising architects, engineers, planners, and other specialists. We have vast experience working at the forefront of fast-changing urban environments, with a deep understanding of delivering complex and significant projects within agreed timeframes and budgets.

K&A was founded more than 50 years ago by two university professors who shared the same vision: to create an organization through which talent could thrive, built on the foundations of professional excellence, integrity, and social responsibility. While today, K&A employs more than 6,000 experts in more than 30 international offices, our people are the custodians of these values. We are driven by curiosity, with a firm belief in the importance of delivering exceptional quality to make a positive and sustainable contribution to the communities in which we work.