Future Trend in Transportation

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The Fourth Industrial Revolutions

Evolutions

1st Industrial Revolution
- Mechanization
- Water power
- Steam power

End of 18th Century

2nd Industrial Revolution
- Mass production
- Assembly line
- Electricity

Start of 20th Century

3rd Industrial Revolution
- Computer
- Automation

Start of 70ies

4th Industrial Revolution
- Cyber Physical Systems that fusing the physical, digital and biological worlds

Today

Industry 1.0
End of 18th Century

Industry 2.0
Start of 20th Century

Industry 3.0
Start of 70ies

Industry 4.0
Today
## 4th Industrial Revolutions
### What are the Components?

### DIGITAL
- Virtual Reality
- Robotics
- Photonics
- Block chain
- Data Analytics
- Cloud Computing
- Artificial Intelligence (AI)
- Augmented Reality
- Internet of Things
- Sensors
- Mobile and Wireless
- 5G networks
- High Performance Computing

### BIOTECHNOLOGY
- Genomics
- Bioinformatics
- Health Monitoring Technology
- Synthetic Biology
- Biochips and Sensors
- Biocatalysis
- Personalized Medicine
- Medical and Bio-imaging
- Regenerating Medicine
- Neuro-Technologies

### ENERGY & ENVIRONMENT
- Advanced Energy Storage and Batteries
- Bio Fuels
- Electric Vehicles
- Wind Turbines
- Carbon Capture and Storage
- Marine and Tidal Power Generation
- Fuel Cells
- Precision Agriculture
- Connected & Autonomous Vehicles
- Nano & Micro Satellites
- Energy Harvesting
- Power Microgeneration
- Smart Grids

### ADVANCED MATERIALS
- Nanomaterials
- Additive Manufacturing
- Nano Devices
- Graphene
- Flexible Electronics
- Carbon Nanotubes
- Functional Materials

Source: Adopted from OECD STI Outlook 2016
The Fourth Industrial Revolutions
Evolution of Mode of Transportation

1st Industrial Revolution
End of 18th Century

2nd Industrial Revolution
Start of 20th Century

3rd Industrial Revolution
Start of 70ies

4th Industrial Revolution
Today

1st Industrial Revolution
2nd Industrial Revolution
3rd Industrial Revolution
4th Industrial Revolution
Key Motivation

“Malaysia’s highway as a World Class, Fast, Convenient and Intelligent preferred Expressway of certified digital and sustainable green technology”

Transportation System of the Future

“Operations will be fully mechanized, automated and sustainable with the use of advanced sensors, user-friendly digital technologies as well as green technologies, making highway safer, efficient and attractive place”
Smart Green Highway: Pathway to Prosperity

Goal
Better, safer and greener highway through digital and green technology

Better

Combined Traffic information through user customized information services for better journey planning

Safer

Increase safety rate through improved driving support for bad weather response and user convenience system

Greener

Provide green highway services through adoption of green technologies (solar, LED, etc)

Better, safer and greener highway will increase safety rate and provide user-customized information services for bad weather, chain-accidents and natural catastrophic early triggering system
Smart Green Highway: User’s Expectation

**01 RELIABILITY**
Risks should provide assurance in terms of predictable travel time and, by extension, free traffic flow for as much of the day as possible.

**02 SAFETY**
Roads should offer the highest safety levels that technical and technological progress to securing mobility with the lowest possible risk.

**03 SECURITY**
Integrated system managing the risks associated to natural and man-made disasters, and in addition providing an adequate response and recovery time.

**04 COMFORT**
Good driving conditions are an essential parameter for ensuring user satisfaction.

**05 MODERNITY**
Making a distinction and typology for road traveling between passenger and goods transport.

**06 FREEDOM**
Fixed departure times or limited service offers the needs and freedom of road users.

Source: Smart Transportation Alliances 2015
4th Industrial Revolutions
Types of Future Technologies in Use (Vehicles)

1. Intermodal Transport
2. Autonomous Vehicles (AV)
3. Drones
4. Sensors
5. Electric Vehicles (EV)
6. Mobile (Smart) Devices
7. Intelligent Transport System (ITS)
8. Shared Economy
9. Usage-based Fees
10. Energy Innovations
11. City Logistics and Urban Mobility

Source: Jurisdictional Scan and Industry Trends Report – EY, Nov 2017
4th Industrial Revolutions
Types of Future Technologies in Use (Roads)

**ILLUMINATION TRAFFIC SIGN**
Development of light-collecting illumination signs or visibility during night time and inclement weather

**PIEZO-ELECTRIC ENERGY ROAD**
Piezo-electric crystal can generate energy from the vibrations generated by the vehicles

**‘NETWORKED’ HIGHWAY**
Roadside ‘listening’ stations will link up with the in-cars GPS receiver to monitor traffic congestion and accidents

**INTERACTIVE LIGHTS**
Sensors controlled street lights illuminate as traffic approaches, reducing energy cost

**GLOWING LINES**
Glow in the dark lines absorb energy during the day and glow in the night

**ELECTRIC PRIORITY LANE**
Underground induction charging refuels electric car while in motion
The Convergence

Technology convergence will revolutionize transportation, dramatically improving safety and mobility while reducing costs and environmental impacts.

Benefits:
- Order of magnitude safety improvements
- Reduced congestion
- Reduced emissions and use of fossil fuels
- Improved access to jobs and services
- Reduced transportation costs for gov’t and users
- Improved accessibility and mobility

Connected Vehicles
Vehicle Automation
Internet of Things
Machine Learning
Big Data
Mobility on Demand

Connected-Automated Vehicles
Smart Highway
Since the beginning of time...
Smart Green Highway
Value Proposition toward Intelligent Transportation System (ITS)

National System for Collective Intelligent for Future Digital Transportation and Smart Green Highway

Future Proof
Improve Efficiency
Informed Decision Making
Centralized Information System
Evidence-based Traceability
Malaysian Intelligent Transport System Blueprint 2017-2022
The 9 ITS Sectors

1. Public Transport
2. Emergency Management
3. Electronic Payment
4. Commercial Vehicle Operations
5. Traveler Information
6. Advanced Traffic Management
7. Advanced Vehicle Control
8. Safety System
9. Information Warehouse

Source: Malaysian Intelligent Transport System Blueprint 2017-2022
Big Data Analytics in Intelligent Transportation System

- Mobile Apps
- Decision Support Systems
- Education
- Training
- Certification

ICT infrastructure for Intelligent Transportation System

Knowledge Based Economy

ICT Human Capital Development

Creative Content development

- Wireless Sensors
- Cloud Servers
- E-Commerce
- Automation

- E-Consultation
- Knowledge Management

- Mobile Apps
- Decision Support Systems

ICT Human Capital Development

Creative Content development

Knowledge Based Economy

ICT infrastructure for Intelligent Transportation System
Intelligent Transport System (ITS) Physical Architecture

Travellers
- Remote Traveler Support
- Personal Info. Mgmt.
- Wide Area Wireless (Mobile) Communications

Vehicles
- Commercial Vehicle
- Emergency Vehicle
- Intermodal Vehicle
- Maintenance Vehicle
- Public Transport Vehicle
- Vehicle

Dedicated Short Range Communications

Centers
- Environment Mgmt.
- Fleet & Freight Mgmt.
- Toll Administration
- Archive Data Management
- Information Service Provider
- Traffic Management
- Commercial Vehicle Registration
- Maintenance Management
- Emergency Management

Wireless (Fixed Point to Fixed Point) Communications

Psychometric

Support
- Remote Traveler Support
- Personal Info. Mgmt.

Vehicles
- Commercial Vehicle
- Emergency Vehicle
- Intermodal Vehicle
- Maintenance Vehicle
- Public Transport Vehicle
- Vehicle

Dedicated Short Range Communications

Intermodal Terminal

Roadsides
- Parking Management
- Roadway
- Toll Collection

Source: Malaysian Intelligent Transport System Blueprint 2017-2022
4th Industrial Revolutions
ITS in Seoul (2m 41s)
4th Industrial Revolution
Key Technologies in Use by MIMOS

Examples of 4IR Technology Area

- Artificial Intelligence
- Internet of Things (IOT)
- Sensors
- Cyber & Physical Security
- Cloud Computing
- Big Data & Analytics
Use Case # 1
Highway Monitoring (17s)
Use Case # 2
Street Traffic Monitoring (17s)
Use Case # 3
Intersection Accident Detection (7s)
Use Case # 4
Sidewalk Monitoring – Loitering (41s)
Use Case # 5
UnAuthorised Road Side Objects (49s)
Use Case # 5 cont.
UnAuthorised Road Side Objects

Detected on 12 May 2017
Latitude: 3.30745 |
Longitude: 101.544442
48000 Rawang, Selangor

Detected on 1 Jan 2017
Detected on 18 March 2017
Detected on 12 May 2017
Detected on 1 April 2017
Detected on 25 May 2017
Detected on 2 April 2017

Options
From: 114 – Sg.Buluh
To: 135 – Pulai
Last Date: 3 - Aug - 2017
To Date: 3 - Aug - 2017

Cloud Computing
Use Case # 6
Crowd Sourced Historical Traffic Jams

Traffic Congestion

Heat Map of Traffic Density

GIS Driven Analytics (Weather)

Crowd Sourced Historical Traffic Data

GIS Driven Analytics (On/Off-Ramps)
Use Case # 7
Vehicle Type and Road Loading (57s)
Use Case # 8
Integrated Vehicle Tracking (1m 14s)
4th Industrial Revolutions
An Example of What Does the Future Holds? (4m 40s)
Thank You.

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