Building Digital Twin Metaverse Cities
Revolutionizing Cities with Emerging Technologies

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Agenda

• Who am I? What is the book?
• An Architectural Design of Digital Twin Metaverse Cities
• Digital Twinning Process for Smart City Intelligence Services
• Smart City Building Blocks: Emerging Technologies (13)
• Smart City Show Cases (13)
• Smart City Development Tools (28)
• Sample Smart City Prototypes: Living, Working, & City (20)
• Digital Twin Metaverse Based Modern MIS (MMIS)
• Summary and Q&A
Who am I?

- Professor in Business Analytics in Northeastern University, University Canada West, Anna Maria College, HDU, ZJUT.
- 23 years of IT industrial experiences in global multinational firms like Nortel Networks, Motorola, Nokia, and Linaro in Canada, USA, and Asia Pacific;
- The earliest CS major (1984), ridded IT revolution from IBM mainframe, PC, LAN/WAN, the Internet, Mobile, to now AI/ML/IoT/5G... credited with 1st touch-screen Linux mobile phone (Motorola), Mobile Internet (Nokia), and Android (Savaje);
- 10+ years of teaching and academic research experiences in NU, AMC, University Canada West, University of Waterloo, University of Toronto, Hangzhou Dianzi University, and Zhejiang University of Technology, mainly in IT, Technology Innovation, Managerial Economics, and Global Leadership;
- MBA (U of Toronto), MAsc (U of Waterloo), BCS (HDU), PhD in Platform and Sharing Economy (U of Waterloo).
What is Book?

- Author: Xiangming Samuel Li
- Book Title: “Building Digital Twin Metaverse Cities: Revolutionizing Cities with Emerging Technologies”
- Publisher: Apress, Springer Nature Book Group
- Estimated Release: July 2024
Rapid Global Urbanization

Fig 1: World’s population growth: urban vs. rural (Source: UN World Urbanization Prospects, 2018).
Fig 2: The world megacities with 10+ million inhabitants in 2018 and 2030 (source: the UN report).
Rapid Global Urbanization

Fig 3: Accumulative number of Covid-19 cases reported to WHO and top infective countries (Source: 2024-4-2 WHO)
Fig 5: Major **challenges for smart city projects** (source: Author’s development based on IHS).
A Problem Statement

- **Rapid Urbanization**: Cities face mounting pressures from exponential population growth, intensifying environmental pollution, traffic congestion, and resource depletion.

- **Resource Strain**: Essential services such as energy, water, healthcare, and housing are under severe strain, affecting the quality of urban life and sustainability.

- **Vulnerability to Pandemics**: Urban centers, as the epicenters of COVID-19, reveal the high vulnerability of densely populated areas to global health crises, with 90% of cases reported in cities.

- **Environmental Impact**: Urban areas are major contributors to climate change, accounting for approximately 70% of greenhouse gas emissions, despite occupying only a small fraction of Earth's land surface.

- **Call to Action**: The urgent need for immediate and concerted efforts by governments and businesses to address these complex challenges and to foster sustainable, safe, and livable urban environments for all.
Fig 6: Metaverse as Digital Twins and Digital Native Continuum (Author’s development based on [13]).
Digital Twin vs Metaverse

Fig 7: Digital twins in three dimensions (Author’s development based on source [14]).

Fig 8: Digital twins in five dimensions (Author’s development based on source:[17]).
Fig 9: The six smart city indicators (Author’s development based on source [21]).
An Architectural Design of Digital Twin Metaverse Cities
Digital Twinning Process to Generate Intelligence Services

Building Digital Twin Metaverse Cities

[Diagram showing the process of generating intelligence services through digital twinning.]
Building Blocks: Emerging Technologies

Core:

5G Mobile Networks
Internet of Things (IoTs)
Big Data Analytics
Artificial Intelligence (AI)
Cloud Computing
Blockchain
Digital Platform

Enablers:

Robotics Automation
Augmented Reality (AR) & Virtual Reality (VR)
3D Printing
Autonomous Driving (AD)
Drone & UAV
Cybersecurity
Showcase: Smart City Examples

- **Core:**
  - Smart Transportation
  - Smart Green Energy
  - Smart Home
  - Smart Housing
  - Smart Streetlight
  - Smart Environment

- **Services:**
  - Smart Healthcare
  - Smart Senior Care
  - Smart Education
  - Smart Retailing
  - Smart Recycling
  - Smart Diester Response
  - Smart Vertical Farming
Research: Digital Twin Dev Tools

1. AWS IoT TwinMaker
2. Microsoft Azure Digital Twins
3. Siemens MindSphere
4. PTC ThingWorx
5. IBM Maximo Asset Monitor
6. Dassault Systèmes 3D EXPERIENCE
7. GE Digital Predix
8. Ansys Twin Builder
9. Bosch IoT Suite
10. SAP Digital Twin
11. Oracle Digital Twin
12. Autodesk Tandem
## Research: Metaverse Dev Tools

<table>
<thead>
<tr>
<th>1. Unity</th>
<th>9. SketchUp</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Unreal Engine (UE)</td>
<td>10. ZBrush</td>
</tr>
<tr>
<td>3. Nvidia's Omniverse</td>
<td>11. Tilt Brush</td>
</tr>
<tr>
<td>5. Roblox Studio</td>
<td>13. Gemini for Metaverse</td>
</tr>
<tr>
<td>7. Blender</td>
<td>15. Decentraland SDK</td>
</tr>
<tr>
<td>8. Autodesk Maya</td>
<td>16. Meta Spark</td>
</tr>
</tbody>
</table>
Smart Living Prototype: Sustainable Smart Homes
Smart Living Prototype: Virtual Healthcare Clinic
Smart Working Prototype: Smart Co-working Spaces
Smart City Prototype: Virtual Concert and Event Arena
Smart City Prototype:
Metaverse Theme Park
Smart City Prototype: Smart Sports Complex
Smart City Prototype: A Metaverse city prototype using UE
Leadership for the Future: New Skills for Smart City Development and Management

- Humility in AI-Driven Smart City Leadership
- Adaptability in Smart City Leadership
- Engagement for Smart City Cohesion
- Visionary Leadership in the AI Era
Fig 4: Traditional data “silos” management information system (MIS) applications (source: Author’s development).
A Digital Twin Metaverse based Modern MIS Architecture
A Digital Twin Metaverse based Modern MIS Architecture

1. Tesla Gagafactory: Digital Twin MIS Automation
2. Amazon Retailing MIS: Pioneering Automation and Personalization
3. SCM MIS: Revolutionizing Supply Chain with Digital Twins
4. Robotaxi Services: Navigating the Future of Urban Mobility
5. Airport MIS: Elevating Airport Operations and Security with Digital Twins
Summary and Q & A

• An **Innovative Architectural Design** of Digital Twin Metaverse Cities with 5 layers
• A Novel Design of **DAFW based Digital Twinning Process**
• Investigating **Emerging Technologies** as Building Blocks
• Researching Cutting-edge Digital Twin Metaverse Development Tools (28)
• **Prototyping** Smart Living/Working/City Examples (20)
• Proposing New Design of **Modern MIS** with application examples
• **Call for Immediate Actions to Build more Digital Twin Metaverse Cities!**
Thank You!