Automated Identification and Evaluation of Factors Influencing Highway Construction Projects

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Outline

- Introduction
- Literature Review
- Research Methodology
  - ✓Factors Influencing Productivity of EMOs
  - ✓Proposed Model
  - ✓ Data Acquisition Module
- Expected Contributions
- Conclusion

Introduction

Earthmoving operations form about 20% of the total cost of construction projects
(Kang et al., 2009)

Importance of Monitoring of Productivity Variation and Early Identification of Influencing Factors

- **Cost Overruns**
- **Schedule Delays**
- **Ineffective utilization of resources**

Introduction

Apply

Earthmoving Operations

Produce

Data

Exploitation

Analysis

Productivity & Performance

Identification

Take

Cyclic Process

Literature Review

Data Acquisition ➔ Existing Research Tools

Conventional Methods

- Manual or Semi automated

Innovative Methods

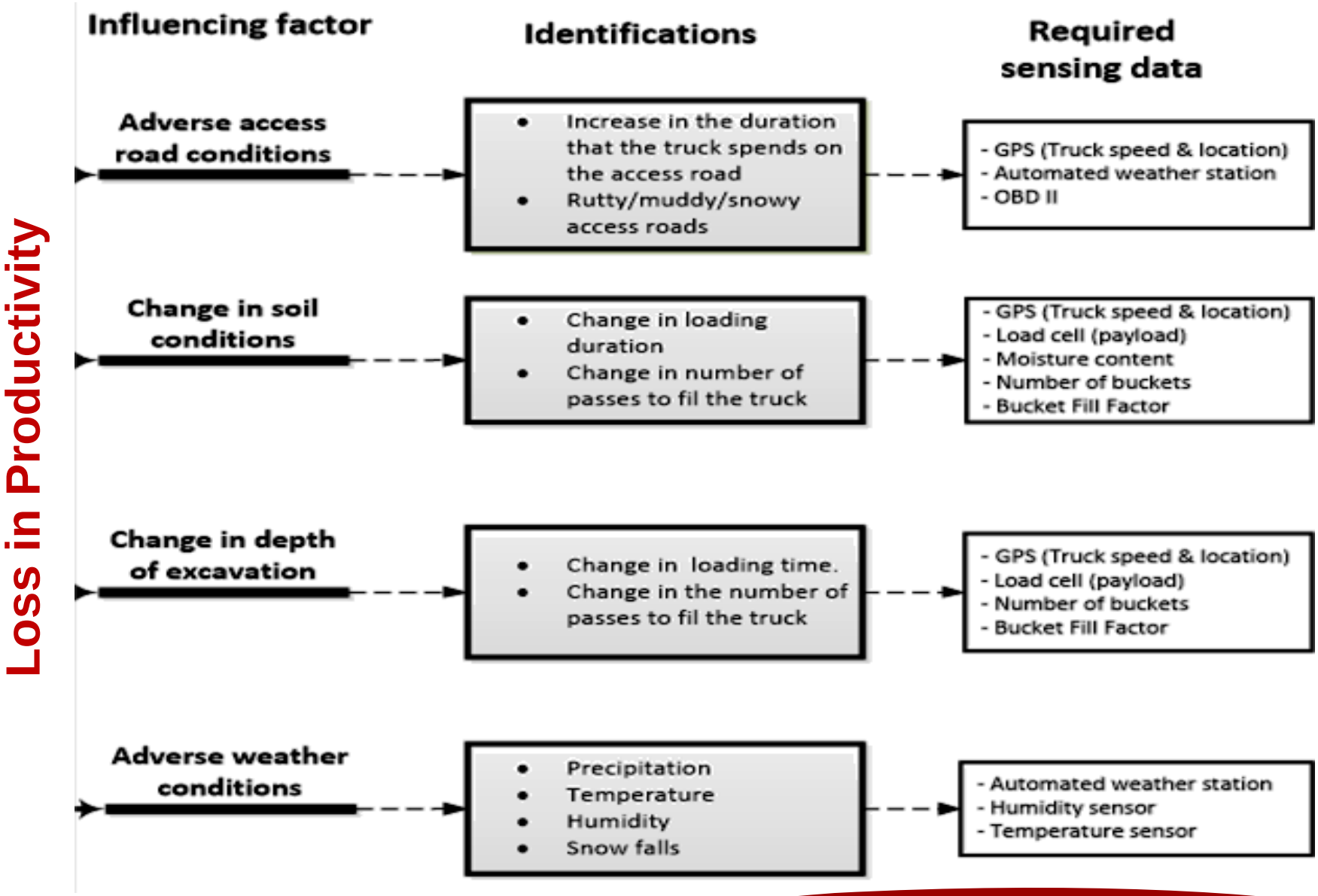
- RFID
- GPS & Aided GPS
- 3D Laser Scanner
- Photogrammetry
- Computer Vision
- Data Fusion

Literature

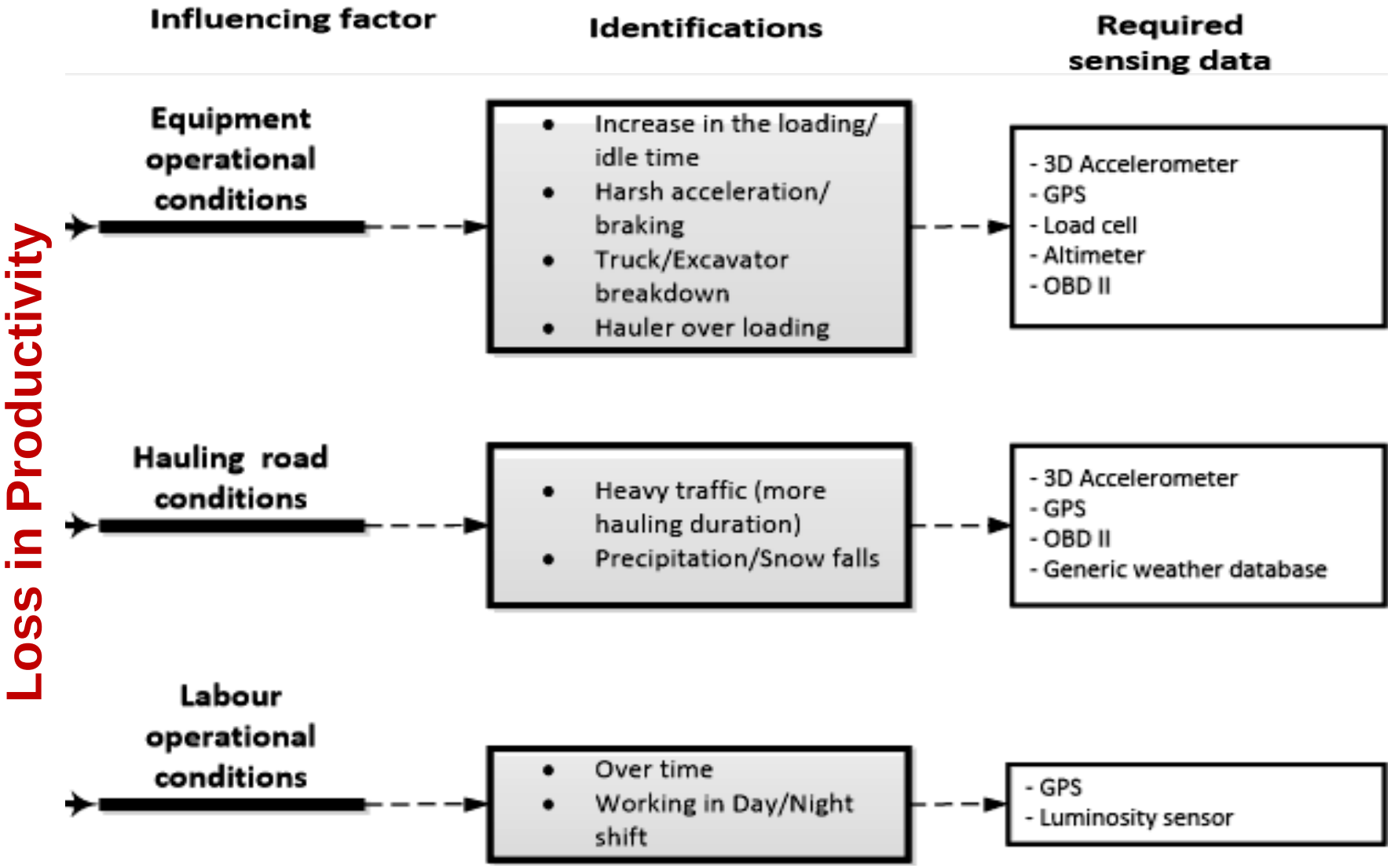
- Influencing factors are varied and the scenarios of its existence as well
- The most significant frequent factors have been documented through the authors' previous and ongoing research (Salem et al., 2017)
- The authors' previous study ranked the factors influencing productivity of hauling equipment using fuzzy-set theory (Salem et al. 2017)

A. Salem, A. Salah, M. Ibrahim, and O. Moselhi, " Study of Factors Influencing Productivity of Hauling Equipment in Earthmoving Projects using Fuzzy Set Theory," *International Journal of Innovation, Management and Technology* vol. 8, no. 2, pp. 151-154, 2017

Methodology - Influencing Factors



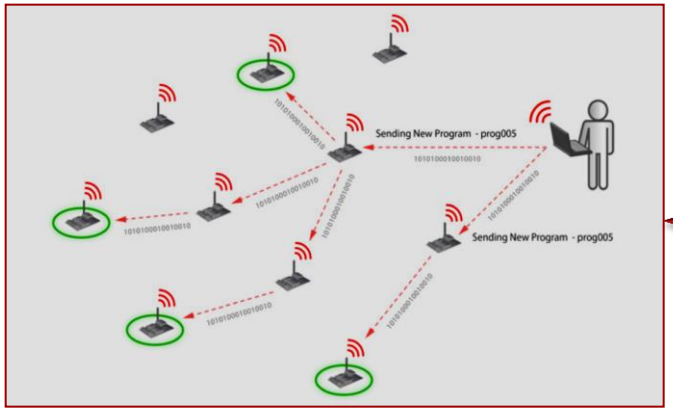
Influencing Factors …. Cont.



Proposed Model

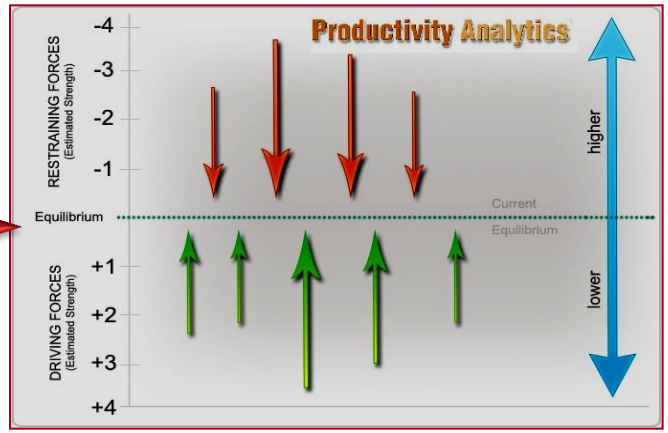
➢ The Proposed Model Consists of 2 Main Modules:

1. Data acquisition module



Various sensors and microcontrollers

2. Productivity analysis module



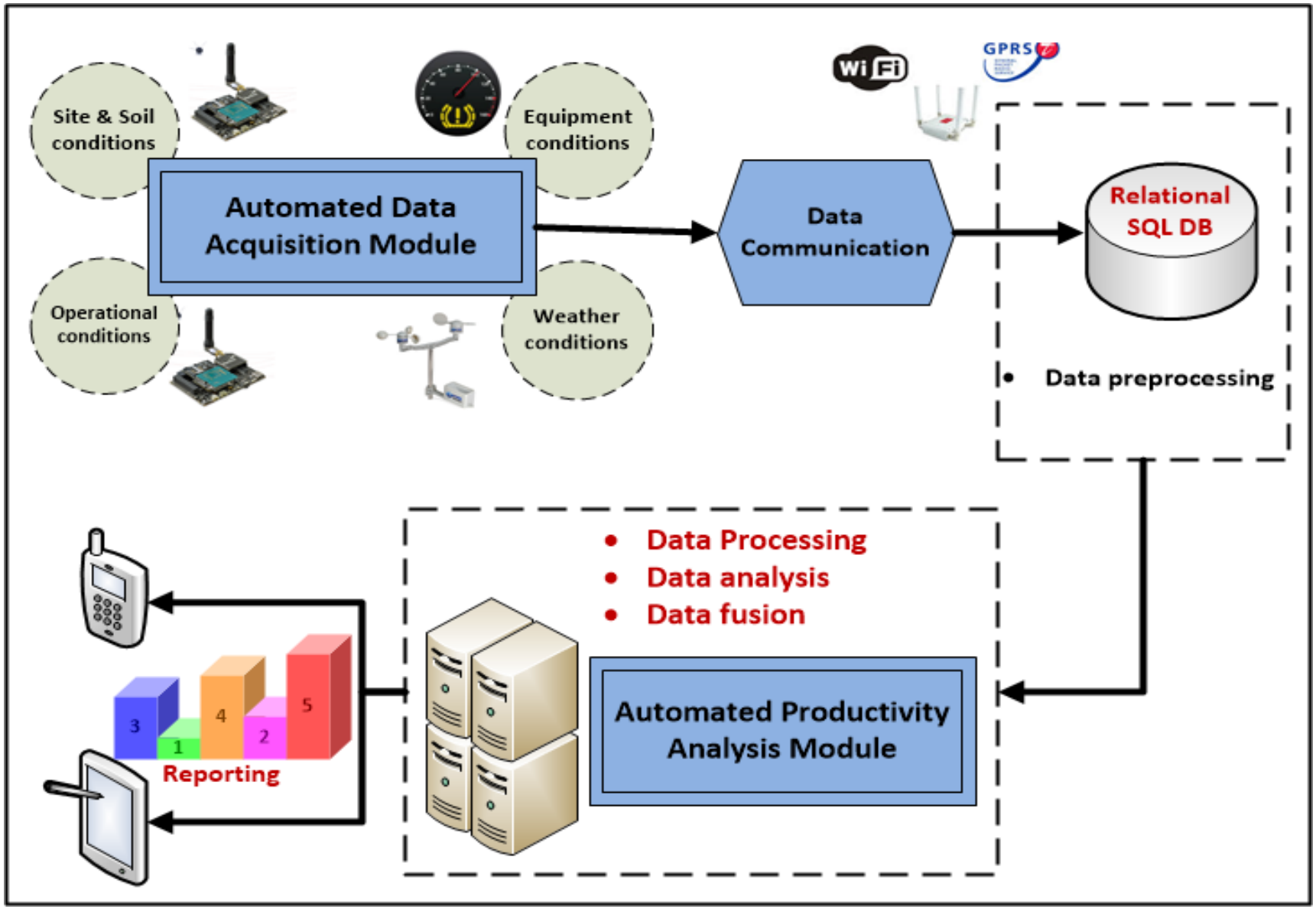
Automated productivity analysis

Automated recognition of the grounds behind the loss of productivity

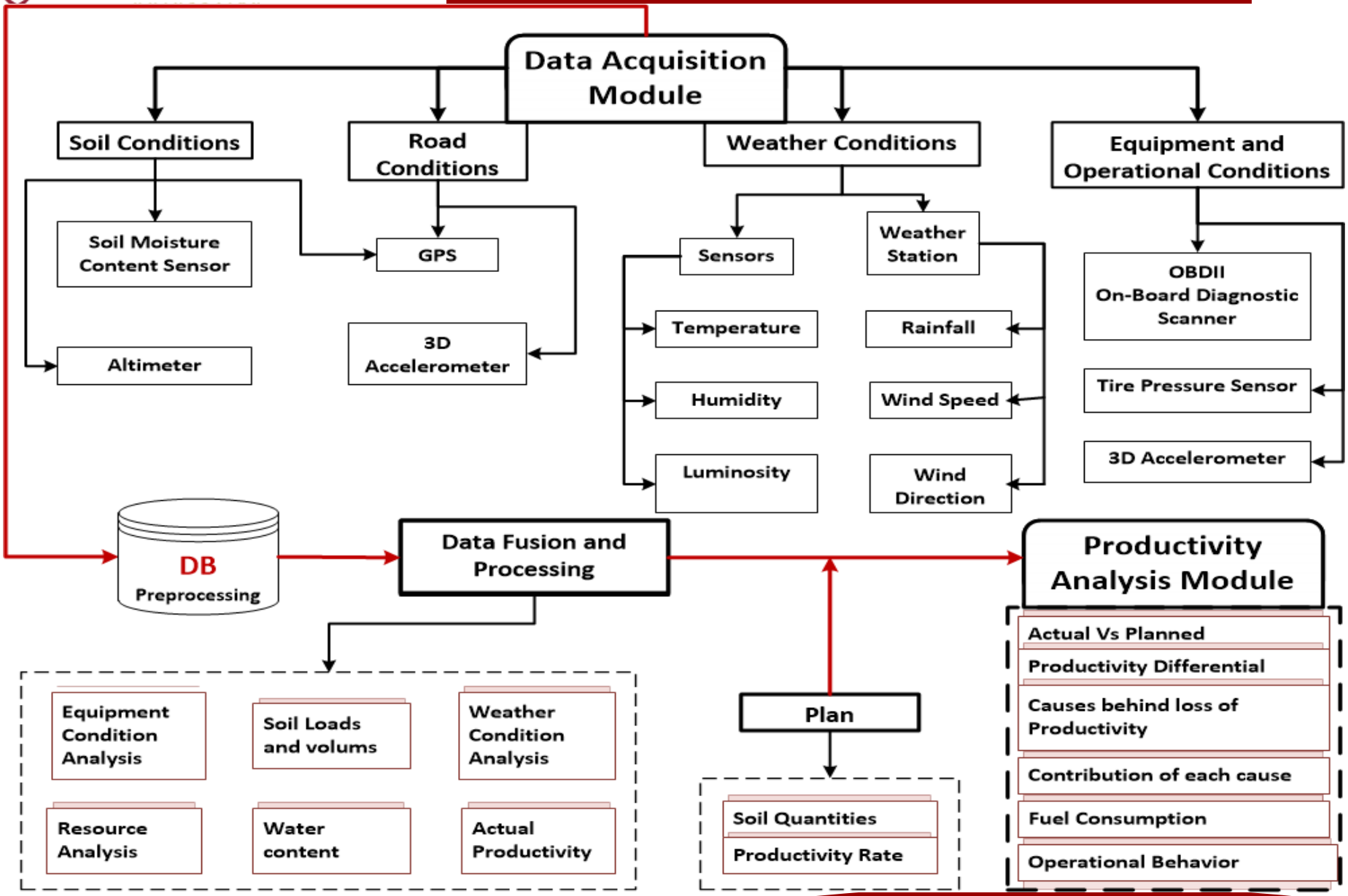
The system is able to identify and report:

- Productivity variance and ratio in near-real-time
- Less production; causes, location and time of occurrence

Research Framework

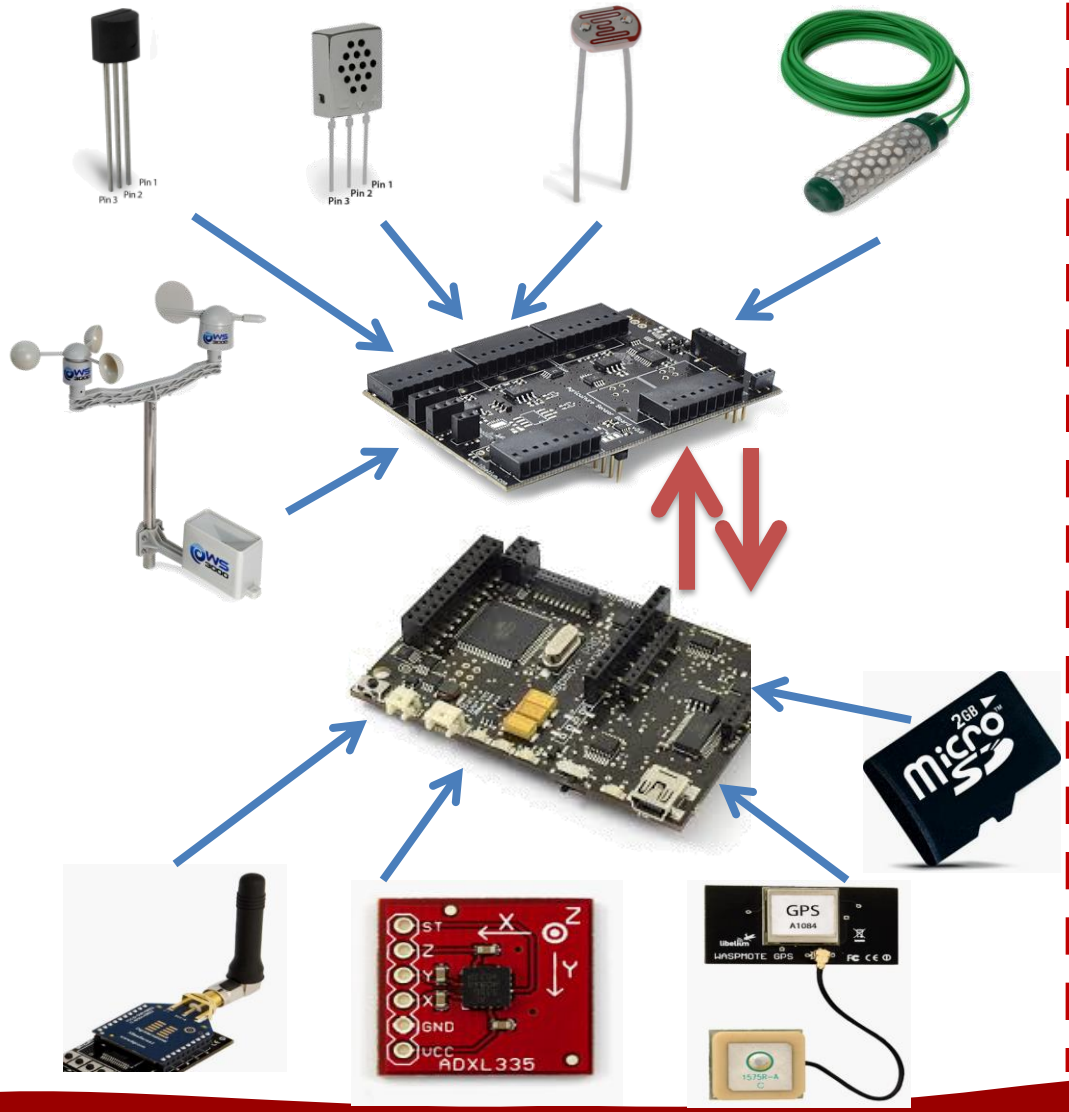


Research Framework

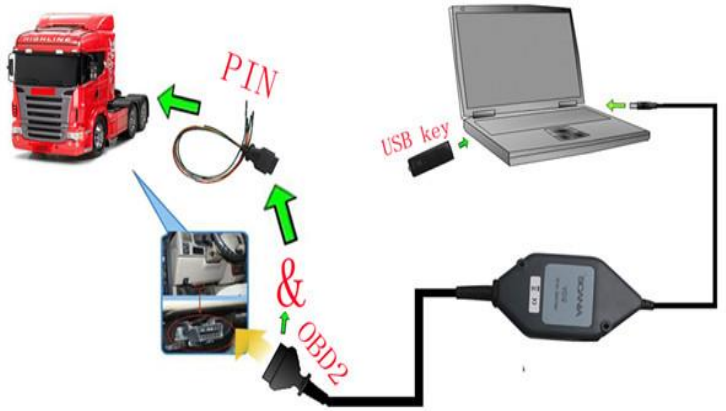


Data Acquisition Module

Onsite Data Acquisition Module–Block Diagram

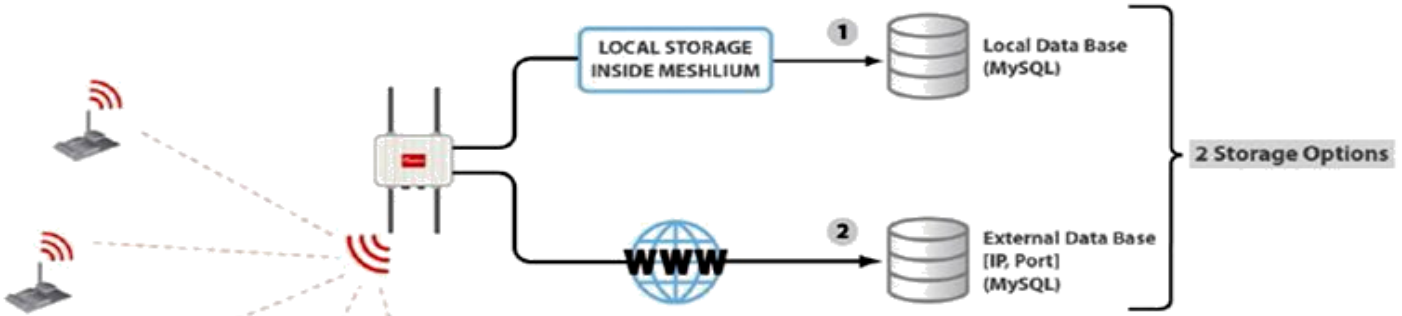


OBD-II



OBD-II Outputs Dashboard

Sensory Hardware Deployment



Contributions

- Identify, evaluate and prioritize factors impacting productivity of EMOs
- Develop automated model to monitor, analyze and control productivity of EMOs, considering uncertainty
- Develop a timely automated identifier and reporter of different causes behind EMOs productivity deficiencies
- Integrate multiple sensing technologies and data fusion techniques to develop automated productivity analyzer

Conclusion

- Models uncertainty associated sensors malfunction
- Provides early warning notification system, highlights the correct time for intervention
- Exploits power of innovative technologies and IoT
- Automates multi-sensor on-site data acquisition
- Utilizes collected data to feed automated collaborative on cloud analyzer

Authors' Biography

Ashraf Salem received his bachelor degree in structural engineering from Al-Azhar University, Cairo, Egypt in 2000, M.Eng. in construction engineering and management from Concordia University, Montreal, Quebec, Canada in 2014. He is pursuing PhD in construction engineering and management in Concordia University.

He has over 15 years of professional experience in construction industry; design and management of projects that have been developed by national and international firms. These projects included residential, commercial, high-rise buildings, super luxury villas, palaces and various projects of utilities and infrastructure. His current research interests include automation, remote sensing and networks, with a focus on on-site automated data acquisition and automated productivity analysis of construction projects. Mr. Salem is a member of several professional societies including Project Management Institute (PMI), American Society of Civil Engineers (ASCE), Canadian Society for Civil Engineering (CSCE), Association for the Advancement of Cost Engineering (AACE) international.

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Authors' Biography

Osama Moselhi is a professor at Concordia University. He received his BSc. in civil engineering from Cairo University, Cairo, Egypt, 1970; master of engineering in structural engineering from Memorial University of Newfoundland, Newfoundland and Labrador, Canada, 1975. He obtained the PhD. In structural engineering, Concordia University, Montreal, Canada, 1978.

Prof. Moselhi held several industrial and academic posts in Canada and abroad in a wide spectrum of the engineering profession, ranging from structural analysis and design to construction engineering and management, on building projects, and heavy civil engineering including bridges, offshore and harbor facilities, and nuclear power plants. He authored and co-authored over 350 scientific papers and supervised to completion 95 PhD and Masters graduates. Dr. Moselhi is Fellow of the Canadian Academy of Engineering, Canadian Society for Civil Engineering, the American Society of Civil Engineers, and the Association for the Advancement of Cost Engineering. He is member of Professional Engineers of Ontario. He is the recipient of numerous honors and awards, including the prestigious Walter Shanly Award of CSCE in recognition of outstanding contributions to the development and practice of construction engineering in Canada

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End of Presentation